a second segment for evaluating the system input signal and identifying transceivers that relayed the system input from the originating transceiver to the gateway;

a third segment for evaluating the system input signal transmitted from the originating transceiver; and

a fourth segment responsive to the first, second, and third segments for determining an action to be taken based upon the data from a sensor, the identified originating transceiver, and the identified transceivers.

47. The system as defined in claim 44, wherein each wireless transceiver is configured to transmit a relatively low-power radio-frequency (RF) signal.

48. The system as defined in claim 44, wherein the at least one gateway is permanently connected to the WAN.

49. The system as defined in claim 44, wherein the gateway translates the RF signal and the RF control signal into TCP/IP for communication over the WAN.

50. The system as defined in claim 44, wherein the WAN is the Internet.

51. The system as defined in claim 44, wherein the WAN is a dedicated Intranet.

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52. A system for managing an arrangement of application specific remote devices comprising:

a computer configured to execute a multiplicity of computer programs, each computer program executed to generate at least one control signal in response to at least one application system input, said computer integrated with a wide area network (WAN);

at least one gateway connected to the WAN configured as a two-way communication device to receive and translate the at least one control signal and the at least one application system input; said gateway further configured to translate and transmit an RF signal containing the control signal and destination information, said gateway further configured to receive and translate the at least one application system input and source information;

at least one wireless transceiver per computer program configured to receive the RF signal from the gateway; said wireless transceiver configured to translate the RF signal to an analog output signal, the wireless transceiver electrically coupled with an actuator and a sensor;

an actuator configured to receive the analog output signal from the wireless transceiver, the actuator further configured to translate the analog output signal into a response; and

a sensor configured to translate a physical condition into an analog version of the application system input.

53. The system as defined in claim 52, wherein the at least one wireless transceiver is configured to transmit a relatively low-power radio-frequency (RF) signal.

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54. The system as defined in claim 52, wherein the at least one gateway is permanently connected to the WAN.

55. The system as defined in claim 52, wherein the at least one gateway translates the RF signal and the RF control signal into TCP/IP for communication over the WAN.

56. The system as defined in claim 52, wherein the WAN is the Internet.

57. The system as defined in claim 52, wherein the WAN is a dedicated Intranet.

58. The system as defined in claim 52, wherein the at least one gateway is connected to the WAN by a network selected from the group consisting of a telecommunications network, private radio-frequency network, and a computer network.

59. A method for collecting information and providing data services comprising:

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adaptively configuring a data translator at the output of a local controller, wherein the data translator converts the output data stream into an information signal consisting of a transmitter code and an information field;

adaptively configuring at least one transmitter with the data translator, wherein the transmitter converts the information signal into a low-power RF signal;

placing a plurality of transceivers dispersed geographically wherein the low-power RF signal is received and repeated as required to communicate the information signal to a gateway, the gateway providing access to a WAN;

translating the low-power RF signal within the gateway into a WAN compatible data transfer protocol;

transferring the translated low-power RF signal via the WAN to a computer wherein the computer is configured to manipulate and store data provided in said signal; and

granting client access to the computer.

60. The method of claim 59, wherein the WAN is the Internet.

61. The method of claim 59, wherein the WAN is an Intranet.

62. The method of claim 59, wherein the computer is configured to provide the information in hypertext mark-up language (HTML).

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63. The method of claim 59, wherein clients access the information using a web browser.

64. A method for controlling an existing control system with a local controller comprising:

adaptively configuring a data translator disposed between and in communication with both a local controller and a wireless transceiver, wherein the data translator is configured to translate the local controller data stream into an information signal consisting of a transceiver identification code and a concatenation of function codes, the data translator further configured to translate control signals from the wireless transceiver into local controller recognized control signals;

remotely collecting data from at least one transceiver integrated with the data translator;

processing the data into a RF signal;

transmitting the RF signal to a gateway;

translating the data in the RF signal into a network transfer protocol;

sending the translated data to a computer, wherein the computer is configured to appropriately respond to the data generated by the at least one sensor by generating an appropriate control signal;

sending the control signal via the network to the gateway;

translating the control signal from a network transfer protocol into a RF control signal;

transmitting the RF control signal;

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receiving the RF control signal;

translating the received RF control signal into a local controller recognized control signal; and

applying the local controller recognized control signal via a local controller to effect the desired system response.

65. The method of claim 64, wherein the step of transmitting the RF control signal is further performed by at least one transceiver, wherein the transceiver is configured to receive and transmit the RF control signal.

66. The method of claim 64, wherein the network is the Internet.

67. The method of claim 64, wherein the network is an Intranet.

68. The method of claim 64, wherein the network transfer protocol is TCP/IP.

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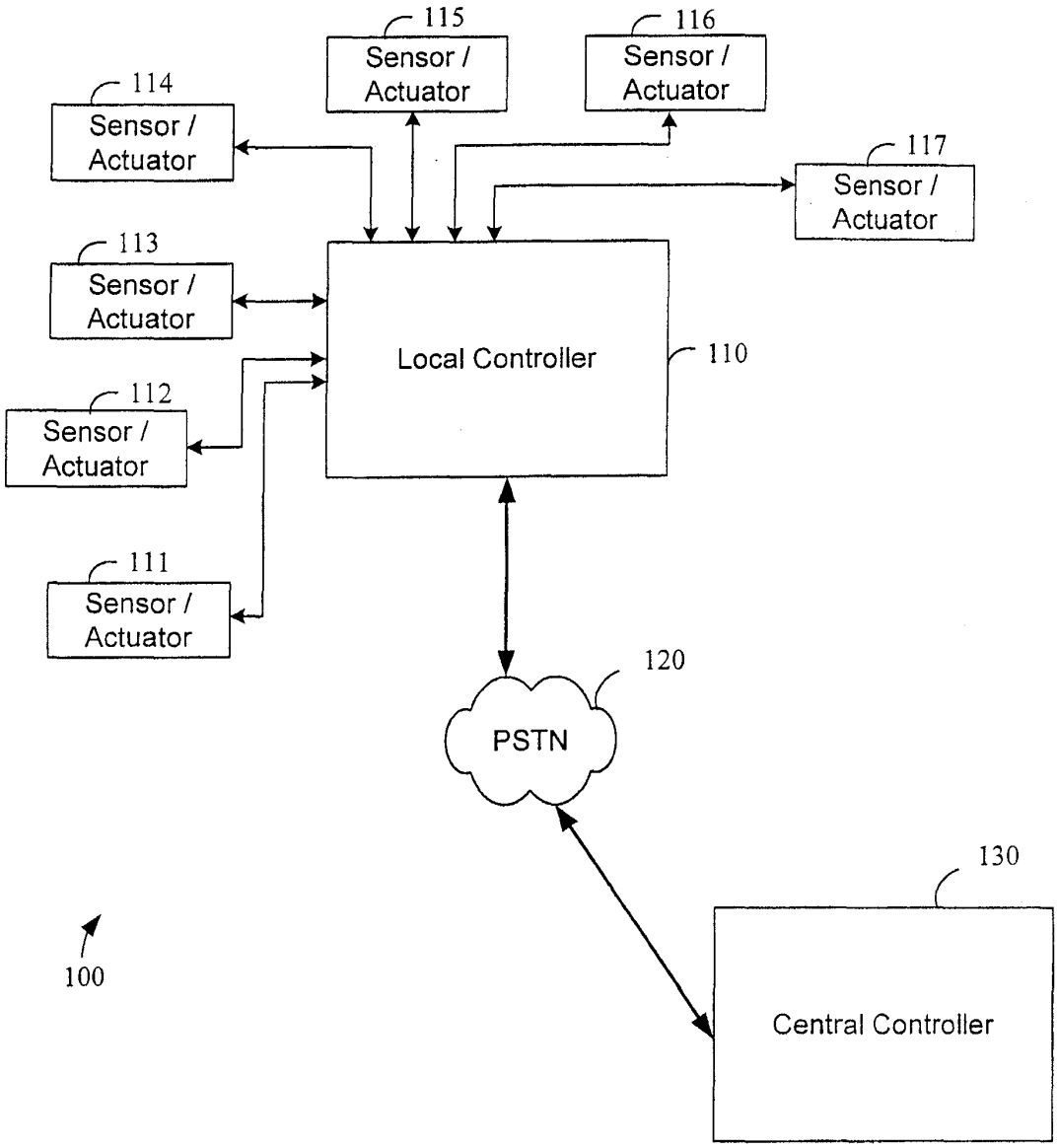

FIG. 1
(PRIOR ART)

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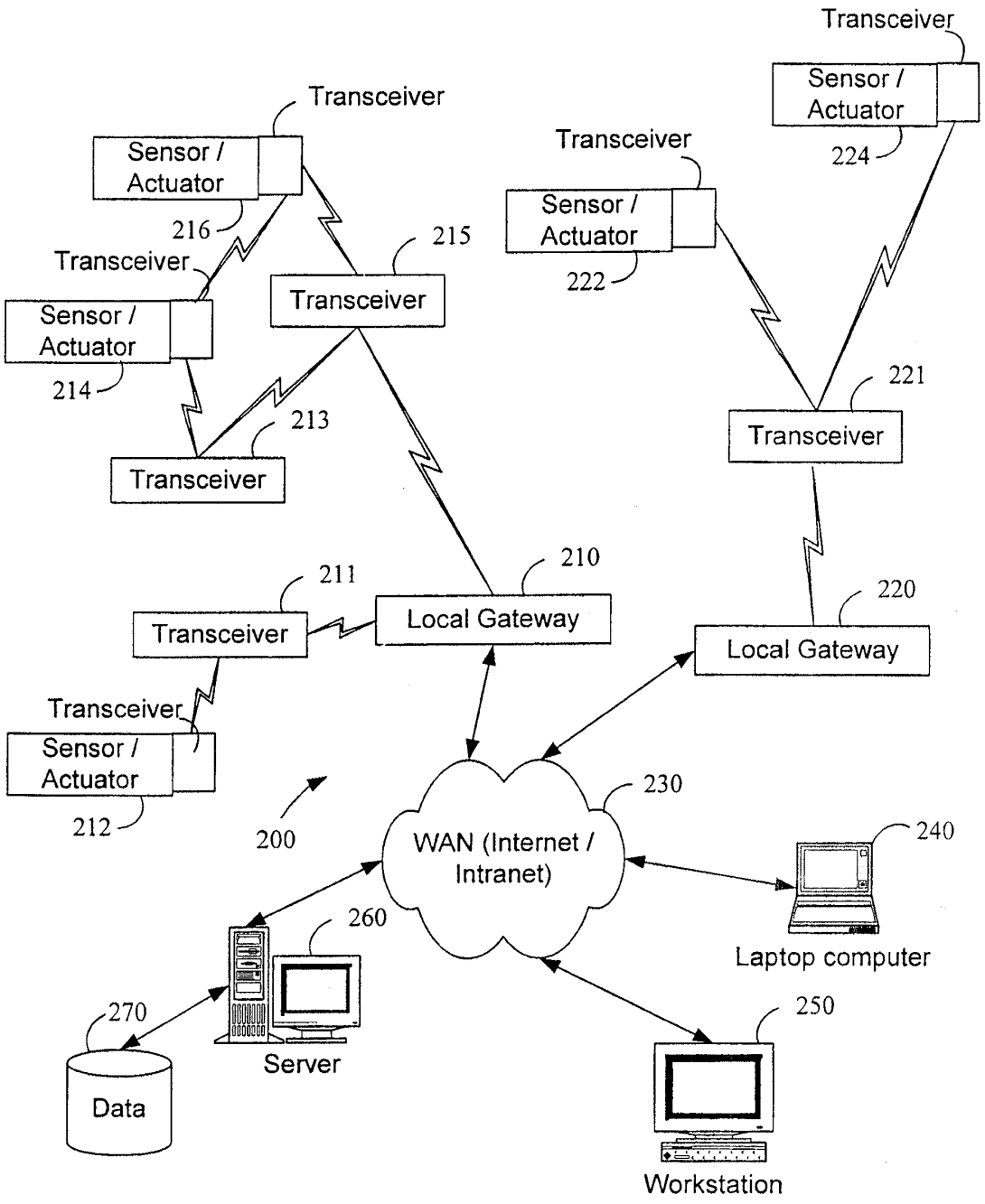

FIG. 2

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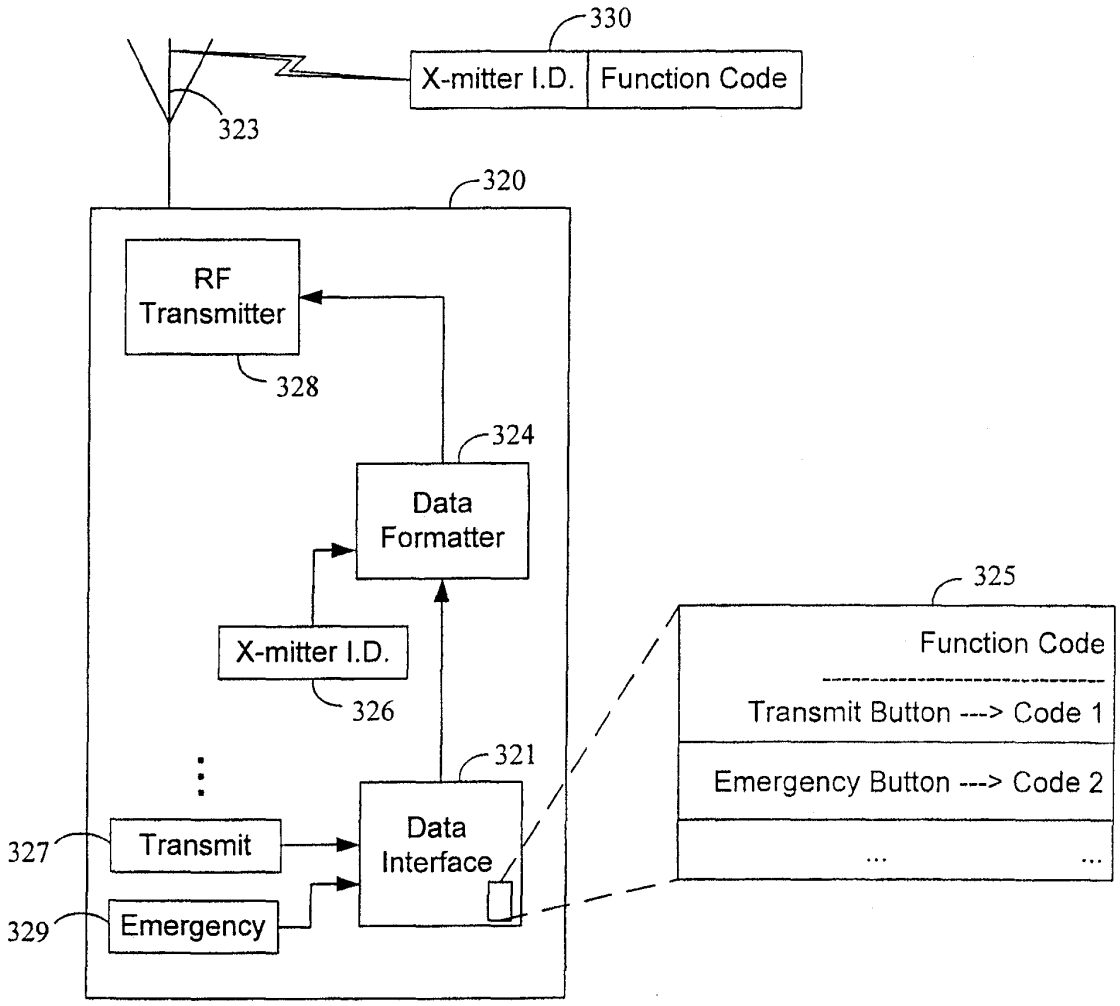

FIG. 3A

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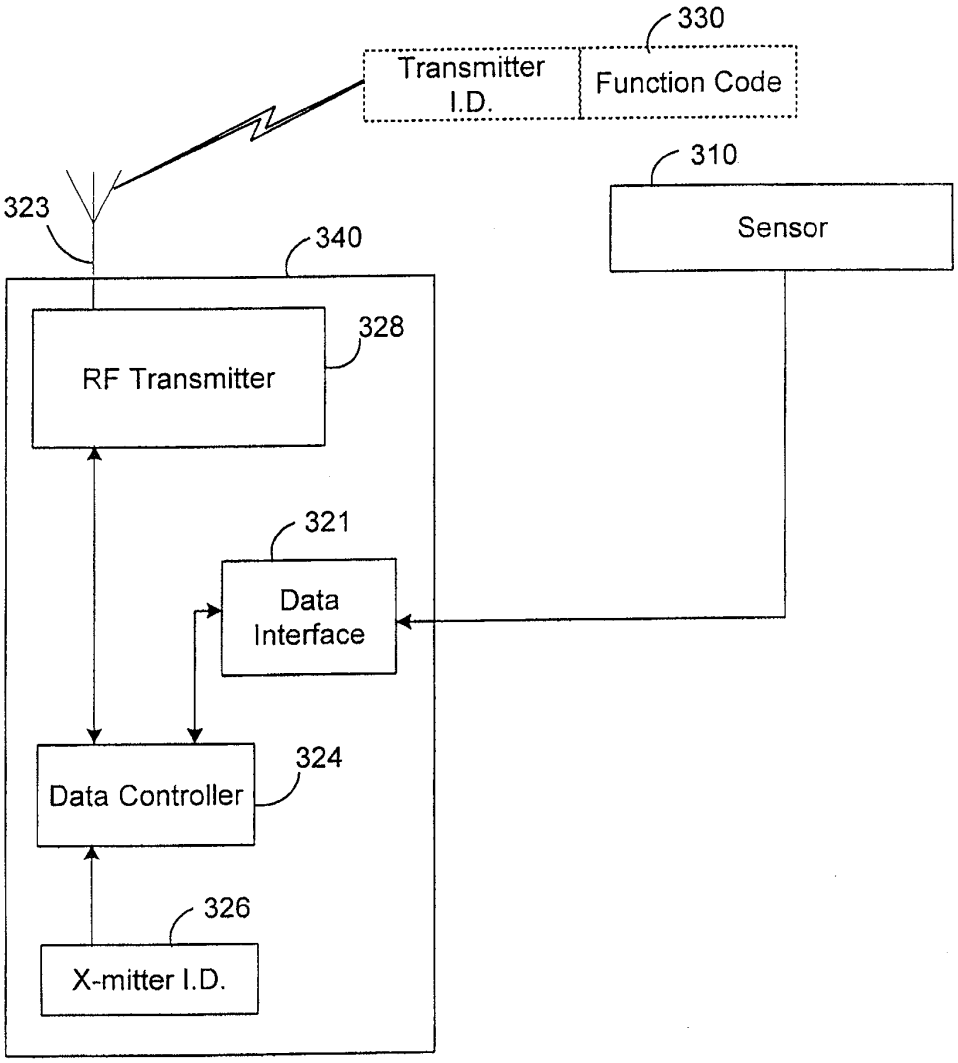

FIG. 3B

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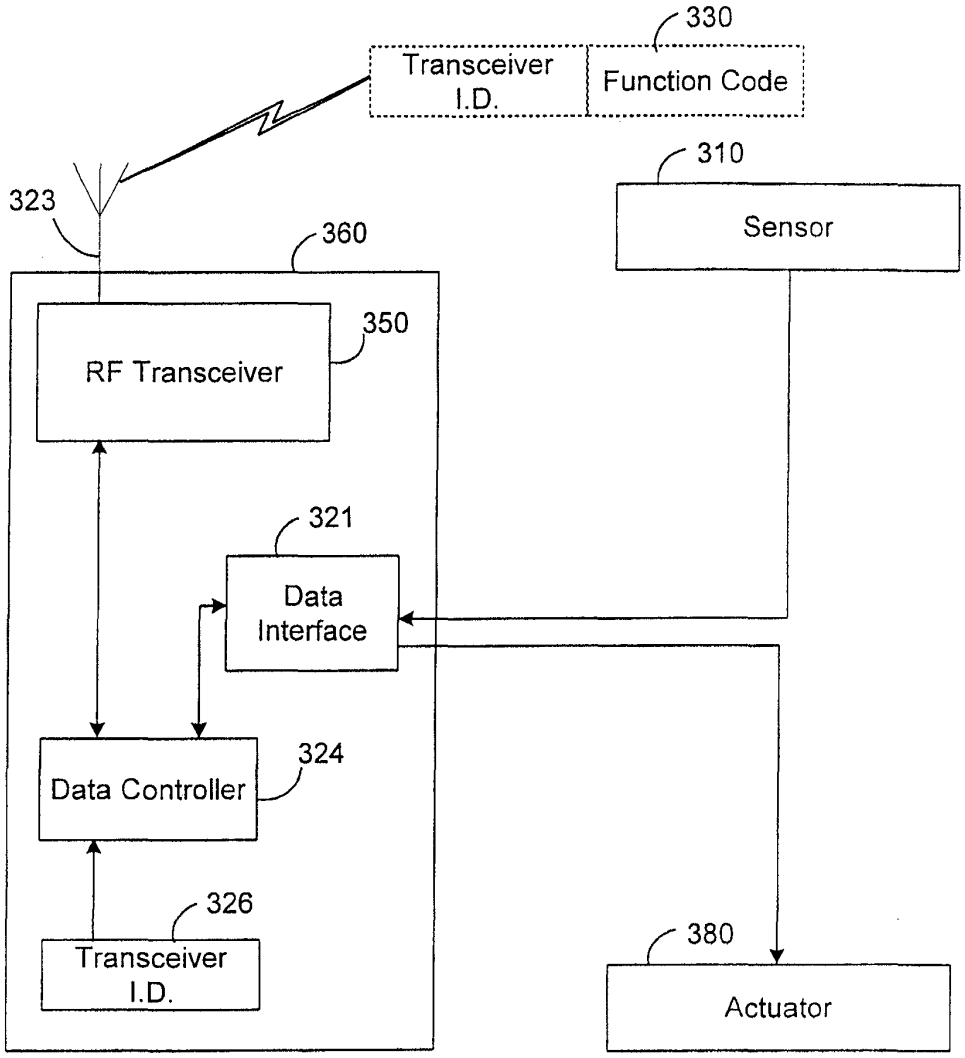

FIG. 3C

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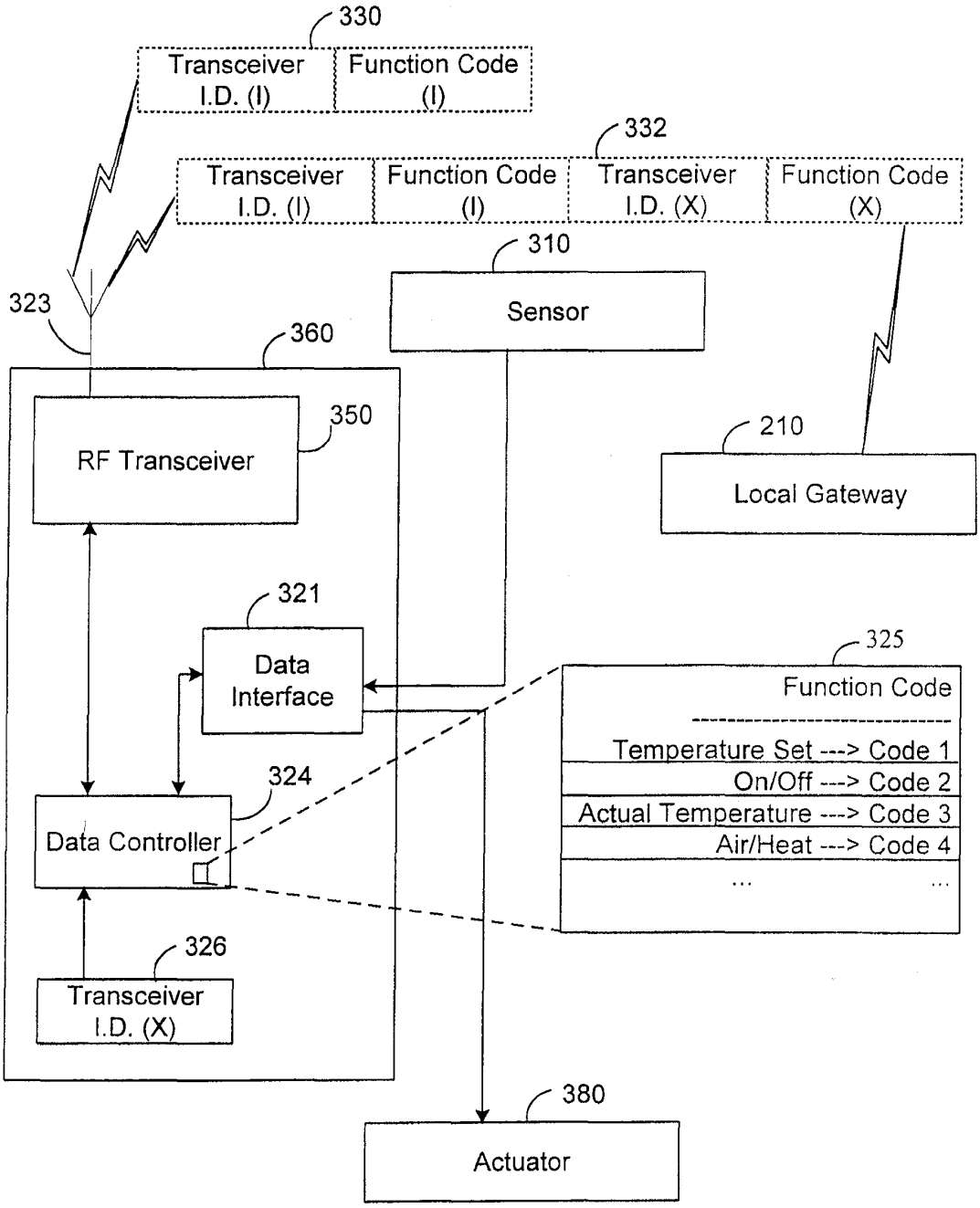

FIG. 3D

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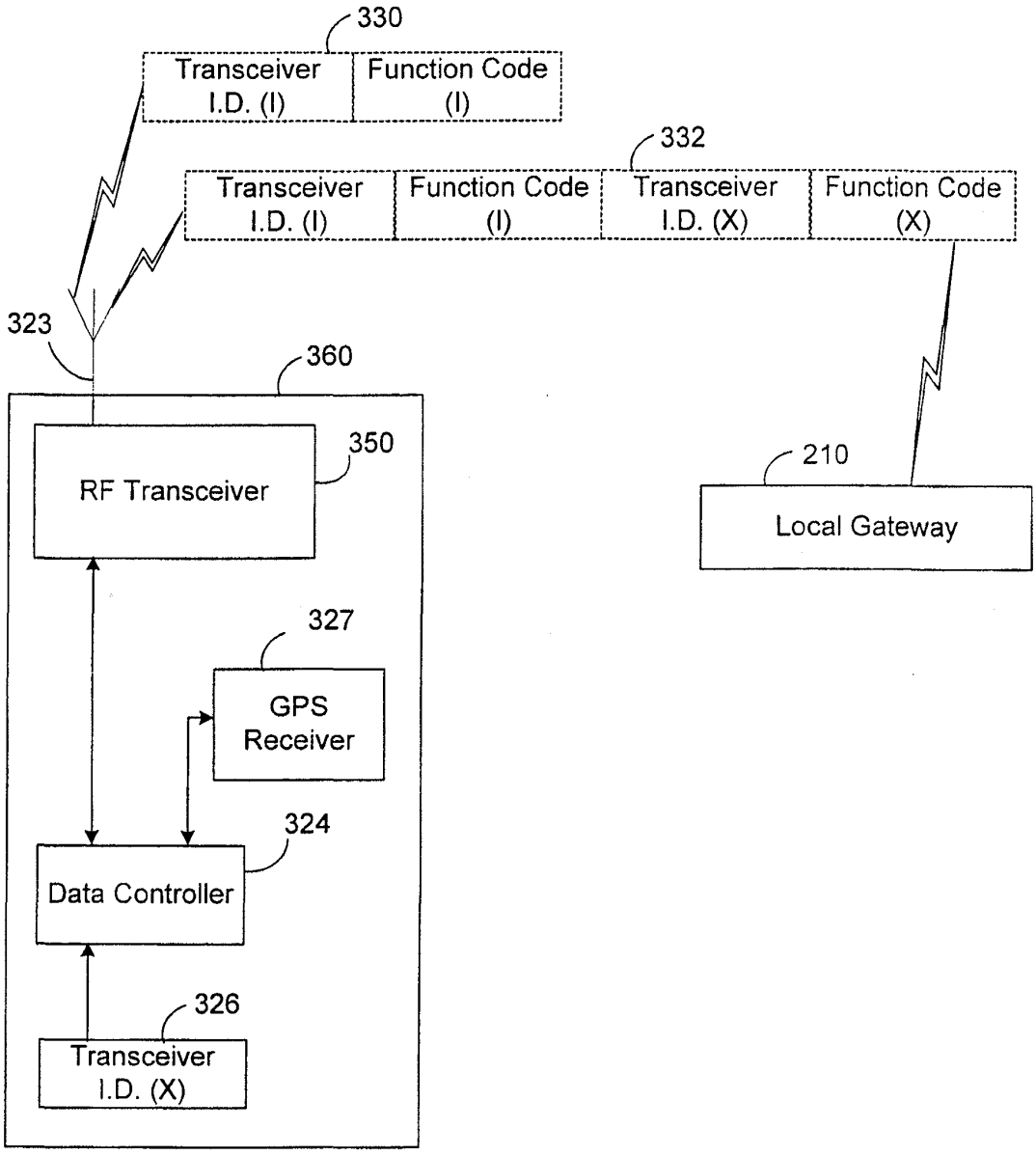

FIG. 3E

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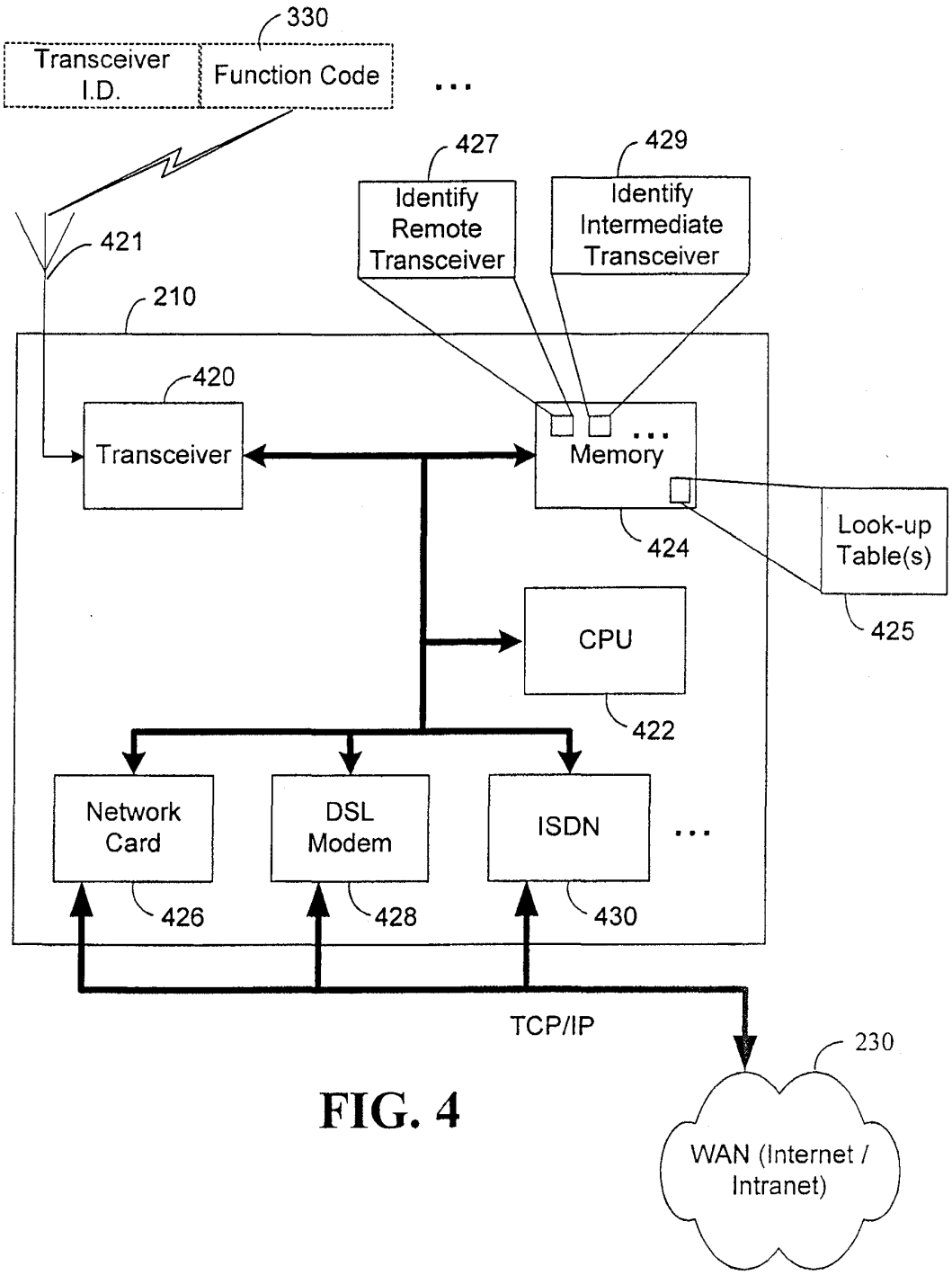

FIG. 4

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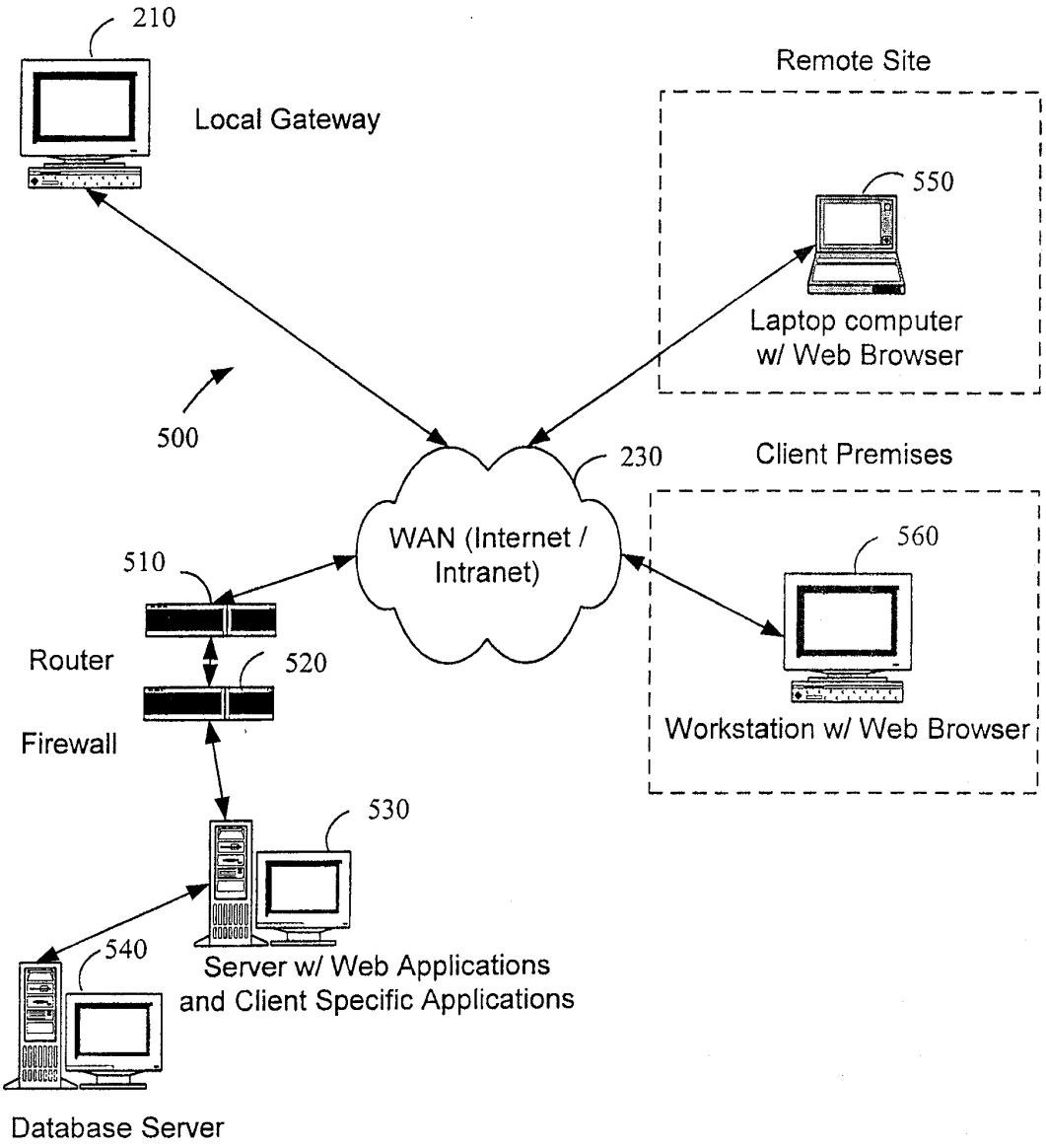

FIG. 5

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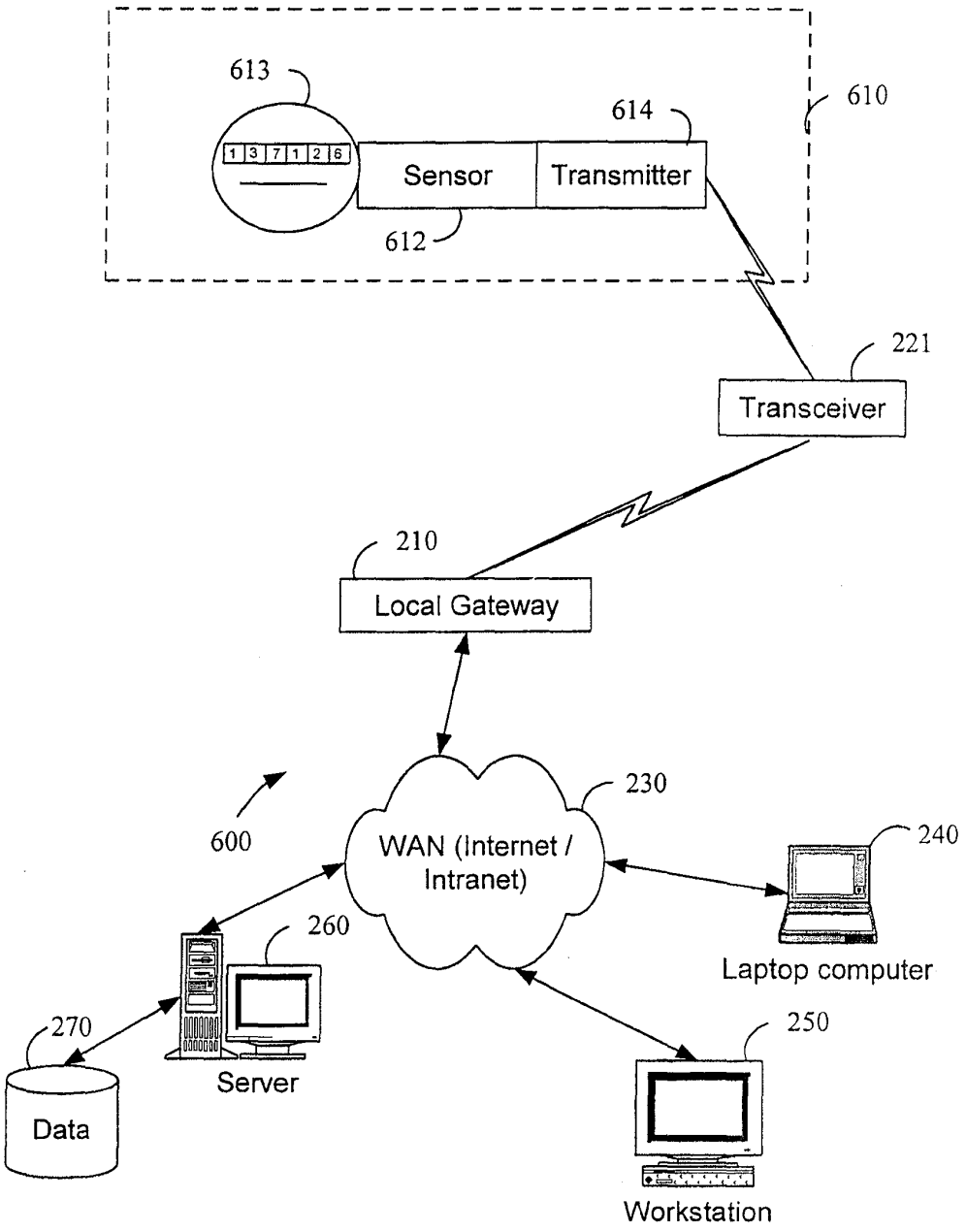

FIG. 6

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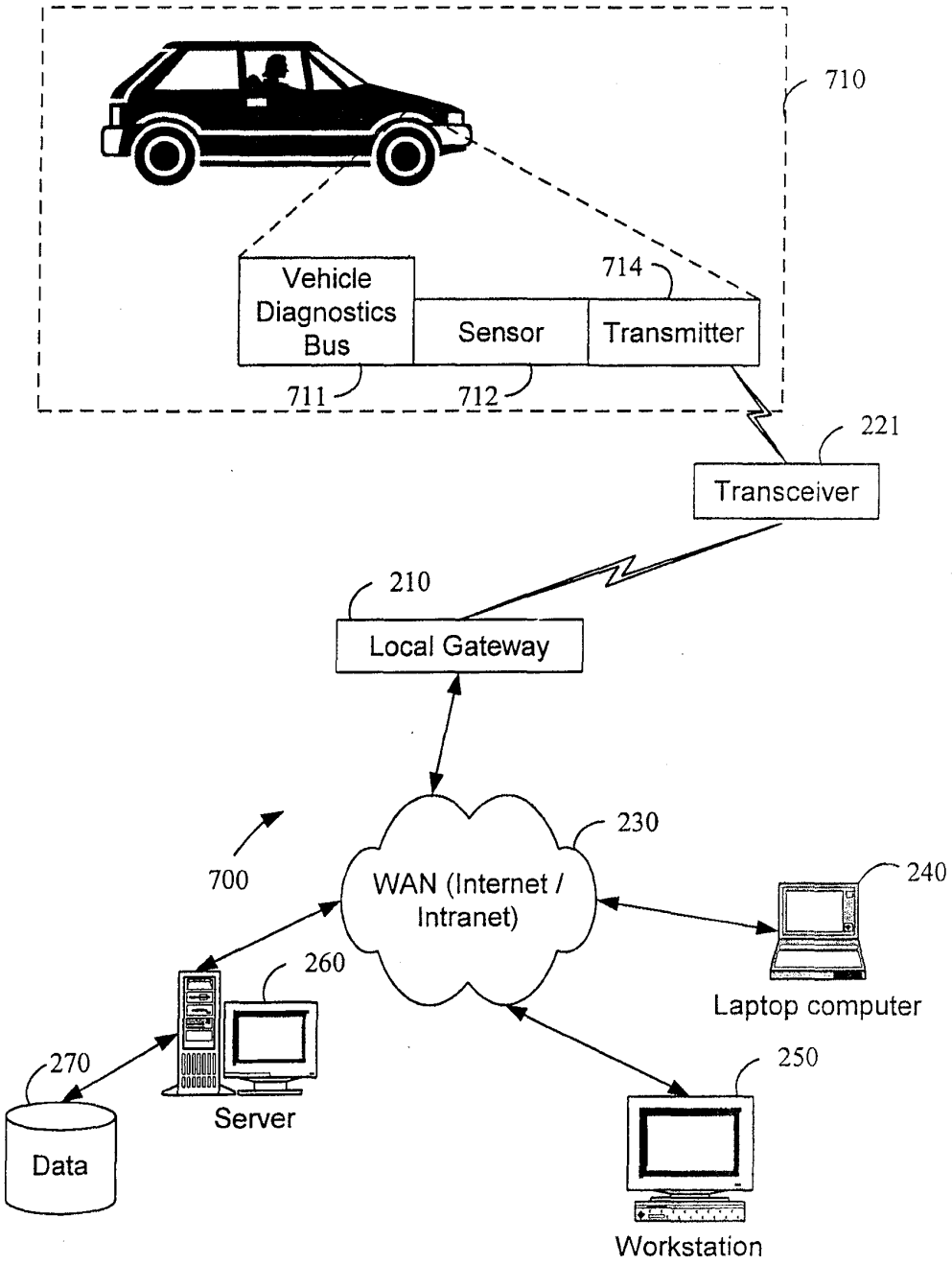

FIG. 7

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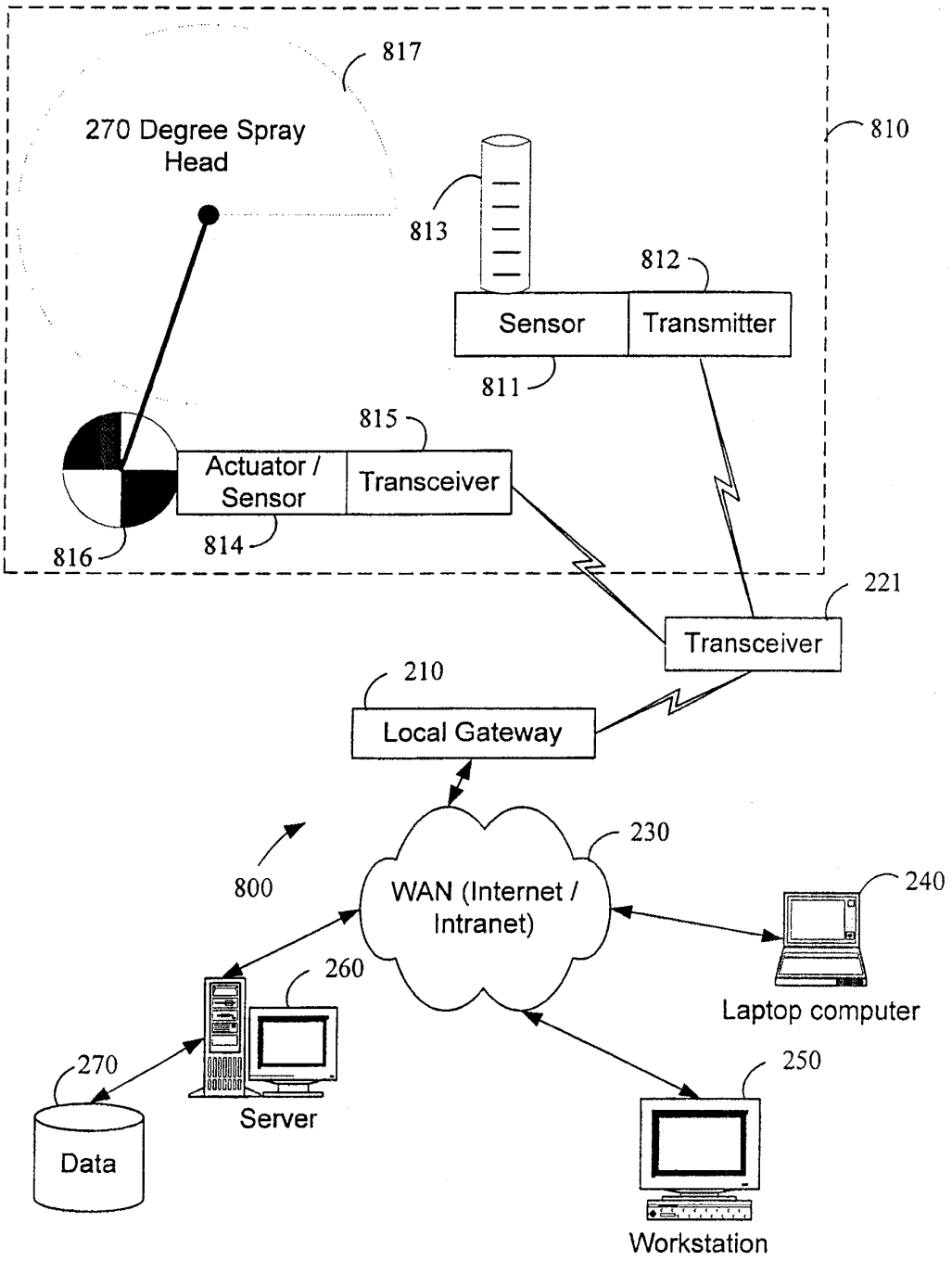

FIG. 8

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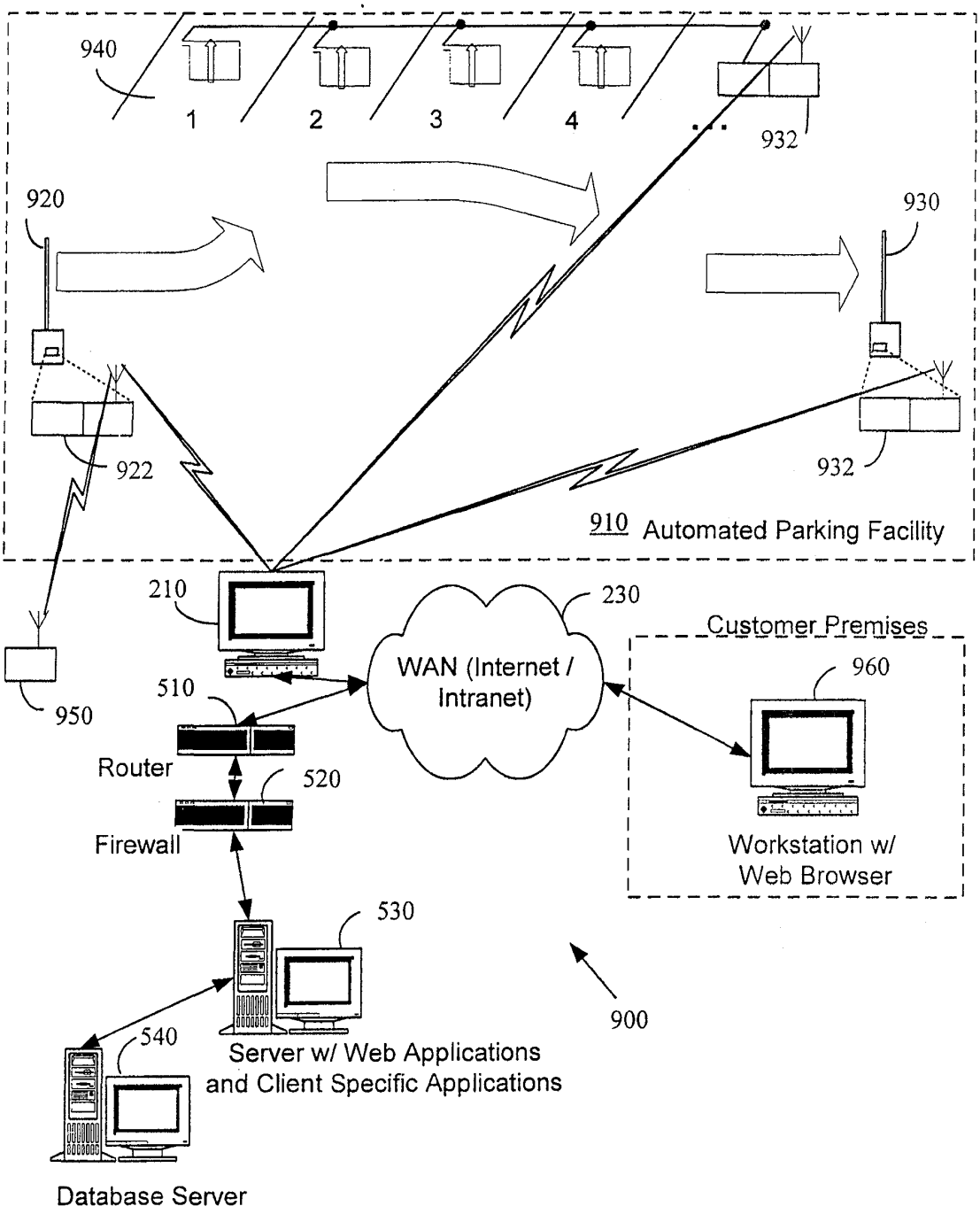

FIG. 9

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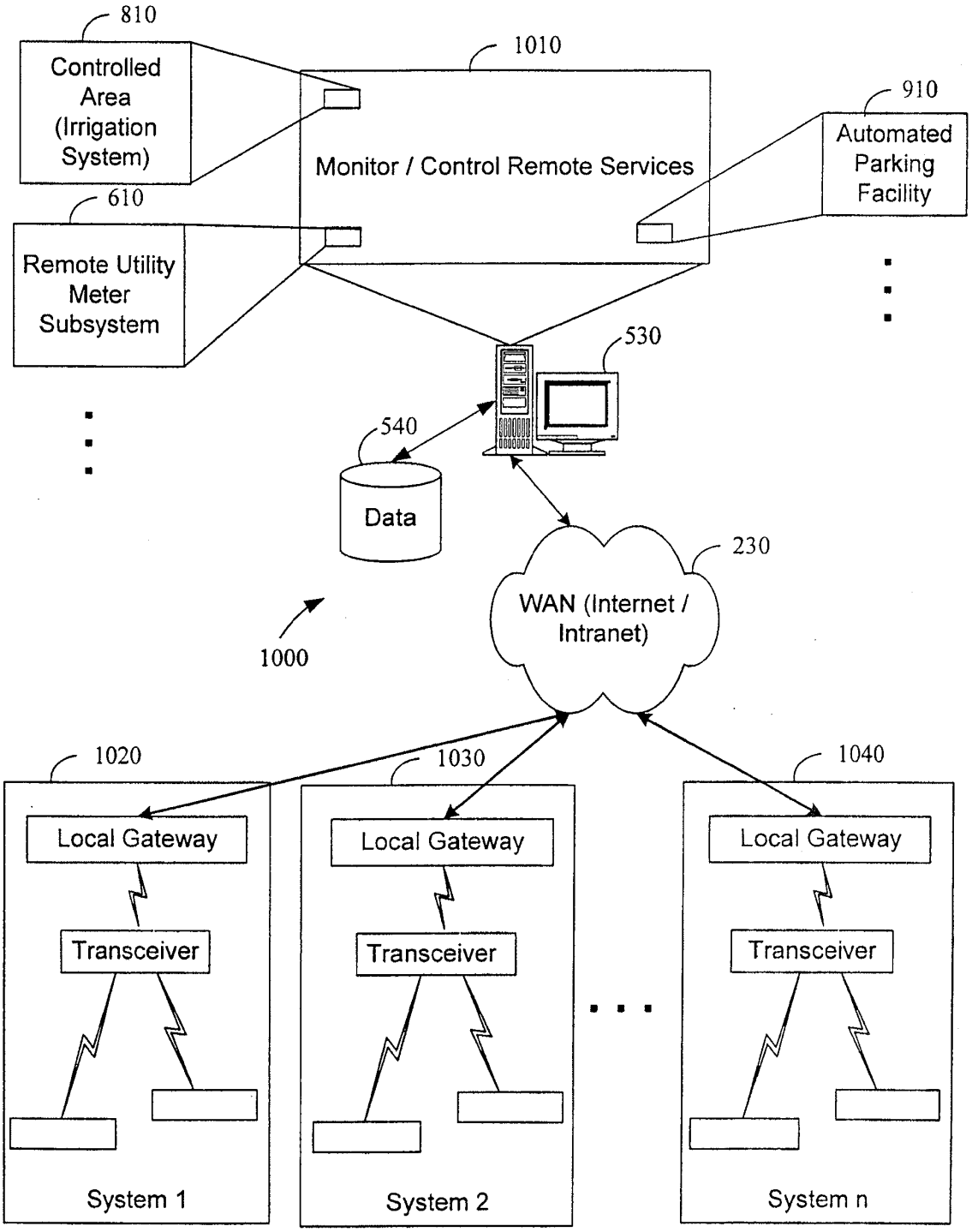

FIG. 10

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FIG. 11 Message Structure

To Addr. (1-6)	From Addr. (6)	Pkt. No. (1)	Pkt. Max. (1)	Pkt. Lngth. (1)	Cmd. (1)	Data (0-238)	CkH (1)	CkL (1)

The order of appearance remains fixed although byte position number in each packet may vary due to one or more of the following reasons:

1. Scalability of the "TO ADDRESS" (1 to 6 Bytes).
2. The CMD Byte.
3. Scalability of the Data portion of the message (0 to 238 Bytes).

"To Address" Byte Assignment:

MSB - Byte 1 Device Type	FF-F0 (16) - Broadcast All Devices (1 Byte Address) EF-1F (224) - Device Type Base (2 to 6 Byte Address) 0F-00 (16) - Personal Transceiver Identification (6 Byte Address)
Byte 2 Mfg./Owner ID	FF-F0 (16) - Broadcast all Devices (Byte 1 Type) (2 Byte Broadcast Address) EF-00 (240) - Mfg./Owner Code Identification Number
Byte 3 Mfg./Owner Extension ID	FF-F0 (16) - Broadcast all Devices (Byte 1 & Byte 2 Type) (3 Byte Broadcast Address) EF-00 (240) - Device Type/Mfg./Owner Code ID Number
Byte 4	FF-F0 (16) - Broadcast all Devices (Byte 1 & Byte 2 Type) (4 Byte Broadcast Address) EF-00 (240) - ID Number
Byte 5	(FF-00) 256 - Identification Number
Byte 6	(FF-00) 256 - Identification Number

"From Address" Byte Assignment:

From Address	(FF-00) Full "ID" of Originating Device (up to 6 Bytes)
Packet Number	(FF-00) Packet Number of Msg. longer than 256 Bytes
Packet Max.	(FF-00) Number of Packets in Message over 256 Bytes
Packet Length	(FF-00) Length (in Bytes) of Packet/Message Transmission*
Command	(FF-00) Command Byte
Data	(FF-00) Data as required by specific command
ChkH	(FF-00) Packet Checksum, High Byte
ChkL	(FF-00) Packet Checksum, Low Byte

* Packet Length - 13 Bytes (Min.) / 256 Bytes (Max.)

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Sample Messages

Central Server to Personal Transceiver - Broadcast Message - FF (Emergency)

Byte Count = 12

To Addr. (FF)	From Addr. (12345678)	Pkt. No. (00)	Pkt. Max. (00)	Pkt. Lngth. (0C)	Cmd. (FF)	CkH (02)	CkL (9E)

First Transceiver to Repeater (Transceiver)
Broadcast Message - FF (Emergency)

Byte Count = 17

To Addr. (F0)	From Addr. (12345678)	Pkt. No. (00)	Pkt. Max. (00)	Pkt. Lngth. (11)	Cmd. (FF)		CkH (03)	CkL (A0)

Data (A000123456)

Note: Additional Transceiver Re-Broadcasts do not change the message.
The messages are simply received and re-broadcast.

Message to Device "A0" From Device "E1" Command - "08" (Respond to PING)
Response will reverse "To" and "From" Addresses

Byte Count = 17

To Addr. (A012345678)	From Addr. (E112345678)	P # (00)	P Max. (00)	P Lngth. (11)	Cmd. (08)	Data (A5)	CkH (04)	CkL (67)

FIG. 12

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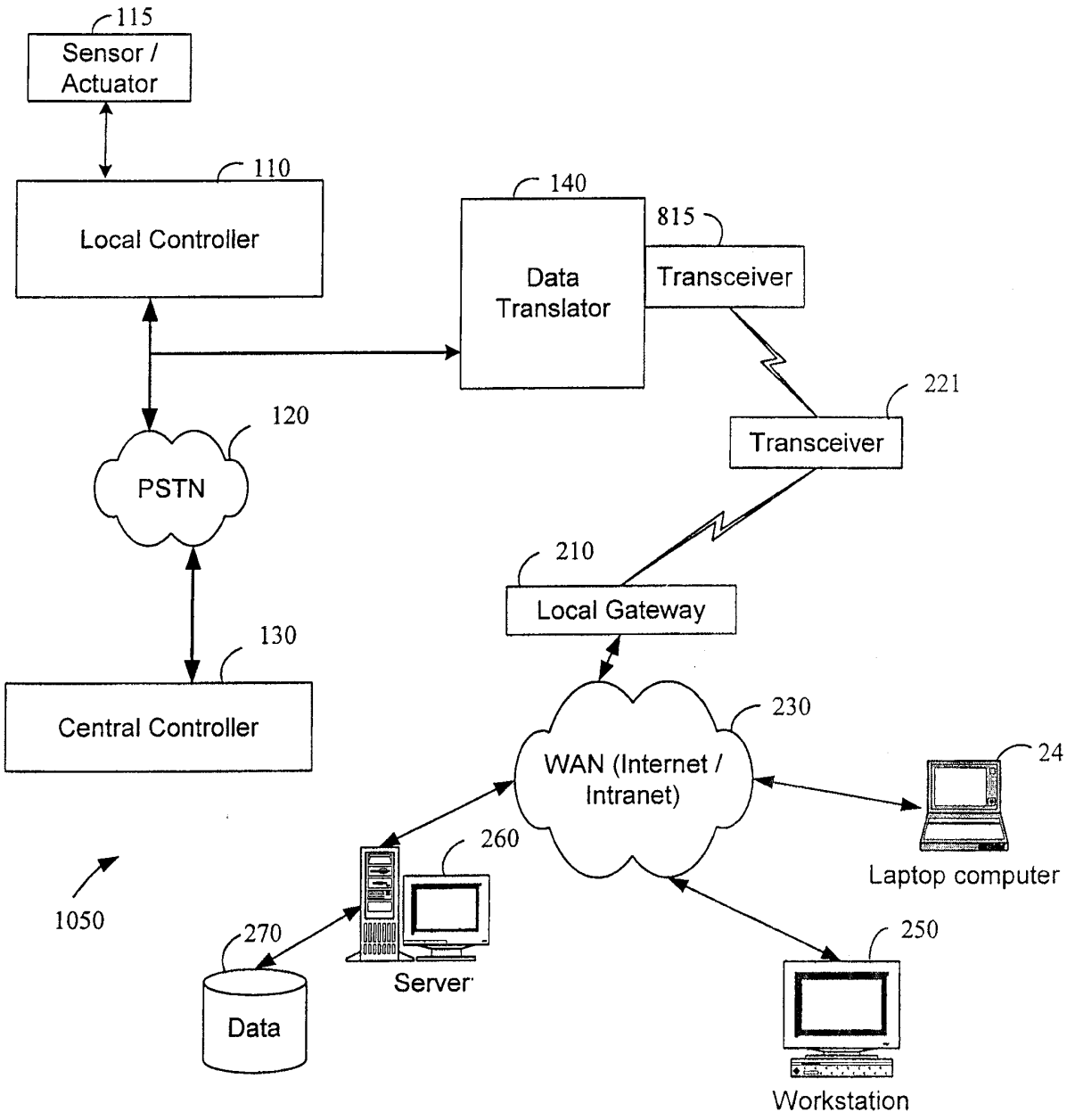

FIG. 13

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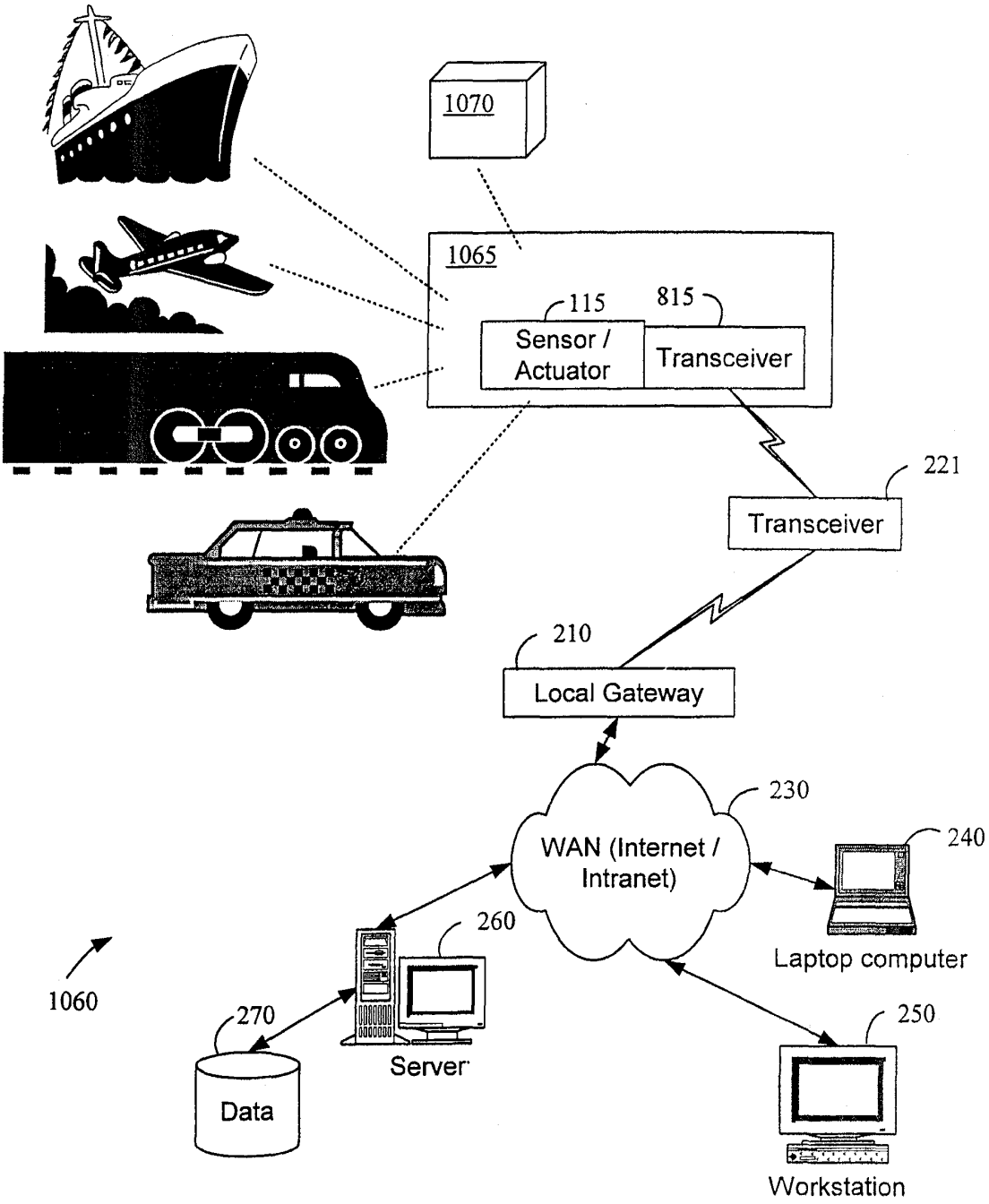

FIG. 14

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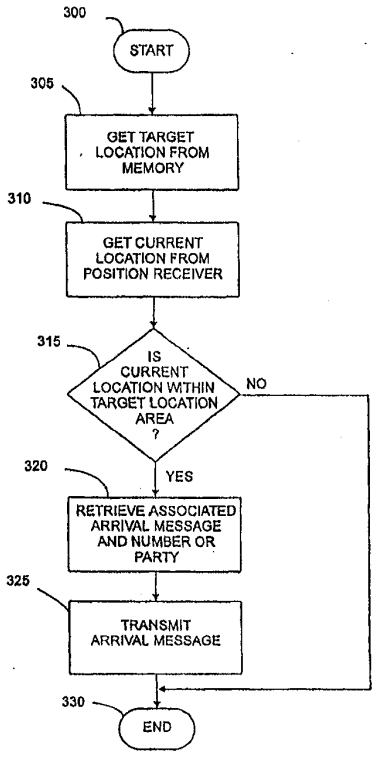
(54) Title: CELLULAR PHONE THAT DISPLAYS OR SENDS MESSAGES UPON ITS ARRIVAL AT A PREDETERMINED LOCATION

(57) Abstract

A mobile communication device, such as a cellular telephone, determines its current location and compares the current location to one or more target locations stored in a target location memory. When the current location of the mobile communication terminal is within one of the target locations in memory, the mobile communication terminal annunciates its arrival by generating an audible alarm, or displays or transmits a predetermined arrival message associated with the target location. In one embodiment of the invention, target location data is determined entered manually via a keypad. In another embodiment, the target location data is obtained from a positioning receiver or a server connected to the communications network and loaded into the target location memory.



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CELLULAR PHONE THAT DISPLAYS OR SENDS MESSAGES UPON ITS ARRIVAL AT A PREDETERMINED LOCATION

Field of the Invention

The present invention relates generally to methods for determining the location of a mobile station in a cellular communication system and, more particularly, to a cellular telephone that is programmed to take some action based upon its arrival at a predetermined location.

Background of the Invention

It is a common practice for a person to place notes in their vehicle to remind them to perform certain tasks. For example, a person may place a note in their vehicle to remind them to pick up groceries on the way home from work. The method most frequently used is to write a note on a sticky note or loose piece of paper which is placed in a location in the vehicle so that it will be seen when the person enters the vehicle. For example, it is common to "stick" notes to an instrument panel or steering wheel, or place notes on loose pieces of paper in a vehicle seat. This method, however, is not foolproof. It is possible that the note will not remain in its original location. For example, a "sticky" note may detach from its original location and fall to the floorboard of a vehicle. Also, a note placed in a vehicle seat may be covered by other articles, or be blown when the door to the vehicle is opened. If the note does not remain in its original location, or if it is covered before it is seen by the user, it will not be effective.

It is also desirable in many cases for a person to periodically call the home or office while traveling to inform family members of their safe arrival, or to inform

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co-workers of their location for business reasons. However, a person may not always remember to call the home or office when arriving at the designated location. Also, the individual may be hurried when arriving at the predetermined location and not have sufficient time to call to report their arrival.

Summary of the Invention

The present invention provides a mobile communication device, such as a cellular telephone, that displays or sends messages when it arrives at a predetermined destination. The phone may be used, for example, to store messages that the user wants to be displayed or sent to another party when the user arrives at predetermined locations. The phone includes a positioning receiver, such as a GPS receiver, and a target location memory. One or more predetermined target locations are stored in the target location memory. The phone periodically determines its current location based on a position signal received by the positioning receiver, and compares its current location to the predetermined target locations stored in memory. The phone is programmed to take some predetermined action when it arrives at the predetermined location or at a predetermined distance from the target location. For example, the phone can annunciate its arrival by sounding an alarm, display a stored message on the phone's display, or transmit the stored message to a remote station.

The phone of the present invention has many applications. For example, the user may want to be reminded when he or she arrives at a known location so that some tasks can be performed. The user can store a reminder in the phone which will be displayed when the user arrives at the target location. Also, it may be desirable in some cases to transmit a message to another party when the user arrives at the predetermined target location. For example, the user may want to

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notify another person when the user arrives at predetermined locations so that the other party will know that the user safely arrived. In this case, the user stores one or more predetermined locations in memory along with a corresponding arrival message. As the user arrives in each location, the corresponding arrival message is transmitted to the other party.

The present invention avoids the age-old problem of writing reminders on note pads, sticky notes, or other pieces of paper which can be lost or overlooked. Also, the present invention avoids the problem of having to stop to notify another person when the user has arrived at certain predetermined location.

Brief Description of the Drawings

Figure 1 is a block diagram of a cellular communication network.

Figure 2 is a block diagram of a mobile communication device of the present invention.

Figure 3 is a flow diagram illustrating the operation of the mobile communication device.

Figure 4 is a flow diagram illustrating the operation of a second embodiment of the mobile communication device.

Figure 5 is a flow diagram illustrating the operation of a third embodiment of the mobile communication device.

Detailed Description of the Invention

Referring now to the drawings, and particularly to Figure 1, a mobile communication system is shown. The mobile communication system, which is

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indicated generally by the numeral 10, comprises a plurality of base stations 12 which are connected via a mobile services switching center (MSC) 14 to a terrestrial communications network such as the Public Switched Telephone Network (PSTN) 16. Each base station 12 is located in and provides service to a geographic region referred to as a cell. In general, there is one base station 12 for each cell within a given network. Within each cell, there may be a plurality of mobile communication terminals 100 that communicate via radio link with the base station 12. The base station 12 allows the user of the mobile communication terminal 100 to communicate with other mobile communication terminals 100, or with users connected to the PSTN 16.

The mobile services switching center 14 routes calls to and from the mobile communication terminal 100 through the appropriate base station 12. Information concerning the location and activity status of the mobile communication terminal 100 is stored in a database which is connected to the MSC 14 so that the network can route communications to the base station that is currently servicing the mobile communication terminal 100.

The MSC 14 also is connected to a target location server 18. The function of the target location server 18 is to convert location data expressed in a particular format, such as a street address, to a geocoordinate that can then be used as hereinafter described. The target location server 18 includes a database for storing data that is needed to convert the location data to a geocoordinate. In this illustration, the communication network 10 is a digital cellular telephone network such as a network that operates according to TIA Standard IS-136.

Referring now to Figure 2, a mobile communication terminal of the present invention is shown and indicated generally by the numeral 100. The mobile

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communication terminal 100 shown in Figure 1 is a fully functional radio transceiver capable of transmitting and receiving digital signals. Those skilled in the art will recognize, however, that the present invention may be implemented in an analog transceiver. The mobile communication terminal 100 includes a control unit or logic unit 102, an operator interface 104, a transmitter 120, a receiver 140, a memory 150, a positioning receiver 160, and a target location memory 170.

The operator interface 104 includes a display 106, keypad 108, control unit 110, microphone 112, speaker 114, alarm 116, and speech synthesizer 118. The display 106 allows the operator to see dialed digits and call status information. The keypad 108 allows the operator to dial numbers, enter commands, and select options. The control unit 110 interfaces the display 106 and keypad 108 with the control unit 102. The microphone 112 receives audio signals from the user and converts the audio signals to analog signals. Speaker 114 converts analog signals from the receiver 140 to audio signals that can be heard by the user. The alarm 116 produces an audible tone to notify the user of an incoming call, or when displaying or sending arrival messages as will be hereinafter described. The speech synthesizer 118 converts text messages to an audible signal that can be played back through the speaker 114.

The analog signals from the microphone 112 are applied to the transmitter 120. The transmitter 120 includes an analog-to-digital converter 122, a digital signal processor 124, and a modulator 126. The analog to digital converter 122 changes the analog signals from the microphone 112 into a digital signal. The digital signal is passed to the digital signal processor 124. The digital signal processor 124 compresses the digital signal and inserts error detection, error correction and signaling information. The compressed and encoded signal from

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The positioning receiver 160 receives signals from a space-based or land-based station that transmits positioning data. For example, the positioning receiver 160 could be a GPS receiver. The received data is passed to the control unit 102 which uses the information to calculate the geographic location of the communication terminal 100.

The target location memory 170 is used to store one or more target locations and associated arrival messages for selected target locations. In general, each target location stored in memory is identified by geocoordinates or other position data. Additional data, such as the number of a receiving party to whom arrival messages are sent, can also be stored in the target location memory 170. The target location memory 170 can be an operational register within the control unit 102 or an address space in memory 150. The target location memory 170 could also be a separate RAM or ROM memory.

The mobile communication terminal 100 of the present invention periodically compares its current location to the target locations stored in the target location memory 170. When the mobile communication terminal 100 arrives at a specified target location, it will take some predetermined action. For example, the mobile communication terminal 100 could annunciate its arrival by activating an alarm, display an arrival message stored in memory to the user, or transmit the arrival message to another person. For purposes of this application, the term target location is not restricted to a single point, but can be considered a geographic area of some geometric shape, such as a circle, centered at a particular point. A mobile communication terminal 100 arrives at the target location when it is within the defined geographic area (e.g. within 2 miles of a designated center point).

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Target location data (i.e. position data) can be input into target location memory 170 in a variety of ways that are well-known in the art. For example, target location data can be input using the mobile communication terminal's keypad 108 and display 106, or downloaded from a computer or other device using a built-in system connector or infrared port on the mobile communication terminal 100. The target location data can also be downloaded over the air interface.

Several methods can be used to obtain geocoordinates or other position data for a particular target location. One method is to drive to the target location and use the positioning receiver 160 to obtain geocoordinates or other position data for the target location. Another method would be to obtain the geocoordinates or other position data from a target location server 18 connected to the communication network 10. For example, Figure 1 shows a target location server 18 connected to the MSC 14. The user enters a street address or other known address, which is transmitted to the base station 12 and forwarded via the MSC 14 to the target location server 18. The target location server 18 converts the address of the target location to geocoordinates. The geocoordinates are transmitted back to the base station 12 and transmitted to the mobile communication terminal 100. Another method is for the user to enter geocoordinates manually through keypad 108 after consulting a map having geocoordinates.

Figure 3 is a flow diagram illustrating the basic operation of the mobile communication terminal 100 of the present invention. As shown in Figure 3, the mobile communication terminal 100 periodically compares its current location to the target locations stored in the target location memory 170. The mobile

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communication terminal 100 retrieves a target location list from the target location memory 170 (block 205) and gets its current location from the position receiver 140 (block 210). The mobile communication terminal 100 then compares the current location to each target location (block 215). If the mobile communication terminal 100 is within any target location in the target location memory 170, the mobile communication terminal 100 notifies the user, for example, by ringing the phone (block 220). The mobile communication terminal 100 then retrieves any arrival message stored in target location memory 170 associated with matching target location (block 225) and outputs the arrival message so that it can be read or heard by the user (block 230). For example, the message can be output to the display 106, or the speech synthesizer 118 can generate an audible message. If the current location does not fall within any target location stored in the target location list, then the procedure ends without any further action (block 235).

The mobile communication terminal 100 described in Figure 3 is useful in an urban environment where target location can be specified by street addresses. The user can store arrival messages in the target location memory 170 which are displayed or played back upon arrival at the target location. For example, the user could store a message in the target location memory 170 to remind the user to stop at the grocery store when the user is in an area near the user's residence.

Figure 4 shows the operation of an alternate embodiment of the mobile communication terminal 100. In this embodiment, the mobile communication terminal 100 is programmed to transmit a message to another party upon its arrival at one of the target locations stored in the target location list. The mobile communication terminal 100 periodically compares its current location to the target locations stored in the target location memory 170. The mobile

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communication terminal 100 retrieves a target location list from the target location memory 170 (block 305) and gets its current location from the position receiver 140 (block 310). The mobile communication terminal 100 then compares the current location to each target location (block 315). If the mobile communication terminal 100 is within any target location, the mobile communication terminal 100 retrieves the number of the party to be notified from the target location memory 170 and the corresponding arrival message (block 320). The mobile communication terminal 100 then formats and sends the arrival message using the SMS message facility (block 325). The message can optionally be displayed or played back to the user so that the user will know that a message has been sent. If the current location does not fall within any target location stored in the target location list, then the procedure ends without any further action (block 330).

The embodiment shown in Figure 4 is useful to notify others when arriving at predetermined locations. For example, the mobile communication terminal 100 could be programmed to send a message to the user's spouse, parent, or other family member to inform a family member that the user has safely arrived at the target location.

Figure 5 shows a third embodiment of the invention. In this embodiment, the mobile communication terminal 100 creates a log of arrival times at predetermined target locations. The mobile communication terminal 100 periodically compares its current location to the target locations stored in the target location memory 170 as in the previous embodiments. The mobile communication terminal 100 retrieves a target location list from the target location memory 170 (block 405) and gets its current location from the position receiver 140 (block 410). The mobile communication terminal 100 then compares the

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current location to each target location (block 415). If the mobile communication terminal 100 is within any target location, the mobile communication terminal 100 records the time of arrival and the target location in memory (block 420) and ends (block 425). If the current location does not fall within any target location stored in the target location list, then the procedure ends without any further action (block 425). The mobile communication terminal 100 can also display an arrival message to the user, or transmit an arrival message to a third party as previously described. This embodiment of the invention is useful to persons who may need to keep a travel log, such as travelling salesmen.

In the examples given thus far, the mobile communication terminal 100 is programmed to take some action upon its arrival at a predetermined location. The same method can be used, for example, to display or send messages as the user travels away from a particular location. For example, a starting location can be stored in the target location memory. The mobile communication device 10 could monitor the distance traveled from the starting location and either display or send messages when a predetermined distance from the starting location is reached.

Although the present invention has been described in connection with a digital cellular telephone network filling the role of the communication network, the invention is not limited to such use, and applies to all kinds of wireless communication networks. The mobile communication devices can be radio transceivers with digital message capability, personal computers or personal digital assistants equipped with wireless modems, and the like. Additionally, the invention may be carried out in specific ways other than those set forth herein without departing from the spirit and the essential characteristics of the present invention. Consequently, the present embodiments are to be construed in all

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aspects as illustrative and not restrictive. All changes coming within the meaning and equivalence range of the appended claims are intended to be embraced by these claims.

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Claims

What is claimed is:

1. A mobile communication device capable of displaying and/or sending user-defined arrival messages upon its arrival at a predetermined location, comprising:

a. a memory for storing target location data identifying one or more target locations, and a corresponding arrival message for each of said target locations;

b. a positioning receiver for determining the current location of the mobile communication device;

c. a control unit operatively connected to said for comparing the current location of the mobile communication device to said target locations stored in said memory;

d. output means responsive to said logic for outputting an arrival message corresponding a target location stored in said memory when the current location matches said target location.

2. The mobile communication device according to claim 1 wherein said output means is a display for displaying said arrival message.

3. The mobile communication device according to claim 1 wherein said output means is a speech synthesizer for converting said arrival message to an audible signal.

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4. The mobile communication device according to claim 1 wherein said output means is a transmitter for transmitting said arrival message to a remote location.

5. The mobile communication device according to claim 1 wherein said target location data comprises a set of target location coordinates corresponding to said target location.

6. The mobile communication device according to claim 1 wherein said target location data is obtained from said positioning receiver.

7. The mobile communication device according to claim 1 further including a keypad and wherein said target location data is entered via said keypad.

8. The mobile communication device according to claim 1 further including a transceiver for communicating with a target location server to obtain said target location data.

9. A method for using a mobile communication device to deliver messages upon arrival at a predetermined location, comprising:

a. storing target location data corresponding to one or more predetermined target locations in a target location memory and an associated arrival message for selected target locations;

b. determining the current location of the mobile communication device ;

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c. comparing said current location of the mobile communication device to said predetermined target locations stored in said target location memory;

d. outputting an arrival message associated with a selected target location when the current location of said mobile communication device matches the selected target location.

10. The method according to claim 9 wherein the arrival message is displayed on a display associated with the mobile communication device.

11. The method according to claim 9 wherein the arrival message is converted to an audible message.

12. The method according to claim 9 wherein the arrival message is transmitted to a designated party.

13. The method according to claim 9 further including inputting said target location data into said target location memory.

14. The method according to claim 9 wherein the target location data is input by entering said target location data on a keypad.

15. The method according to claim 9 wherein the target location data is input from a positioning receiver.

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16. The method according to claim 9 wherein the target location data is input from a target location server connected to a communications network.

17. A mobile communication device capable of displaying and/or sending messages upon its arrival at a predetermined location, comprising:

a. a wireless transceiver for transmitting signals to and receiving signals from a remote station;

b. a memory for storing target location data identifying one or more target locations;

c. a positioning receiver for determining the current location of the mobile communication device;

d. a control unit operatively connected to said transceiver, said memory, and said positioning receiver for comparing the current location of the mobile communication device to said target locations stored in said memory and performing a predetermined action when the current location matches one of said target locations.

18. The mobile communication device according to claim 17 further includes an audible alarm operatively connected to said control unit for generating an audible signal when the current location matches one of said target locations.

19. The mobile communication device according to claim 17 further includes a display operatively connected to said control unit for displaying a

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predetermined arrival message when the current location matches one of said target locations.

20. The mobile communication device according to claim 19 wherein said arrival message is a user-defined message.

21. The mobile communication device according to claim 20 wherein said arrival message is stored in said memory.

22. The mobile communication device according to claim 17 wherein said transceiver transmits a predetermined arrival message to a remote location under direction of said control unit when the current location of said mobile communication device matches one of said target locations.

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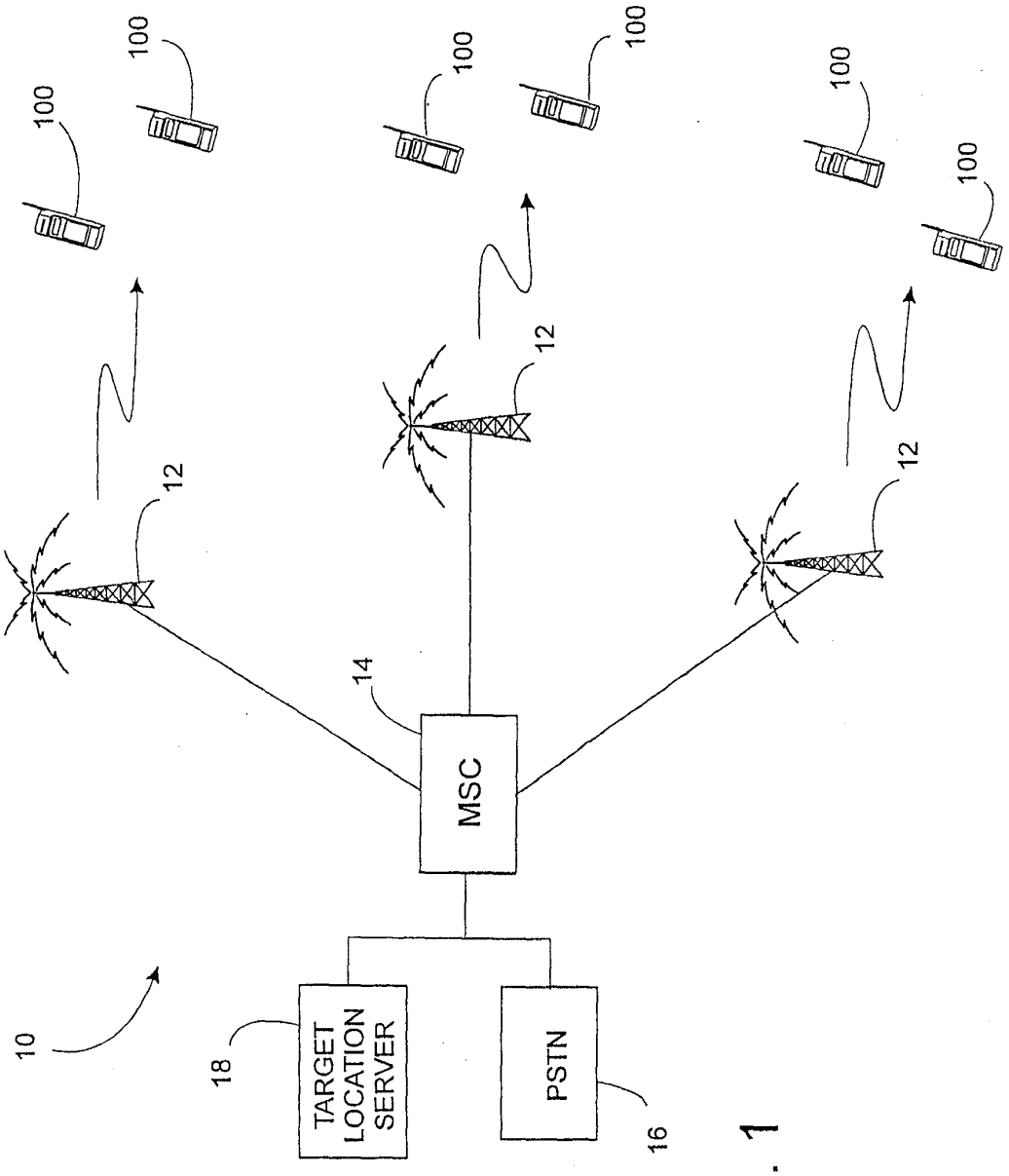

FIG. 1

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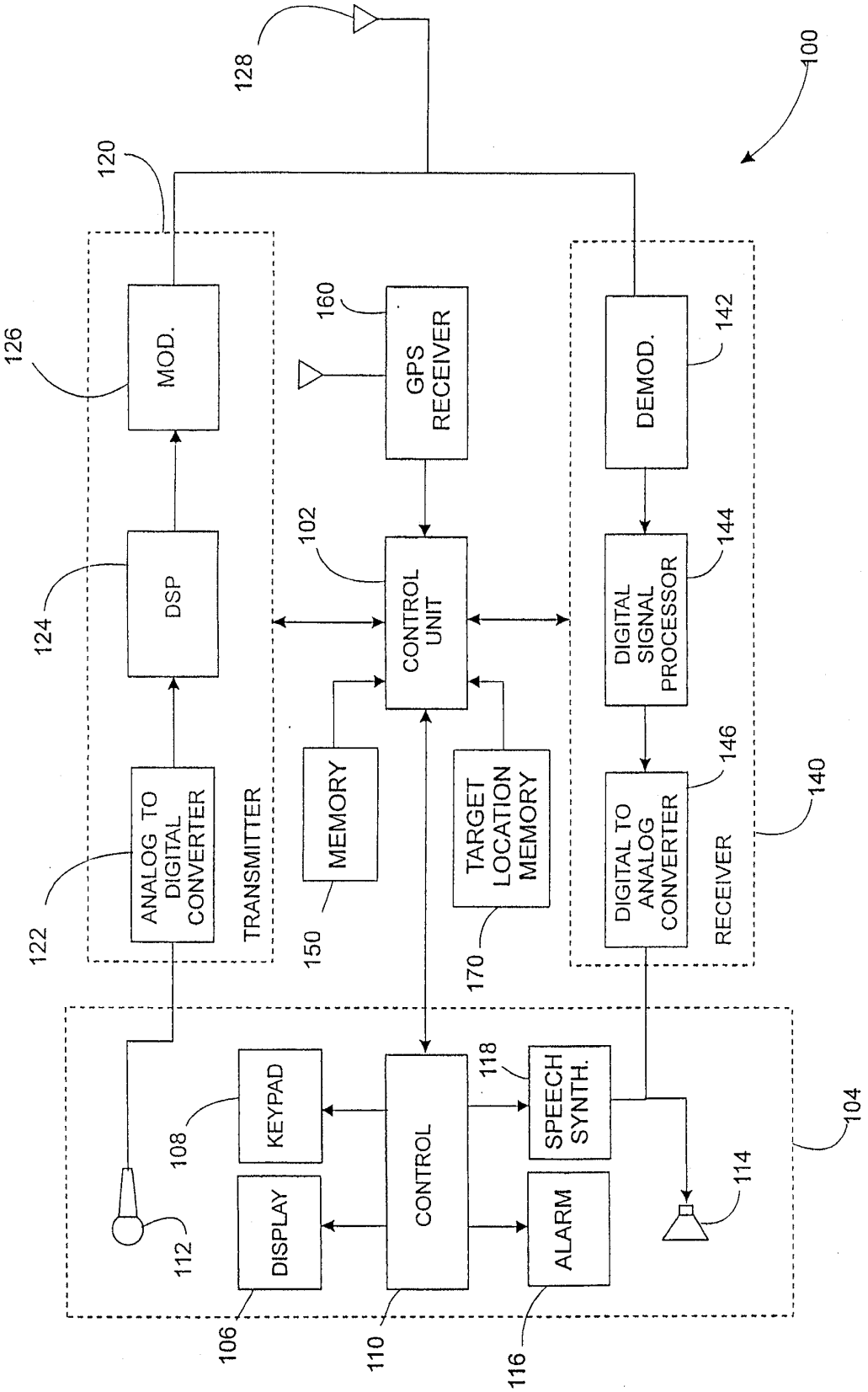

FIG. 2

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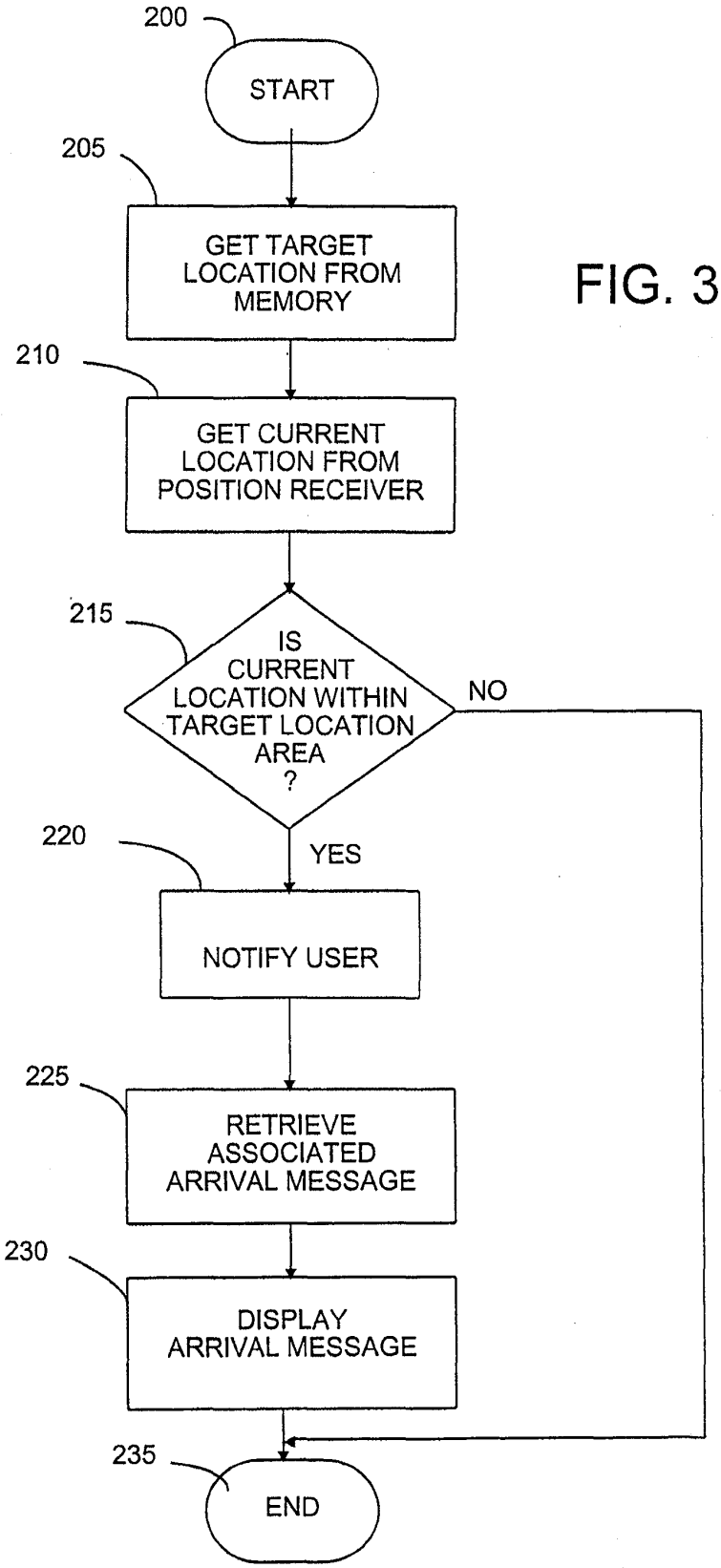

FIG. 3

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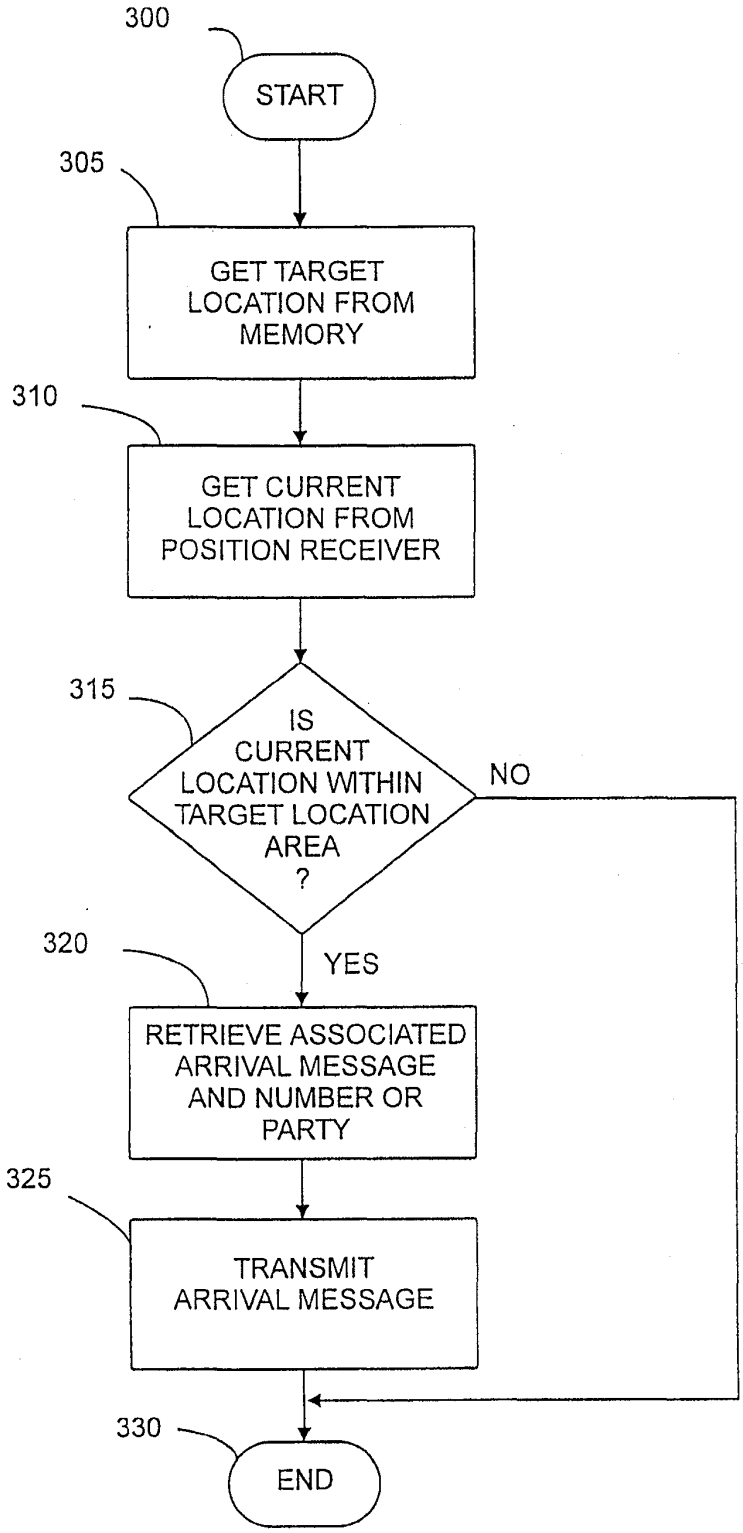

FIG. 4

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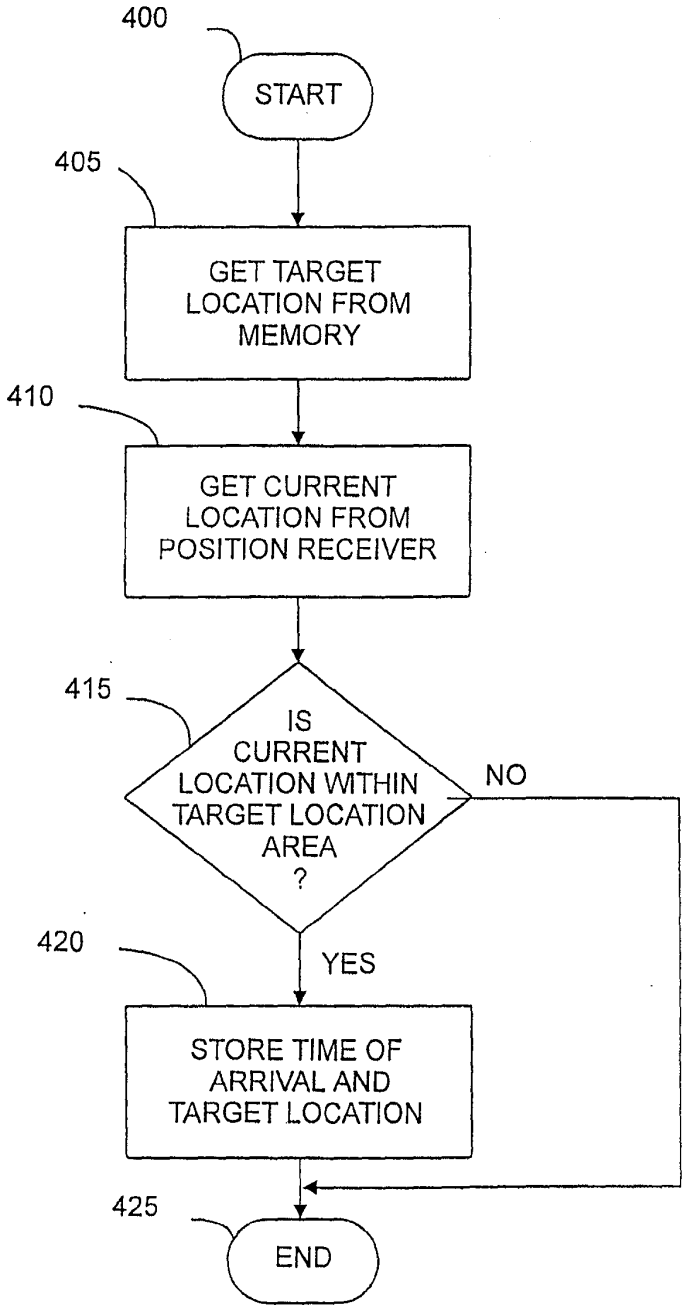

FIG. 5

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 99/30389

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04Q7/38 H04Q7/32 H04M1/274

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04Q H04M G08G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 874 529 A (CASIO COMPUTER CO LTD) 28 October 1998 (1998-10-28) column 3, line 16 - line 22 column 3, line 52 -column 4, line 3 column 5, line 27 - line 49 column 6, line 4 - line 8 ---	1-22
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	-/--	

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

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Date of the actual completion of the international search	Date of mailing of the international search report
23 May 2000	02/06/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Janyszek, J-M

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Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

	ıational Application No
	PCT/US 99/30389

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
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(12) **Offenlegungsschrift**

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G 06 F 15/50
G 01 C 21/20
G 06 F 15/332
// B60R 16/02,G05D 1/02

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(43) Offenlegungstag: 12. 3. 92

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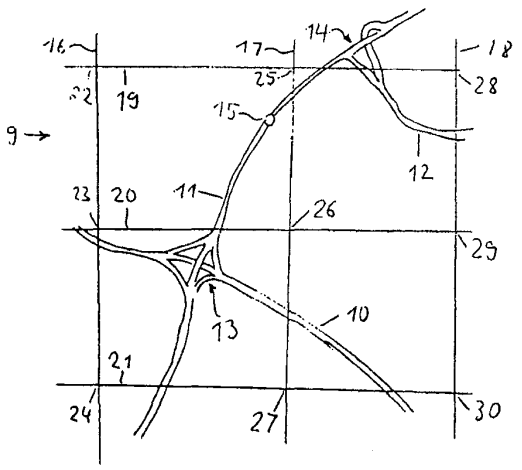
(54) Verfahren zur Umsetzung von in Werten eines geographischen Koordinatensystems erzeugten Standortdaten in eine auf einem karthesischen Koordinatensystem beruhende Rasterform

(57) Gegenstand der Erfindung ist ein Verfahren zur Umsetzung von in Form von Längen- und Breitenangaben erzeugten, geographischen Standortdaten in eine, auf einem karthesischen Koordinatensystem beruhende Rasterform. Die Rasterform ist einer Karte zugeordnet, die auf einem Bildschirm dargestellt wird. Die Umsetzung wird mit einem Kalibriernetz von Datenpunkten ausgeführt, die jeweils durch einen Schnittpunkt einer in der Karte enthaltenen Längengradlinie mit einer Breitengradlinie und durch die Koordinatenwerte in einem kartesischen Koordinatensystem bestimmt sind. Die gelieferten Standortdaten werden mit den Datenpunkten verglichen, um den nächstgelegenen Datenpunkt zu finden, dessen Daten für Kalibrierfaktoren verwendet werden, mit denen die Umrechnung durchgeführt wird.



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Beschreibung

Die Erfindung bezieht sich auf ein Verfahren zur Umsetzung von in Werten eines geographischen Koordinatensystems quasi kontinuierlich erzeugten Standortdaten in eine auf einem kartesischen Koordinatensystem beruhende Rasterform die einer auf einem Bildschirm dargestellten Karte zugeordnet ist, und auf die wahlweise Umsetzung geographischer Standortdaten der Rasterform in die Standortdaten des geographischen Koordinatensystems.

Geographische Informationssysteme erlauben es Benutzern, große Mengen räumlich verteilter Daten zu sammeln, zu verwalten und zu analysieren. Charakteristisch hierbei ist, daß diese Daten räumlich bzw. flächemäßig indexiert sind, wodurch Daten von Karten und beispielsweise Positionsdaten miteinander vereinigt und dargestellt werden können. So können z. B. die Standorte von sich bewegenden Fahrzeugen, Flugzeugen oder Schiffen in einer auf einem Bildschirm dargestellten Landkarte angezeigt werden. Die Standortdaten der sich bewegenden Objekte, die einem Rechner mitgeteilt werden, müssen von diesem in die Koordinaten der gespeicherten Karten umgerechnet werden.

Für die Speicherung, Analyse und Ausgabe von räumlichen Daten werden zwei Verfahren benutzt:

In der Vektordarstellung werden Daten nach Objekten organisiert. Ihre Darstellung geschieht durch Polygone. Geographische Objekte werden durch Punkte, Linien oder Gebiete (Polygone) dargestellt. Beispielsweise werden Städte durch Punkte, Straßen und Flüsse durch Linien und Seen sowie politische Einheiten durch Regionen dargestellt. Ein Vektorsystem kann dann gewählt werden, wenn die Daten nach Eigenschaften interpretiert werden sollen. Mit einer Vektorgrafik ist eine präzise Darstellung der Standorte auf einer Karte möglich; diese Erstellung von Vektorkarten ist aber zeitaufwendig und erfordert aufwendige, nicht standardisierte technische Einrichtungen.

In der Rasterdarstellung werden Daten nach räumlichen Adressen organisiert und mit Hilfe eines Gitters angezeigt. Die X-Y-Lage eines Datenfelds entspricht dabei der räumlichen Lage des jeweiligen Merkmalpunkts. In den Elementen des Datenfelds sind die Attribute des jeweiligen Punkts enthalten. Das Rasterformat eignet sich für die Verarbeitung von auf Gebiete bezogenen Merkmalen. Die Rastergrafik kommt mit Standardeinrichtungen aus und erfordert einen geringeren Aufwand als die Vektorgrafik. Die Genauigkeit der Rastergrafik ist infolge von Abweichungen des verwendeten Kartenmaterials und infolge der Verwendung eines konstanten Kalibrierfaktors in vielen Fällen unbefriedigend.

Für die Darstellung von geographischen Daten, insbesondere von Standorten auf einer Kartengrafik, die auf einem Bildschirm angezeigt wird, wäre es vorteilhaft, als Quellen auf Kartenmaterial für den menschlichen Kartenleser zurückgreifen zu können und trotzdem die Standorte mit hoher Präzision darzustellen. Kartenmaterial der vorstehend beschriebenen Art ist kostengünstig verfügbar und kann z. B. manuell eingescannt werden.

Der Erfindung lieg daher die Aufgabe zugrunde, ein Verfahren der eingangs beschriebenen Gattung dahingehend weiterzuentwickeln, daß auf einfache Weise Standortdaten, die auf ein geographisches Koordinatensystem bezogen sind, in eine auf einem kartesischen Koordinatensystem beruhende Rasterform mit großer Genauigkeit umgesetzt werden können oder wahlweise die in Rasterform vorliegenden Standortdaten in Angaben des geographischen Koordinatensystems mit großer Genauigkeit umgesetzt werden können.

Die Aufgabe wird erfindungsgemäß dadurch gelöst, daß im Rastermaß enthaltene feste Daten über das geographische Koordinatensystem der Karte in Beziehung zu den Koordinaten des Rastermaßes für die Erzeugung von Kalibrierfaktoren gesetzt werden, daß die Kalibrierfaktoren derjenigen Daten des Koordinatensystems, die den geographischen Standortdaten am nächsten kommen, zur Umrechnung der geographischen Standortdaten in die Koordinaten des Rastermaßes verwendet werden und daß wahlweise diejenigen Kalibrierfaktoren von Daten des geographischen Koordinatensystems, die den Standortdaten in den Koordinaten des Rastermaßes am nächsten kommen, zur Umrechnung in geographische Standortdaten verwendet werden. Insbesondere werden die geographischen Standortdaten als Längengrad- und Breitengradangaben erzeugt, wobei die festen geographischen Daten auf Längen- und Breitengradlinien bezogen sind.

Die Erfindung beruht auf dem Prinzip, den in konkreten kartesischen Koordinatenwerten vorliegenden Rasterkarten ein vektorisiertes Netz, bestehend aus Längen- und Breitengradlinien, zu überlagern. Es werden die jeweiligen Kreuzungspunkte dieses Netzes unter Zuordnung zu den entsprechenden geographischen Längen- und Breitengraden vermessen. Hieraus ergibt sich eine von der Lage abhängige Kalibriermatrix beziehungsweise ein Kalibriernetz mit Bereichen äquivalenter, ortsabhängiger Kalibrierfaktoren. Für die Umrechnung der Koordinaten aus den geographischen in das kartesische Koordinatensystem und umgekehrt wird, abhängig vom geographischen Ort, der jeweils gültige und auf den Äquivalenzbereich beschränkte Kalibrierfaktor verwendet. Es wird also derjenige Punkt der Kalibriermatrix für die Bestimmung von Kalibrierfaktoren herangezogen, der den Längen- und Breitenangaben eines gemeldeten Standorts am nächsten gelegen ist. Anstelle nur eines Punkts des Kalibriernetzes können auch mehrere, den vorgegebenen Standortdaten benachbarte Punkte des Kalibriernetzes, z. B. zwei von vier Eckpunkten des Bereichs, in denen die Längen- und Breitenangaben liegen, für die Kalibrierung ausgewählt werden. Die zwei Eckpunkte liegen auf der gleichen Diagonalen durch den Bereich. Mit der Auswahl dieser Punkte des Kalibriernetzes kann die Genauigkeit beeinflußt und z. B. auf einen gewünschten Wert gebracht werden.

Die Datenpunkte für die Kalibrierung werden auf der Grundlage der geographischen Standortdaten eines Punkts derart ausgewählt, daß geprüft wird, ob im Kalibriernetz Datenpunkte mit größeren und kleineren Koordinatenwerten, nur größeren oder nur kleineren Koordinatenwerten als diejenigen des Punkts vorhanden sind. Sind größere und kleinere oder nur kleinere Koordinatenwerte von Datenpunkten vorhanden, wird der Datenpunkt mit den nächstkleineren Koordinatenwerten für die Kalibrierung ausgewählt. Liegen nur Datenpunkte mit größeren Koordinatenwerten vor, wird der Datenpunkt mit den nächstgrößeren Koordinatenwerten für die Kalibrierung ausgewählt. Bei Datenpunkten mit größeren und kleineren Koordinatenwerten wird ein weiterer Datenpunkt für die Kalibrierung ausgewählt, dessen Abszissenwert größer und dessen Ordinatenwert kleiner als der Abszissenwert bzw. Ordinatenwert des Punkts ist. Diese Verfahrensschritte werden sowohl angewendet, wenn Koordinatenwerte eines

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Punkts in geographischen Standorten als auch im Rastermaß vorliegen, wobei die Umsetzung in das jeweils andere Koordinatensystem durchgeführt werden soll. Die Kalibrierfaktoren ergeben sich bei zwei Datenpunkten als Verhältnis aus der Differenz der Koordinatenwerte der Datenpunkte im Rastermaß als Zählerwert und aus der Differenz der Koordinatenwerte der Datenpunkte im geographischen Koordinatensystem als Nennwert, wenn geographische Standortdaten in Werte für die Rasterform umgesetzt werden sollen.

Im umgekehrten Fall, d. h. bei der Umwandlung von Koordinatenwerten der Punkte des Rastermaßes in geographische Standortdaten entsprechen die Kalibrierfaktoren den Reziprokwerten der vorstehend angegebenen Quotienten.

Die genauen Koordinatenwerte für die einzelnen Punkte ergeben sich für das Rasterkoordinatensystem aus der Summe der Koordinatenwerte des einen Datenpunkts im Rasterkoordinatenmaß und des Produkts des jeweiligen Kalibrierfaktors mit der Differenz des Koordinatenwerts im geographischen Koordinatensystem und des Koordinatenwerts des Punkts im geographischen Koordinatensystem. Geographische Koordinatenwerte ergeben sich aus der Summe des einen Datenpunkts im geographischen Koordinatensystem und des Produkts des jeweiligen oben erwähnten Reziprokwerts mit der Differenz des Koordinatenwerts des einen Datenpunkts und des jeweiligen Punkts, wobei beide Koordinatenwerte im Rastermaß verwendet werden.

Nach der Kalibrierung werden die in das Rastermaß der Karte umgesetzten Standortdaten in der auf einem Bildschirm dargestellten Karte angezeigt. Fortlaufend sich ändernde Standortdaten, die insbesondere von einem sich bewegenden Objekt erzeugt werden, ergeben auf dem Bildschirm eine genaue Anzeige der veränderlichen Objektpositionen.

Ebenso ist es möglich, aus der Karte Objekte auszuwählen, deren Daten in X-Y-Rastermaß gespeichert sind. Danach werden die den ausgewählten Stellen am nächsten kommenden Längen- und Breitenangaben festgestellt. Mit Hilfe der zugeordneten Kalibrierfaktoren werden die Standortdaten in Längen- und Breitenangaben erstellt und z. B. als Steuerdaten an ein bewegbares Objekt ausgegeben.

Bei den bewegbaren Objekten, deren Standortdaten angezeigt werden sollen oder die an Hand einer Karte Steuerdaten erhalten, kann es sich um Fahrzeuge handeln. Für das Bild der Karte werden Datenpunkte definiert, von denen jeder durch einen Schnittpunkt der in der Karte angegebenen Breiten- und Längengradlinien bestimmt ist und die entsprechenden Angaben über den Breiten- und Längengrad enthält. Darüber hinaus sind jedem Datenpunkt Positionsangaben in der Abszissen- und Ordinatenachse des kartesischen Koordinatensystems zugeordnet, das der gerasterten Grafik zugrundeliegt. Die als Längen- und Breitenangabe beispielsweise von einem sich bewegenden Objekt eingehenden Standortdaten werden mit den Datenpunkten der gerasterten Grafik verglichen, um mindestens einen nächstliegenden Datenpunkt aufzufinden. Dessen im Rastermaß vorgegebene Standortdaten werden zur Umrechnung in das X-Y-Rastermaß benutzt, bevor die umgerechneten Daten auf einem Bildschirm bzw. Monitor dargestellt werden.

Weitere Einzelheiten, Vorteile und Merkmale der Erfindung ergeben sich nicht nur aus den Ansprüchen, den diesen zu entnehmenden Merkmalen — für sich und/oder in Kombination —, sondern auch aus dem der Zeichnung zu entnehmenden bevorzugten Ausführungsbeispiels.

Es zeigt

Fig. 1 eine Anordnung zur Erzeugung, Übertragung und Darstellung von Standortdaten im Schema und

Fig. 2 einen Ausschnitt aus einer auf einem Bildschirm dargestellten Landkarte mit angezeigten Standortdaten eines Fahrzeugs.

Ein Fahrzeug (1) hat ein an sich bekanntes Standortbestimmungsgerät, das Standortdaten unter Bezug auf die Längen- und Breitengradpositionen erzeugt. Diese Standortdaten werden durch Funk zu einer ortsfesten Station (2) übertragen, die Standortdaten über eine Antenne (3) empfängt, der ein Umsetzer (4) nachgeschaltet ist, der die Standortdaten an eine Schnittstelle (5) ausgibt. An die Schnittstelle (5) ist eine Datenverarbeitungseinrichtung (6), mit der eine Tastatur (7) und ein Monitor (8) verbunden sind, angeschlossen. In der Datenverarbeitungseinrichtung (6) ist ein nicht näher dargestellter Speicher vorhanden, der in Rasterdarstellung eine Landkarte enthält. Bei der Rasterdarstellung sind die Elemente eines Datenfelds, den räumlichen Stellen der Landkarte entsprechend, X-Y-Koordinatenwerten zugeordnet. Die Elemente des Datenfelds enthalten Attribute für den jeweiligen Kartenpunkt. Die Datenfeldstruktur des Rasters eignet sich besonders für die Datenrepräsentation in Programmiersprachen. Es werden Informationen den digitalen Bilddaten entnommen.

Auf dem Monitor (8) wird die digital gespeicherte Landkarte angezeigt. Es kann auch nur ein Teil der Landkarte angezeigt werden, wobei die anzuzeigenden Teile über die Tastatur (7) ausgewählt werden.

Die **Fig.** 2 zeigt einen Ausschnitt einer auf dem Monitor (8) dargestellten Landkarte (9). Der Ausschnitt gemäß **Fig.** 2 enthält Straßen (10), (11), (12) mit einer Kreuzung (13) und einem Abzweig (14). In dem Ausschnitt der Landkarte (9) soll der Standort des Fahrzeugs (1) mit hoher Genauigkeit dargestellt werden. Hohe Genauigkeit bedeutet auch, daß das Fahrzeug, z. B. mittels eines CURSORS genau auf Straßen, Plätzen, Höfen usw. der Landkarte angezeigt wird. In **Fig.** 2 ist das Fahrzeug (1) durch einen Punkt (15) auf der Landkarte (9) dargestellt.

Bei den vom Fahrzeug erzeugten Standortdaten handelt es sich um quasi kontinuierliche Daten. Daher müssen die vom Fahrzeug (1) mitgeteilten Standortdaten in die gerasterte Grafik der Landkarte (9) umgesetzt werden, bevor sie auf dem Monitor (8) angezeigt werden können.

Die gespeicherten Daten der Landkarte (9) sind durch z. B. manuelle Einscannung einer kommerziell erhältlichen Landkarte gewonnen. Auf diese Weise kann das darzustellende Kartenmaterial kostengünstig erstellt werden. In kommerziell erhältlichen Landkarten, z. B. der Landkarte (9), sind Längengradlinien (16), (17), (18) und Breitengradlinien (19), (20), (21) angegeben. Diese Angaben sind auch im gerasterten Datenfeld in X-Y-Koordinaten enthalten. Dieser Sachverhalt wird dazu benutzt, die in Längen- und Breitenangaben angelieferten Standortdaten des Fahrzeugs (1) auf der Karte mit großer Präzision anzuzeigen. Diese präzise Darstellung läßt sich auf einfache Weise erreichen.

Für das Bild der Landkarte (9) wird ein Kalibriernetz von Datenpunkten definiert. Jeder Datenpunkt ist der Schnittpunkt eines im Rastermaß der Karte enthaltenen Längengradlinie und einer Breitengradlinie. Für den in **Fig.** 2 dargestellten Ausschnitt ergeben sich neun Datenpunkte (22), (23), (24), (25), (26), (27), (28), (29) und (30)

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als Schnittpunkte der Längenradlinien (16) bis (18) und der Breitengradlinien (19) bis (21). Den Datenpunkten (22) bis (30) sind jeweils Ordinaten- und Abszissenwerte des kartesischen Koordinatensystems zugeordnet. Diese Ordinaten- und Abszissenwerte werden zur Erzeugung von Kalibrierfaktoren ausgenutzt, mit denen die in Form von Längen- und Breitenangaben vorliegenden Standortdarten des Fahrzeugs (1) von der Datenverarbeitungseinrichtung (6) in die X-Y-Koordinatenwerte der Rastergrafik der Landkarte (9) umgesetzt werden, bevor sie auf dem Monitor (8) dargestellt werden. Es wird also der in konkreten kartesischen Koordinatenwerten vorliegenden Rasterkarte ein vektorisiertes Netz, bestehend aus geographischen Längen- und Breitengradlinien überlagert. Die Kreuzungspunkte des Längen- und Breitengradliniennetzes werden im kartesischen Koordinatensystems vermessen, wodurch eine Zuordnung erhalten wird, die ein von der Lage abhängiges Kalibriernetz beziehungsweise eine Kalibriermatrix mit Bereichen äquivalenter ortsabhängiger Kalibrierfaktoren ergibt.

Die eingehenden Standortdaten in Form der Längen- und Breitenangaben werden zunächst mit den Werten der Längen- und Breitengradlinien verglichen, um den Datenpunkt zu ermitteln, der den geringsten Abstand zu den eingehenden Standortdaten hat. An Hand der Differenz zwischen dem Längen- und Breitengradwert der eingehenden Standortdaten und dem ermittelten nächstgelegenen Datenpunkt werden mittels der X-Y-Koordinatenwerte des Datenpunkts Kalibrierfaktoren gewonnen, mit denen jeweils der Längen- und Breitengradwert multipliziert wird. Hierdurch ergibt sich eine Darstellung der eingehenden Standortdaten im gespeicherten Rasterformat der Kartengrafik. In diesem Format werden die eingehenden Standortdaten auf der Landkarte (9) angezeigt, wobei sich für eine bestimmte Position auf der Straße (11) der Punkt (15) ergibt. Wenn eine besonders schnelle Umsetzung der Standortdaten des Rastermaßes der Längen- und Breitenangaben in das Rastermaß der X-Y-Koordinaten notwendig ist, kann eine Datenverarbeitungseinrichtung (6) mit Parallel- und Pipeline-Verarbeitung verwendet werden. Es wird also, abhängig vom geographischen Ort der jeweils gültige und auf den Äquivalenzbereich beschränkte Kalibrierfaktor verwendet.

Eine Umsetzung von Standortdaten aus der Kartengrafik in Standortdaten mit Längen- und Breitenangaben ist ebenfalls möglich. Diese Umsetzung beruht auf dem gleichen Netz von Datenpunkten. Die X-Y-Koordinatenwerte eines z. B. über die Tastatur (7) ausgewählten Standorts der Landkarte (9) werden mit den X-Y-Koordinatenwerten der Datenpunkte verglichen, um den nächstgelegenen Datenpunkt festzustellen. Aus der Differenz der Standortkoordinatenwerte und der Datenpunktkoordinatenwerte werden mit Hilfe der dem Datenpunkt zugeordneten Längen- und Breitengradwerte Kalibrierfaktoren gewonnen, mit denen die X-Y-Standortdaten in solche mit Längen- und Breitenangaben umgewandelt werden, die danach von der Datenverarbeitungseinrichtung (6) über die Antenne (3) ausgesendet und z. B. vom Fahrzeug (1) als anzufahrende Sollwerte empfangen werden.

Anstelle nur eines Datenpunkts können auch mehr, insbesondere zwei von vier des den Standort einschließenden Netzwerks für die Kalibrierung verwendet werden. Diese beiden Datenpunkte liegen sich vorzugsweise diagonal gegenüber. Aus den gespeicherten Längen- und Breitenangaben bzw. den X-Y-Koordinatendaten werden die Kalibrierfaktoren gewonnen. Damit können nicht nur Fehler beim Rastern der Karte reduziert, sondern auch systematische Fehler, z. B. des Maßstabs, beseitigt werden.

Ein Punkt (15) hat als geographische Standortdaten die Werte X_{PG}, Y_{PG}, die sich auf ein geographisch kartesisches Koordinatensystem, z. B. auf Längen- und Breitengrade beziehen. Die Rasterkoordinatenwerte, die für die Darstellung auf dem Monitor (8) im Rasterkoordinatensystem erforderlich sind, sind X_{PR} und Y_{PR}.

Die Werte X_{PR} und Y_{PR} werden auf folgende Weise gewonnen:

In einem ersten Verfahrensschritt werden an Hand des geographischen Abszissenwerts X_{PG} und des geographischen Ordinatenwerts Y_{PG} die nächstliegenden Datenpunkte festgestellt. Zuerst wird im Rahmen einer Vergleichsoperation derjenige Datenpunkt gesucht, dessen Abszissenwert im geographischen Koordinatensystem größer und dessen Ordinatenwert im geographischen Koordinatensystem kleiner als die Abszisse X_{PG} und die Ordinate Y_{PG} z. B. des Punkts (15) sind. Die größere Abszisse des Datenpunkts im geographischen Koordinatensystem ist mit X_{1G} und die kleinere Ordinate des Datenpunkts mit Y_{1G} bezeichnet.

In **Fig. 2** wäre der im ersten Verfahrensschritt bestimmte Datenpunkt der Datenpunkt (26).

An Hand des Datenpunkts (26) wird der nächste zur Kalibrierung notwendige Datenpunkt bestimmt. Hierzu wird das Verhältnis des geographischen Punkts (15) zum Kalibriernetzwerk bestimmt. Ein geographischer Punkt kann unterhalb, innerhalb oder oberhalb des Kalibriernetzwerks liegen. Ein Punkt liegt in der Abszissenrichtung unterhalb des Netzwerks, wenn es keinen Datenpunkt im Netzwerk gibt, dessen Abszissenwert kleiner als der Abszissenwert des geographischen Punkts ist. Der Punkt liegt innerhalb des Netzwerks, wenn es Datenpunkte mit größeren und kleineren Abszissenwerten gibt. Oberhalb des Kalibriernetzwerks liegt der Datenpunkt, wenn es nur Datenpunkte mit größeren Abszissenwerten gibt. In entsprechender Weise gilt dies für den Ordinatenwert des Punkts. Diese Prüfung wird für den jeweiligen geographischen Punkt durchgeführt. Wenn der geographische Punkt inner- oder unterhalb des Kalibriernetzwerks liegt, wird der Datenpunkt in der unmittelbar vorhergehenden Zeile oder Spalte als zweiter Datenpunkt bestimmt. Falls der geographische Punkt oberhalb des Netzwerks liegt, dann wird der Datenpunkt in der unmittelbar folgenden Zeile oder Spalte des Kalibriernetzwerks als zweiter Datenpunkt ausgewählt.

Der Punkt (15) liegt innerhalb des Kalibriernetzwerks. Deshalb wird die Längengradlinie (16) und die Breitengradlinie (20) des Kalibriernetzwerks bei der Vergleichsoperation ermittelt, wodurch der Datenpunkt (23) als Kalibrierpunkt ausgewählt ist. Der Datenpunkt (23) hat den geographischen Abszissenwert X_{0G} und den Ordinatenwert Y_{0G}. Die Rasterabszissenwerte und die Rasterkoordinatenwerte der Datenpunkte (23), (26) sind vorgegeben. Die Rasterabszissenwerte der Datenpunkte (23), (26) sind vorgegeben. Die Rasterabszissenwerte der Datenpunkte (23), (26) sind mit X_{0R} und X_{1R}, und die Rasterordinatenwerte der Datenpunkte (23), (26) mit Y_{0R} und Y_{0R} bezeichnet.

Mit den geographischen Abszissen- und Ordinatenwerten und den Rasterabszissen- und Rasterordinatenwerten der Datenpunkte (23), (26) werden zwei Kalibrierfaktoren nach folgender Beziehung für die jeweils Koordinatenachse bestimmt:

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$$k_x = \frac{X_{1R} - X_{0R}}{X_{1G} - X_{0G}} \text{ und } k_y = \frac{Y_{1R} - Y_{0R}}{Y_{1G} - Y_{0G}}.$$

Die für die Darstellung in Rasterform benötigten Koordinatenwerte z. B. des Punkts (**15**) ergeben sich aus der Summe der Koordinatenwerte des einen Kalibrierpunkts und des Produkts des Kalibrierfaktors und der Differenz der geographischen Koordinatenwerte der beiden Datenpunkte.

Es gelten folgende Gleichungen:

$X_{PR} = X_{0R} + k_x (X_{0G} - X_{PG})$ und $Y_{PR} = Y_{0R} + k_y (Y_{0G} - Y_{PG})$.

Der Punkt, z. B. (**15**), dessen Rasterkoordinatenwerte X_{PR} und Y_{PR} sind, wird auf dem Monitor (**8**) mit großer Genauigkeit dargestellt.

Wenn Rasterkoordinatenwerte in geographischen Koordinatenwerte umgesetzt werden sollen, dann wird vom Abszissenwert X_{PR} und vom Ordinatenwert Y_{PR} eines Punkts ausgegangen. Ähnlich wie bei der oben für geographische Koordinaten beschriebenen Methode zur Bestimmung von Datenpunkten für die Kalibrierung werden Datenpunkte mit den Abszissenwerten X_{0R} und X_{1R} und den Ordinatenwerten Y_{0R} und Y_{1R} bestimmt. Diesen Datenpunkten sind geographische Koordinatenwerte X_{0G}, X_{1G} in Abszisseneinrichtung und Koordinatenwerte Y_{0G}, Y_{1G} in Ordinatenrichtung zugeordnet. Hieraus werden die Kalibrierfaktoren in den beiden Koordinatenrichtungen nach folgenden Beziehungen bestimmt:

$$\frac{1}{k_x} = \frac{X_{1G} - X_{0G}}{X_{1R} - X_{0R}} \text{ und } \frac{1}{k_y} = \frac{Y_{1G} - Y_{0G}}{Y_{1R} - Y_{0R}}$$

Die Kalibrierfaktoren für die Umrechnung in geographische Standortdaten sind demnach die Reziprokwerte der Kalibrierfaktoren für die Umrechnung von geographischen Standortdaten in Rasterkoordinaten. Die geographischen Koordinatenwerte in den beiden Koordinateneinrichtungen ergeben sich nach folgenden Beziehungen:

$$X_{PG} = X_{0G} + \frac{1}{k_x}(X_{0R} - X_{PR}) \text{ und } Y_{PG} = Y_{0G} + \frac{1}{k_y}(Y_{0R} - Y_{PR}).$$

Die oben beschriebenen Verfahrensschritte bewirken, daß innerhalb des Kalibriernetzwerks die Koordinatenwerte von nicht auf Zeilen- oder Spaltenlinien liegenden Punkten interpoliert werden. Die Koordinatenwerte von außerhalb des Kalibriernetzwerks liegenden Punkten werden extrapoliert. Für die Extrapolation werden ebenfalls zwei Datenpunkte verwendet, bei denen es sich um die dem Standort am nächsten kommenden handelt. Die Umsetzung erfolgt dann in entsprechender Weise, wie oben dargelegt.

Mit dem oben erläuterten Verfahren werden Ungenauigkeiten der Darstellung vermindert. Das Verfahren basiert auf der Annahme, daß die Kalibrierfaktoren innerhalb eines jeden von Daten- bzw. Kalibrierungspunkten begrenzten Rechtecks überall richtig sind. Je kleiner diese Rechtecke sind, desto mehr trifft diese Annahme zu.

Die Bestimmung der Koordinatenwerte eines in Rasterkoordinaten oder geographischen Koordinaten darzustellenden Punkts wurde oben mittels zweier Datenpunkte beschrieben. Das Verfahren kann aber auch mit mehr als zwei Daten- bzw. Kalibrierungspunkten durchgeführt werden.

Die Datenverarbeitungseinrichtung (6) mit einer rastergraphischen Ausrüstung (auch Pixelgraphik genannt) versehen. Diese Ausrüstung enthält eine Graphikkarte, den Monitor (**8**) und ein Zeigerinstrument, z. B. eine Maus. Das Verfahren wird mit der Darstellungslogik der Rastergraphik ausgeübt und ist unabhängig von einem bestimmten Typ. Bei der Datenverarbeitungseinrichtung (**6**), der Tastatur (**7**) und dem Monitor (**8**) kann es sich um einen Personal-Computer der Type PC AT mit Matrox PC-1281 Graphikkarte und einer Maus der Type Genius GM-6 handeln.

Patentansprüche

1. Verfahren zur Umsetzung von in Werten eines geographischen Koordinatensystems quasi kontinuierlich erzeugten Standortdaten in eine auf einem kartesischen Koordinatensystem beruhende Rasterform, die einer auf einem Bildschirm darstellbaren Karte zugeordnet ist, und auf die wahlweise Umsetzung geographischer Standortdaten der Rasterform in die Standortdaten des geographischen Koordinatensystems, **dadurch gekennzeichnet**, daß im Rastermaß enthaltene feste Daten über das geographische Koordinatensystem der Karte in Beziehung zu den Koordinaten des Rastermaßes für die Erzeugung von Kalibrierfaktoren gesetzt werden, daß die Kalibrierfaktoren derjenigen Daten des geographischen Koordinatensystems, die den geographischen Standortdaten am nächsten kommen, zur Umrechnung der geographischen Standortdaten in die Koordinaten des Rastermaßes verwendet werden und daß wahlweise diejenigen Kalibrierfaktoren von Daten des geographischen Koordinatensystems, die den Standortdaten in den Koordinaten des Rastermaßes am nächsten kommen, zur Umrechnung in geographische Standortdaten verwendet werden.
2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß die geographischen Standortdaten in Längengrad- und Breitengradangaben erzeugt werden und daß die festen Daten auf Längen- und Breitengradlinien bezogen sind.
3. Verfahren nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß für das Bild der Karte ein Kalibriernetz mit Datenpunkten definiert wird, die jeweils durch einen Schnittpunkt einer in der Karte angegebenen Längengradlinie mit einer Breitengradlinie und durch die kartesischen Koordinatenwerte des Rasternetzes festgelegt sind und daß die in Breitengrad- und Längengradangaben vorgegebenen Standortdaten mit Kalibrierfaktoren umgerechnet werden, die aus den Daten mindestens eines Datenpunktes des Kalibriernetzes bestimmt werden, der den Standortdaten am nächsten kommt.
4. Verfahren nach zumindest einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die Kalibrierfaktoren aus den Daten von zwei Datenpunkten gewonnen werden, die auf der Diagonale eines vier Datenpunkte enthaltenden Bereichs liegen, in dem die Standortdaten liegen.
5. Verfahren nach einem oder mehreren der vor-

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hergehenden Ansprüche, dadurch gekennzeichnet, daß die in das Rastermaß der Karte umgesetzten Standortdaten, in einer auf einem Bildschirm dargestellten Karte angezeigt werden.

6. Verfahren nach einem oder mehreren der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß für jeweils einen durch geographische Standortdaten in Form von Koordinatenwerten (X_{PG}, Y_{PG}) bestimmten Punkt geprüft wird, ob im Kalibriernetz Datenpunkte mit größeren und kleineren Koordinatenwerten, nur größeren oder nur kleineren Koordinatenwerten als diejenigen des Punkts vorhanden sind, daß bei Vorhandensein von größeren und kleineren oder nur kleineren Koordinatenwerten der Datenpunkt mit den nächstkleineren und bei nur größeren Koordinatenwerten der Datenpunkt mit den nächstgrößeren Koordinatenwerten als Datenpunkt für die Kalibrierung ausgewählt wird und daß bei größeren und kleineren Koordinatenwerten der Datenpunkte weiterhin derjenige Datenpunkt für die Kalibrierung ausgewählt wird, dessen Abszissenwert größer und dessen Ordinatenwert kleiner als der Abszissenwert bzw. Ordinatenwert des Punkts ist.

7. Verfahren nach einem oder mehreren der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß bei zwei für die Kalibrierung ausgewählten Datenpunkten die Kalibrierfaktoren für die Darstellung im kartesischen Koordinatensystem der Rasterform nach folgenden Beziehungen bestimmt werden:

$$k_x = \frac{X_{1R} - X_{0R}}{X_{1G} - X_{0G}} \text{ und } k_y = \frac{Y_{1R} - Y_{0R}}{Y_{1G} - Y_{0G}},$$

worin mit k_x und k_y die Kalibrierfaktoren in den einzelnen Koordinatenrichtungen, mit X_{1G} und Y_{1G} die Koordinatenwerte im geographischen Koordinatensystem des ersten Datenpunkts, mit X_{0G} und Y_{0G} die Koordinatenwerte im geographischen Koordinatensystem des zweiten Datenpunkts, mit X_{1R}, Y_{1R} die Koordinatenwerte im Rastermaß des ersten Datenpunkts und mit X_{0R}, Y_{0R} die Koordinatenwerte des zweiten Datenpunkts im Rastermaß bezeichnet sind.

8. Verfahren nach einem oder mehreren der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die Koordinatenwerte für jeweils einen im kartesischen Koordinatensystem der Rasterform darzustellenden Punkt nach folgenden Beziehungen bestimmt werden:

$$X_{PR} = X_{0R} + k_x (X_{0G} - X_{PG}) \text{ und } Y_{PR} = Y_{0R} + k_y (Y_{0G} - Y_{PG}),$$

worin mit X_{PR} und Y_{PR} die Koordinatenwerte in Rasterform, mit X_{0R} und Y_{0R} die Koordinatenwerte des einen Datenpunkts in Rasterform und mit k_x und k_y die Kalibrierfaktoren bezeichnet sind.

9. Verfahren nach einem oder mehreren der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß für jeweils einen im kartesischen Koordinatensystem der Rasterform ausgewählten Punkt geprüft wird, ob im Kalibriernetz Datenpunkte mit größeren und kleineren Koordinatenwerten, nur größeren oder nur kleineren Koordinatenwerten als diejenigen des Punkts vorhanden sind, daß beim Vorhandensein von größeren und kleineren oder nur kleineren Koordinatenwerten der Datenpunkt mit den nächstkleineren Koordinatenwerten und bei nur größeren Koordinatenwerten der Datenpunkt mit den nächstgrößeren Koordinatenwerten als Datenpunkt für die Kalibrierung ausgewählt wird und daß bei größeren und kleineren Koordinatenwerten der Datenpunkte weiterhin derjenige Datenpunkt für die Kalibrierung ausgewählt wird, dessen Abszissenwert größer und dessen Ordinatenwert kleiner als der Abszissenwert bzw. Ordinatenwerte des Punkts ist.

10. Verfahren nach einem oder mehreren der Ansprüche 1 bis 5 oder 9, dadurch gekennzeichnet, daß bei zwei für die Kalibrierung ausgewählten Datenpunkten die Kalibrierfaktoren für die Korrektur von Koordinatenwerten in einem kartesischen, geographischen Koordinatensystem nach folgender Beziehung bestimmt werden:

$$\frac{1}{k_x} = \frac{X_{1R} - X_{0R}}{X_{1G} - X_{0G}} \text{ und } \frac{1}{k_y} = \frac{Y_{1G} - Y_{0G}}{Y_{1R} - Y_{0R}}$$

worin mit k_x die Kalibrierfaktoren in den einzelnen Koordinateneinrichtungen , mit X_{1G} und Y_{1G} die Koordinatenwerte im geographischen Koordinatensystem des ersten Datenpunkts, mit X_{0G} und Y_{0G} die Koordinatenwerte im geographischen Koordinatensystem des zweiten Datenpunkts, mit X_{1R} und Y_{1R} die Koordinatenwerte im Rastermaß des ersten Datenpunkts und mit X_{0R} und Y_{0R} die Koordinatenwerte im Rastermaß des zweiten Datenpunkts bezeichnet sind.

11. Verfahren nach einem oder mehreren der Ansprüche 1 bis 5, 9 oder 10 dadurch gekennzeichnet, daß die Koordinatenwerte für einen im geographischen Koordinatensystem zu bestimmenden Punkt nach folgenden Beziehungen bestimmt werden:

$$X_{PG} = X_{0G} + \frac{1}{k_x}(X_{0R} - X_{PR}) \text{ und } Y_{PG} = Y_{0G} + \frac{1}{k_y}(Y_{0R} - Y_{PR}),$$

worin mit X_{PG} und Y_{PG} die geographischen Koordinatenwerte, mit X 0G und Y_{0G} die geographischen Koordinatenwerte des einen Datenpunkts und mit k_x und k_y die Kalibrierfaktoren bezeichnet sind.

Hierzu 1 Seite(n) Zeichnungen

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– Leerseite –

Nummer: DE 40 28 214 A1
Int. Cl.[5]: G 09 B 29/10
Offenlegungstag: 12. März 1992

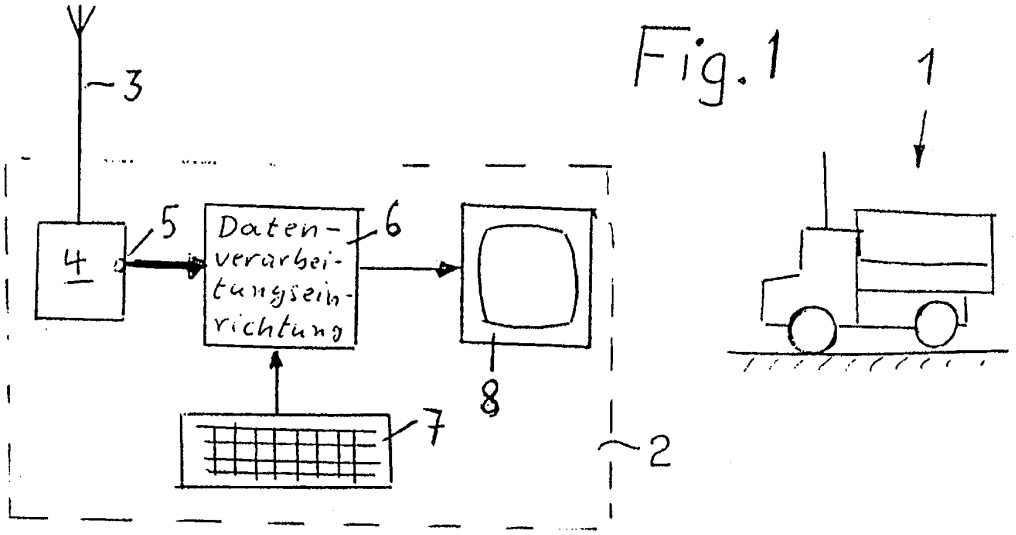

Fig. 1

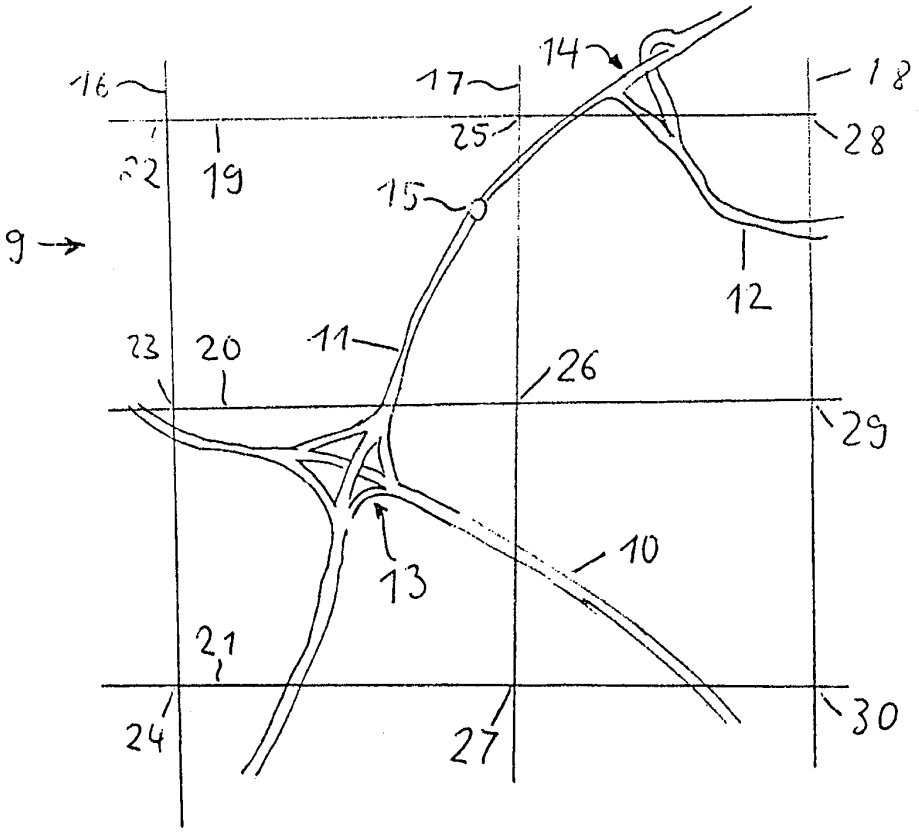

Fig. 2

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uncaptured satellites are also displayed by graphic images for discrimination.

The display 2 indicates the current position of the portable terminal. The current latitude, longitude and altitude are displayed by numerals, and the current position is displayed together with a path from the start location of navigation, using simple graphic images. Although not shown in the display 2, a map is actually displayed here, and the holder of the portable terminal can know the region where he/she is.

The display 3 indicates a target position and navigation. A target latitude, longitude, azimuth and distance and a current azimuth and speed are indicated as character information. A graphic image depicted at the lower part of the display 3 is the pattern of a compass so as to facilitate understanding of a target direction and a current proceeding direction. A white-painted arrow denotes the current proceeding direction, while a black-painted arrow denotes the direction of the target location.

Figs. 10A - 10D are views showing examples of the external appearances of the respective portable terminals of the present invention.

Figs. 10A and 10B exemplify the external

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appearance of a terminal of a portable type. Fig. 10A is a front view, while Fig. 10B is a side view.

A display screen 50 for displaying navigation information, a map, etc. is provided on the front of the terminal, and a GPS antenna 51 is attached to the side part thereof. The GPS antenna 51 may be of either a built-in type or of a construction which is attached afterwards using a PC card slot or the like. Further, the GPS antenna 51 should preferably have a structure whose mounting portion can be moved flexibly so as to capture the radio waves from the satellite, and which can be faced upward in any attitude from the terminal. Incidentally, the terminal has the function of communications installed therein so that it can communicate with a central system. Without the communicating function, however, navigation based on the GPS is still possible.

Figs. 10C and 10D exemplify the external appearances of the terminal of a portable telephone type.

Fig. 10C illustrates the state in which a flipper (cover) 54 is closed. A display screen 52 is provided on the front of the terminal. Navigation information and a map are displayed on the display screen 52. A GPS antenna 53 is disposed in the flipper 54, and it

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can capture the radio waves from the satellite so as to offer current position information etc. to the holder of the terminal.

Fig. 10D illustrates the state in which the flipper 54 is opened. When the flipper 54 is opened, input buttons 55 become visible, and they can be used for giving inputs in order to make a telephone call and to receive the services of navigation etc. There is a mouthpiece at the base of the flipper 54. Thus, the flipper 54 reflects the voice of a person so as to transmit the voice to the mouthpiece.

In this manner, a GPS antenna 53 is built into a part, such as flipper 54, including almost no electric circuitry therein, whereby the GPS function can be installed without enlarging the size of the terminal.

According to the present invention, it is possible to provide a position information management system of high serviceability in which the actions of, for example, an old person or a child can be supervised, in which persons holding portable terminals can acquire position information from each other, and in which an abnormal situation of a person holding a portable terminal can be quickly known.

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In the above description, explanation was given of a supervisory process for detecting when a third party remains at the same site unnecessarily long. However, it is also possible to detect when the third party moves from a certain site before a supervisory period has elapsed, in a case where the third party is intended to remain at the site (for example, a hospital or school).

Although the above description refers to supervision of an old person or child, the present invention may also allow tracking of vehicles, valuable goods, and so forth. In this case, the terminal carried by the item to be tracked may be of a simplified design having reduced display and input capabilities.

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CLAIMS

1. A position information management system comprising:

an information terminal (11) for acquiring information from one of a plurality of kinds of positioning systems (12, 13, 23, 24, 33) and for automatically changing any of said positioning systems in an unavailable state, over to an available one of said positioning systems so as to acquire a current position thereof by the use of the positioning system available; and

a central system for processing said acquired information so as to manage information on a position of the information terminal.

2. The position information management system as set forth in claim 1, wherein said information terminal (11) includes a built-in device (20) which detects a moving direction and a moving speed of said information terminal (11), and even when all of said positioning systems (12, 13, 23, 24, 33) have become unavailable, said information terminal (11) independently detects its current position.

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3. The position information management system as set forth in claim 1 or 2,wherein a third party can acquire the position of a holder of said information terminal (11) through the central system (10).

4. The position information management system as set forth in claim 3, wherein the third party is the holder of said information terminal (11).

5. The position information management system as set forth in claim 3 or 4, wherein a movement of the current position of the holder of said information terminal (11) is supervised, and when said holder of said information terminal (11) either has, or, has not, moved from a certain position after a predetermined time period, an alarm is raised upon a judgement that an unusual situation has occurred to said holder.

6. The position information management system as set forth in any preceding claim, wherein said information terminal (11) transmits position information of a destination to the central system (10), thereby to automatically download map data of an appropriate scale from said central system (10) on demand, the map data containing the current position of said

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information terminal (11) and a position of the destination, and to display said map data.

7. The position information management system as set forth in any preceding claim, wherein said information terminal (11) retains minimum map data of a region in which a holder thereof wants to move, in the form of an IC card.

8. The position information management system as set forth in any preceding claim, wherein said information terminal (11) retains map data downloaded from the central system (10) for a certain period of time, and when map data needed before becomes necessary again, it is searched for from within the map data retained in said information terminal (11) and is displayed.

9. The position information management system as set forth in Claim 8, wherein said information terminal (11) sets a time period for retaining map data of higher use frequency, to be longer than a certain period of time.

10. An information terminal which can communicate with a central system for managing

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position information, and which acquires information from a positioning system so as to display information on a position of the information terminal, comprising:

interface means (14, 15, 16, 17) being serviced by a plurality of kinds of positioning systems (12, 13, 23, 24, 33); and

control means (22) for automatically changing any of the positioning systems in an unavailable state, over to an available one of said positioning systems so as to acquire a current position of said information terminal (11) by the use of the positioning system available.

11. The information terminal as set forth in claim 10, further comprising a built-in device (20) which detects a moving direction and a moving speed of said information terminal (11), and wherein even when all of said positioning systems (12, 13, 23, 24, 33) have become unavailable, said information terminal (11) independently determines and displays its current position.

12. The information terminal as set forth in claim 10 or 11, wherein a third party can acquire the position of a holder of said information terminal (11)

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through the central system (10).

13. The information terminal as set forth in claim 12, wherein the third party is the holder of said information terminal (11).

14. The information terminal as set forth in claim 12 or 13, wherein a movement of the current position of the holder of said information terminal (11) is supervised, and when said holder of said information terminal (11) either has, or has not, moved from a certain position after a predetermined time period, an alarm is raised upon a judgement that an unusual situation has occurred to said holder.

15. The information terminal as set forth in any of claims 10 to 14, wherein said information terminal (11) transmits position information of a destination to the central system (10), thereby to automatically download map data of an appropriate scale from said central system (10) on demand, the map data containing the current position of said information terminal (11) and a position of the destination, and to display said map data.

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16. The information terminal as set forth in any of claims 10 to 15, wherein said information terminal (11) retains minimum map data of a region in which a holder thereof wants to move, in the form of an IC card.

17. The information terminal as set forth in any of claims 10 to 15, wherein said information terminal (11) retains map data downloaded from the central system (10) for a certain period of time, and when map data needed before becomes necessary again, it is searched for from within the map data retained in said information terminal (11) and is displayed.

18. The information terminal as set forth in claim 17, wherein said information terminal (11) sets a time period for retaining map data of higher use frequency, to be longer than a certain period of time.

19. The information terminal as set forth in any of claims 10 to 18, wherein said information terminal (11) is a terminal of portable telephone type, in which an antenna (53) for the positioning systems (12, 13) is disposed in a cover (54) for an input button portion of said information terminal (11).

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20. A portable radio terminal, comprising:

position information acquisition means (14, 15, 16, 17) for obtaining current position information; and

means (22) for transmitting the position information obtained by said position information acquisition means (14, 15, 16, 17), to another equipment through a radio channel, in compliance with a request for said position information made through the radio channel by the other equipment.

21. The portable radio terminal as set forth in claim 20, further comprising means (18) for displaying a map which contains a destination, on the basis of position information of the destination.

22. The portable radio terminal as set forth in claim 21, wherein the display means (18) displays a map of an appropriate scale containing the current position of said portable radio terminal (11) and said destination.

23. The portable radio terminal as set forth in claim 20, 21, or 22, further comprising:

means connected to another equipment, for

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acquiring position information of a third party; and

means for outputting the acquired position information of the third party.

24. A portable radio terminal, comprising:

position information acquisition means (14) for obtaining current position information on the basis of electromagnetic waves from a positioning system;

means (15, 16; 22) for connecting said portable radio terminal through a radio channel with a center which manages current position information of a plurality of portable radio telephone terminals;

means (15, 16; 22) for registering the current position information obtained by said position information acquisition means (14), in the center through the connection means (15, 16; 22); and

means (15, 16; 22) for acquiring a current position of the portable radio terminal of a third party from said center through said connection means (15, 16; 22).

25. The portable radio terminal as set forth in claim 24, wherein an antenna (53) for said position information acquisition means (14) is disposed in a cover (54) for an input button portion of said

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portable radio terminal.

26. The portable radio terminal as set forth in claim 24 or 25, further comprising means (52) for displaying a map which contains the acquired current position of said portable radio terminal of the third party.

27. The portable radio terminal as set forth in claim 26, wherein the display means (52) displays a map of an appropriate scale containing a current position of said portable radio terminal itself and said current position of said portable radio terminal of said third party.

28. A position information management system, substantially as hereinbefore described with reference to the accompanying drawings.

29. An information terminal for use in a position information management system, substantially as hereinbefore described with reference to the accompanying drawings.

30. A portable radio terminal for use in a position information management system, substantially as hereinbefore described with reference to the accompanying drawings.

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Patent Office

54

Application No:	GB 9716207.7	**Examiner:**	Dr E P Plummer
Claims searched:	1 to 19	**Date of search:**	30 October 1997

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): H4D(DAA,DAB,DPBX,DPX), H4L(LDSL,LDDRS)

Int Cl (Ed.6): G01S, H04Q

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB2283873A	TELIA whole document, eg abstract	1,10 at least
X	GB2025185A	SIEMENS whole document, eg abstract	1,10 at least
Y	GB1528180	SPERRY RAND whole document	1,10 at least
Y	EP0601293A2	MOTOROLA whole document, eg abstract	1,10 at least
Y	EP0528090A1	CAE-LINK whole document, eg abstract	1,10 at least
X	EP0006448A1	SIEMENS whole document, eg abstract	1,10 at least
Y	US4806940	HONEYWELL whole document, eg abstract	1,10 at least

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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The Patent Office

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Application No:	GB 9716207.7	**Examiner:**	Dr E P Plummer
Claims searched:	20 to 23	**Date of search:**	23 April 1998

Patents Act 1977
Further Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): H4D (DAB, DSDX)

Int Cl (Ed.6): G01S

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X Y	EP0766096A2	Shimadzu whole document	20 21-23
Y	WO97/01104A1	Thomson-CSF whole document	21-23
X Y	WO95/27219A1	Motorola whole document	20 21-23
X Y	WO92/13284A1	Song whole document	20 21-23
X Y	WO83/02501A1	Jysk Telefon whole document	20 21-23
X	US5548822	Aisin Seiki whole document	20-23
X Y	US5519403	Motorola column 4 line 53ff	20 21-23
X Y	US5504491	Chapman whole document, nb column 2 lines 1 to 5	20-22 23

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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The Patent Office

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Application No: GB 9716207.7 **Examiner:** Dr E P Plummer
Claims searched: 20 to 23 **Date of search:** 23 April 1998

Category	Identity of document and relevant passage		Relevant to claims
X Y	US5461390	AT&T whole document	20 21-23

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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The Patent Office

Application No: GB 9716207.7 **Examiner:** Dr E P Plummer
Claims searched: 24 at least **Date of search:** 9 April 1998

Patents Act 1977
Further Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): H4D(LDSL,LDSM,LDRRS), H4D(DAA,DAB,DPX,DPBA, DPBC,DPBX,DPDA,DPDD,DPDG,DPDK,DPDN,DPDR,DPDX)

Int Cl (Ed.6): H04Q, G01S

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	WO95/27219A1	MOTOROLA whole document - nb mobile unit 6	24,25
A	WO95/17685A1	TANNER	
X	US5389934	THE BUSINESS EDGE GROUP whole document	24,25
X	US5327144	ASSOCIATED RT whole document, eg abstract, column 8 line 63 to column 9 line 38	24-27

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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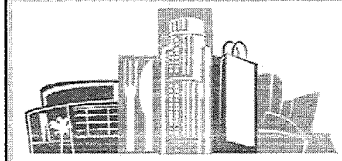

Major Companies Downtown Los Angeles

as of 3Q06

Company Name	Building Name	Address	Suite	SF Occupied	# Emp
Southern California Gas Company	The Gas Company Tower	555 W 5th St	Suite# 17th floor	492,678	1,000
Gibson, Dunn & Crutcher LLP	Wells Fargo Tower	333 S Grand Ave	Suite# 4600	292,700	600
Transamerica Occidental Life Insurance Co	AT&T Tower	1150 S Olive St	Suite# 2700	245,000	25
Paul, Hastings, Janofsky & Walker, LLP	City National Plaza	515 S Flower St	Suite# 25th floor	221,845	500
The Capital Group Companies, Inc.	Bank Of America Plaza	333 S Hope St	Suite# 53rd floor	204,682	800
AT&T	AT&T Tower	1150 S Olive St		181,480	1,000
Quinn Emanuel trial lawyers	TCW Bldg	865 S Figueroa St	Suite# 10th	161,557	428
Munger, Tolles & Olson LLP	KPMG Tower	355 S Grand Ave	Suite# 35th	160,998	300
City of Los Angeles	Figueroa Plaza South Tower	201 N Figueroa St	Suite# 1000	156,065	475
Sheppard, Mullin, Richter & Hampton LLP	Bank Of America Plaza	333 S Hope St	Suite# 48th floor	132,880	300
Los Angeles Community College District	Dai-Ichi Kangyo Bank Bldg	770 Wilshire Blvd		109,166	300
Lewis Brisbois Bisgaard & Smith LLP	Figueroa Plaza North Tower	221 N Figueroa St	Suite# 1200	108,214	330
Musick, Peeler & Garrett LLP	One Wilshire Bldg	624 S Grand Ave	Suite# 2000	106,472	250
Aames Investment Corp	Two California Plaza	350 S Grand Ave	Suite# 43rd Floor	105,244	300
Telepacific Communications Corp	City National Tower	555 S Flower St	Suite# 47th	99,916	400
Oaktree Capital Management LLC	Wells Fargo Tower	333 S Grand Ave	Suite# 2800	99,076	150
DMJM H&N	City National Plaza	515 S Flower St	Suite# 8th Floor	94,800	400
Buchalter Nemer		1000 Wilshire Blvd	Suite# 1500	89,986	120
Manufacturers Bank	Manulife Plaza	515 S Figueroa St	Suite# 2nd Fl	69,204	200
Wedbush Morgan Securities		1000 Wilshire Blvd	Suite# 9th Floor	66,972	322

Downtown Center Business Improvement District
626 Wilshire Blvd, Ste 200
Los Angeles CA 90017
www.downtownla.com

Note: List includes Class A only tenants occupying 20,000 square feet or greater

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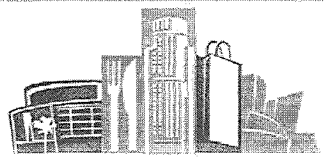

Major Companies Downtown Los Angeles

as of 3Q06

Company Name	Building Name	Address	Suite	SF Occupied	# Emp
Mellon 1st Business Bank	One Bunker Hill Bldg	601 W 5th St		62,868	160
Cooperative of American Physicians, Inc.	Bank Of America Plaza	333 S Hope St	Suite# 800	60,000	195
Cushman & Wakefield, Inc.	Figueroa at Wilshire	601 S Figueroa St	Suite# 4700	60,000	240
Trust Company of the West	TCW Bldg	865 S Figueroa St		58,950	100
Latham & Watkins	The Gas Company Tower	555 W 5th St	Suite# 800	55,052	250
La Opinion	MCI Center	700 S Flower St	Suite# 3000	54,075	500
Southern California Association of Governments		818 W 7th St	Suite# 1200	50,511	165
City of Hope	Wilshire Bixel Bldg	1055 Wilshire Blvd	Suite# 12	48,000	200
Great American Custom Insurance Services	Ernst & Young Plaza	725 S Figueroa St	Suite# 3400	47,982	130
American Business Bank	Pacific Center	523 W 6th St	Suite# 900	47,000	50
Cromwell Weedon, Co.	One Wilshire Bldg	624 S Grand Ave	Suite# 2510	45,000	130
PACE	Wilshire Bixel Bldg	1055 Wilshire Blvd		42,558	285
CB Richard Ellis Investors, L.L.C.	City National Plaza	515 S Flower St	Suite# 3500	40,648	125
Harrington, Foxx, Dubrow & Canter		1055 W 7th St	Suite# 2900	40,453	125
Morris Polich & Purdy		1055 W 7th St	Suite# 2400	40,200	150
LaFollette, Johnson, DeHaas, Fesler	TCW Bldg	865 S Figueroa St	Suite# 3100	39,300	85
Murchison & Cummings		801 S Grand Ave	Suite# 9th floor	38,135	75
Allen, Matkins, Leck, Gamble & Mallory LLP	Manulife Plaza	515 S Figueroa St	Suite# 7th Floor	37,392	150
Nossaman Guthner Knox & Elliott LLP	Union Bank Plaza	445 S Figueroa St	Suite# 3100	37,300	100
Four Corners Capital Management	City National Plaza	515 S Flower St	Suite# 4300	32,485	40
Rose, Klein & Marias		801 S Grand Ave	Suite# 11th flloor	30,870	75

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Los Angeles CA 90017
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Note: List includes Class A only tenants occupying 20,000 square feet or greater

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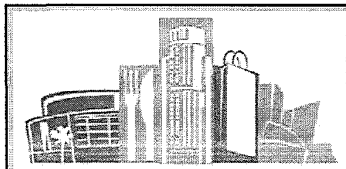

Major Companies
Downtown Los Angeles

as of 3Q06

Company Name	Building Name	Address	Suite	SF Occupied	# Emp
Veatch, Carlson, Grogan & Nelson	MCI Center	700 S Flower St	Suite# 2200	28,749	75
Davis-Elen Advertising	TCW Bldg	865 S Figueroa St	Suite# 1200	27,177	125
Richards Watson & Gershon APC	KPMG Tower	355 S Grand Ave	Suite# 40th Floor	27,108	102
CB Richard Ellis	KPMG Tower	355 S Grand Ave	Suite# 2700	26,658	175
BreitBurn Energy	City National Plaza	515 S Flower St	Suite# 4800	26,430	35
Parker, Milliken, Clark, O'Hara & Samuelian	City National Tower	555 S Flower St	Suite# 2700	26,386	90
Payden & Rygel	Wells Fargo Tower	333 S Grand Ave	Suite# 32nd F	26,076	120
Consulate-General of Japan in Los Angeles	Two California Plaza	350 S Grand Ave	Suite# 1700	26,000	55
Far East National Bank	Two California Plaza	350 S Grand Ave	Suite# 4100	26,000	60
Parsons Dillingham Corporation	AON Center	707 Wilshire Blvd		26,000	130
SulmeyerKupetz	Bank Of America Plaza	333 S Hope St	Suite# 35th Floor	25,849	60
LA Inc., The Convention & Visitors Bureau	Bank Of America Plaza	333 S Hope St	Suite# 18th	24,903	50
Burke, Williams & Sorensen, LLP	Citibank Center	444 S Flower St	Suite# 2500	24,506	50
Davis Wright Tremaine LLP	TCW Bldg	865 S Figueroa St	Suite# 2400	24,427	50
Hill Farrer & Burrill LLP	One California Plaza	300 S Grand Ave	Suite# 3700	24,000	100
Pinnacle Travel Services, L.L.C.	Wilshire Bixel Bldg	1055 Wilshire Blvd	Suite# 1000	24,000	175
Thomas Properties Group, LLC	City National Plaza	515 S Flower St	Suite# 600	23,700	40
OCE-USA	Ernst & Young Plaza	725 S Figueroa St	Suite# 1700	23,000	50
Iverson, Yoakum, Papiano & Hatch	One Wilshire Bldg	624 S Grand Ave	Suite# 2700	22,901	46
Metro Link	MCI Center	700 S Flower St	Suite# 2600	22,136	136

Downtown Center Business Improvement District
626 Wilshire Blvd, Ste 200
Los Angeles CA 90017
www.downtownla.com

Note: List includes Class A only tenants occupying 20,000 square feet or greater

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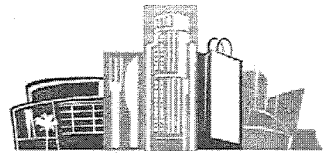

Major Companies Downtown Los Angeles

as of 3Q06

Company Name	Building Name	Address	Suite	SF Occupied	# Emp
W.M. Keck Foundation	550 South Hope	550 S Hope St	Suite# 2500	21,896	29
HSBC Bank	Figueroa Tower	660 S Figueroa St	Suite# 100	21,660	16
K&R Law Group LLP.	Two California Plaza	350 S Grand Ave	Suite# 21st floor	21,202	111
Colliers International	Citibank Center	444 S Flower St	Suite# 2200	21,000	62
Grace, Genson, Cosgrove & Schirm	Citibank Center	444 S Flower St	Suite# 1100	21,000	50
Pacific Western Bank	Citibank Center	444 S Flower St	Suite# 1400	21,000	60
IDS Real Estate Group	Manulife Plaza	515 S Figueroa St	Suite# 1600	20,231	40
Staubach Commercial Services - SoCal, Inc.	City National Plaza	515 S Flower St	Suite# 1300	20,073	15
Source: CoStar Tenant courtesy of Cushman & Wakefield Research (11.15.2006)					

Note: List includes Class A only tenants occupying 20,000 square feet or greater

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FR Cite. 10

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

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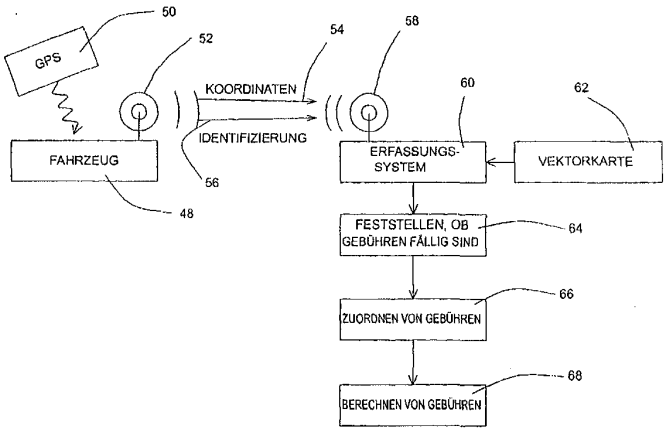
(81) Bestimmungsstaaten *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR,

[Fortsetzung auf der nächsten Seite]

(54) Title: DETECTION SYSTEM FOR SURFACE AREAS FOR DETECTING VEHICLES WITH A GPS

(54) Bezeichnung: ERFASSUNGSSYSTEM FÜR FLÄCHIGE BEREICHE ZUM ERFASSEN VON FAHRZEUGEN MIT GPS



48 VEHICLE
50 GPS
54 COORDINATES
56 IDENTIFICATION
60 DETECTION SYSTEM
62 VECTORIAL MAP
64 DETERMINING WHETHER A TAX IS TO BE PAID
66 ASSIGNMENT OF TAXES
68 CALCULATION OF TAXES

(57) **Abstract:** The invention relates to a detection system (60) and a method for detecting vehicles (48) with a digital satellite navigation system (50) using surface areas (10) such as cities or town districts. A surface area (10) is stored in a computer and surrounded by a polyline (12). The vehicle is detected as soon as the coordinates supplied by the satellite navigation system (50) reach the polyline (14).

(57) **Zusammenfassung:** Die Erfindung betrifft ein Erfassungssystem (60) und ein Verfahren zum Erfassen von Fahrzeugen (48) mit digitalem Satellitennavigationssystem (50) bei der Benutzung von flächigen Bereichen (10), wie beispielsweise Städte bzw. Stadtteile. Ein flächiger Bereich (10) wird in einem Rechner gespeichert und von einem Polygonenzug (12) umgeben. Sobald die durch das Satellitennavigationssystem (50) gelieferten Koordinaten in den Polygonenzug (14) gelangen, wird das Fahrzeug (48) erfasst.

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CU, CZ, DE (Gebrauchsmuster), DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.

(84) Bestimmungsstaaten *(regional)*: ARIPO-Patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), eurasisches Patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), europäisches Patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SK, TR), OAPI-Patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Erklärungen gemäß Regel 4.17:

— *hinsichtlich der Identität des Erfinders (Regel 4.17 Ziffer i) für die folgenden Bestimmungsstaaten AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZM, ZW, ARIPO-Patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), eurasisches Patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), europäisches Patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SK, TR), OAPI-Patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)*

— *hinsichtlich der Berechtigung des Anmelders, ein Patent zu beantragen und zu erhalten (Regel 4.17 Ziffer ii) für die folgenden Bestimmungsstaaten AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZM, ZW, ARIPO-Patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), eurasisches Patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), europäisches Patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SK, TR), OAPI-Patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)*

— *Erfindererklärung (Regel 4.17 Ziffer iv) nur für US*

Veröffentlicht:

— *mit internationalem Recherchenbericht*

— *vor Ablauf der für Änderungen der Ansprüche geltenden Frist; Veröffentlichung wird wiederholt, falls Änderungen eintreffen*

Zur Erklärung der Zweibuchstaben-Codes und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.

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Patentanmeldung

Erfassungssystem für flächige Bereiche zum Erfassen von Fahrzeugen mit GPS

Technisches Gebiet

Die Erfindung betrifft ein Erfassungssystem zum Erfassen von Fahrzeugen mit digitalem Satellitennavigationssystem (GPS) bei der Benutzung von flächigen Bereichen; mit den Merkmalen

a) Mittel, mit denen ein Fahrzeug sein empfangenes GPS-Koordinatensignal an das Erfassungssystem übermittelt,

b) wobei das Erfassungssystem eine Rechnereinheit enthält;

c) in einem Speicher der Rechnereinheit eine digitale Karte vorliegt,

d) wobei eine ausgewählte Fläche der Karte mit einem Polygonenzug eingegrenzt ist.

Ferner betrifft die Erfindung ein Verfahren zum Erfassen von Fahrzeugen mit Satellitennavigationssystem (GPS) bei der Benutzung von flächigen Bereichen, mit folgenden Verfahrensschritten:

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a) Übermitteln des empfangenen GPS-Koordinatensignals an ein Erfassungssystem mit einer Rechnereinheit, in dessen Speicher eine digitale Karte vorliegt;

b) Eingrenzen der ausgewählten Fläche in der digitalen Karte mit einem Polygonenzug.

Stand der Technik

Für die Nutzung von bestimmten Straßen, wie z.B. Autobahnen, großen Brücken oder Tunneln, werden schon seit langem in einigen Ländern Gebühren erhoben. Diese Straßennutzungsgebühren, auch "Maut" genannt, werden üblicherweise an bestimmten Punkten, bei Autobahnen in der Regel an der Ausfahrt, an Mautstationen fällig. Die Vorgehensweise hierzu kann kurz wie folgt beschrieben werden: Ein Nutzer fährt mit seinem Fahrzeug zunächst an einer Autobahnauffahrt auf die Autobahn auf. Dabei zieht er von einer Mautstation beispielsweise eine Mautkarte, aus der hervorgeht, wo er auf die Autobahn aufgefahren ist. Beim Abfahren wird bei einer Mautstation an der Ausfahrt die zurückgelegte Strecke anhand der Mautkarte ermittelt und die entsprechende Gebühr kassiert.

In anderen Ländern wird für Transitreisende an der Grenze eine Vignette verkauft. Nur Inhaber einer solchen Vignette dürfen bestimmte Straßen, wie beispielsweise Autobahnen, nutzen.

Beide Verfahren haben Vor- bzw. Nachteile. Dieses Gebührenerhebung mit Mautstationen ist relativ personalintensiv, da die fällige Mautgebühr an den Mautstationen von menschlichen Arbeitskräften entgegengenommen wird. Sie ist jedoch auf die wirklich zurückgelegte Strecke bezogen. Ein weiterer Nachteil bei der Erhebung der Straßennutzungsgebühren mit Mautstationen ist, daß bei einem hohen Verkehrsaufkommen die Mautstationen Ausgangspunkte für Verkehrsstaus sind. Die

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Vignettenlösung ist zwar nicht sonderlich personalintensiv, weil die Vignette in jedem Laden verkauft werden kann, trifft aber alle, auch diejenigen, die die gebührenpflichtige Straße nur relativ kurz nutzen. Diese zahlen dann bereits für die kurze Benutzung einen sehr hohen Preis.

Eine weitere Lösung für die Erhebung von Mautgebühren sind Erfassungssysteme über Funk, bei denen eine Abrechnung in der Regel später erfolgen kann. Aus der europäischen Patentschrift EP 0 730 488 ist ein solches Erfassungssystem bekannt. Die zu erfassenden Fahrzeuge verfügen hier über eine Einrichtung zum Empfangen von Satellitennavigationssignalen. Hiermit wird die jeweilige geographische Position des Fahrzeugs ermittelt. Die entsprechenden Koordinaten werden über Funk an eine Rechnereinrichtung übertragen. Die Rechnereinheit prüft, ob die Position der Koordinaten gebührenpflichtig ist. Im Fall der Gebührenpflichtigkeit wird dies dem Fahrzeug bzw. dessen Halter berechnet.

Diese Arten der Gebührenerfassung sind vorwiegend für die Nutzung von Straßen vorgesehen. Es gibt aber Fälle, wo nicht nur die Straße allein ausreicht, sondern auch Fahrzeuge in einem flächigen Bereich, wie beispielsweise in einer kompletten Innenstadt, erfaßt werden sollen.

Offenbarung der Erfindung

Aufgabe der Erfindung ist es daher, die Nachteile des Standes der Technik zu beseitigen und ein System und ein Verfahren zu schaffen, bei dem in flächigen Bereichen, wie es z.B. insbesondere Stadtbereiche darstellen, Fahrzeuge erfaßt werden. Dabei soll der verbrauchte Speicherplatz in dem Rechner des Erfassungssystems möglichst optimiert ausgenutzt werden.

Erfindungsgemäß wird die Aufgabe dadurch gelöst, daß bei einem Erfassungssystem zum Erfassen von Fahrzeugen mit digitalem Satellitennavigationssystem (GPS) bei der Benutzung von flächigen Bereichen der eingangs genannten Art; mit den Merkmalen

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e) Mittel, zum Erfassen von Fahrzeugen, sobald ein Fahrzeug in den Polygonenzug der ausgewählten Fläche gelangt.

Weiterhin wird die Aufgabe durch ein Verfahren der eingangs genannten Art mit folgenden Verfahrensschritten gelöst:

c) Erfassen eines Fahrzeugs mit dem Erfassungssystem, sobald die so erhaltenen GPS-Koordinaten des Fahrzeugs über den Polygonenzug in die ausgewählte Fläche gelangen.

Durch das erfindungsgemäße Erfassungssystem und das entsprechende Verfahren wird es nun möglich, auf einfache Weise ganze flächige Bereiche zu überwachen, ohne die einzelnen Straßen in den flächigen Bereichen kontrollieren zu müssen. Die Verwendung von flächigen Bereichen birgt den Vorteil, daß erheblich weniger Speicherplatz in dem Rechner des Erfassungssystems verbraucht wird, als es bei der digitalen Speicherung von Straßenkarten der Fall ist.

In einer vorteilhaften Ausgestaltung des erfindungsgemäßen Erfassungssystems sind Mittel vorgesehen, die die Erfassung des Fahrzeugs bei Eintritt des GPS-Koordinatensignals in den ausgewählten flächigen Bereich aktiviert. Entsprechend können Mittel vorgesehen sein, die die Erfassung des Fahrzeugs bei Austritt des GPS-Koordinatensignals aus dem flächigen Bereich deaktiviert.

Das Erfassungssystem erweist sich als besonders geeignet, wenn es sich bei den ausgewählten Bereichen um Städte, bzw. Teile von Städten, handelt.

Um eine eindeutige Zuordnung der Koordinaten zu einem Fahrzeug zu erhalten, ist es vorteilhaft, wenn Identifizierungsmittel vorgesehen sind, welche ein Identifizierungssignal zum eindeutigen Identifizieren eines erfaßten Fahrzeugs an das Erfassungssystem senden.

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In einer weiteren vorteilhaften Ausgestaltung der Erfindung sind Mittel für eine Gebührenzuordnung für die erfaßten Fahrzeuge vorgesehen. Hiermit kann das Erfassungssystem für eine Gebührenüberwachung genutzt werden. Fahrzeuge, deren Koordinaten in einen überwachten Bereich kommen, müssen ggf. Gebühren bezahlen.

Eine vorteilhafte Weiterbildung der Erfindung ergibt sich durch Mittel zum Optimieren bzw. Reduzieren der Datenmengen. Beispielsweise durch geeignete Kompressionen der Daten und durch optimierte Auswahl der Polygonenzüge, welche den zu erfassenden Bereich abdecken, können die Datenmengen erheblich reduziert werden. Geringere Daten bedeuten immer eine schnellere Abarbeitungszeit. Hierdurch wird das System schneller. In der einfachsten Form wird eine zu überwachende Fläche von einem Rechteck umschlossen.

Damit nicht gleich jedes Fahrzeug erfaßt wird, welches beispielsweise die zu überwachende Fläche nur tangiert, sind vorteilhafterweise Mittel zum Festlegen eines Toleranzbereiches vorgesehen, in dem die Aktivierung bzw. Deaktivierung der Erfassung des Fahrzeugs erfolgt.

In einer vorteilhaften Ausbildung des erfindungsgemäßen Erfassungssystems liegt die digitale Karte als Vektordaten vor. Dadurch gehen bei verschiedenen Vergrößerungen oder Verkleinerungen keine Informationen verloren, wie es beispielsweise bei einer Pixelgrafik der Fall wäre.

Um festzustellen, wie lange ein Fahrzeug sich in einem zu überwachenden Bereich aufhält, können vorteilhafterweise Mittel vorgesehen sein, die die Aufenthaltsdauer eines erfaßten Fahrzeugs in dem relevanten flächigen Bereich ermitteln. Damit kann ggf. auch eine zeitabhängige Gebührenzuordnung erfolgen.

Es kann sich als vorteilhaft erweisen, wenn ein relevanter flächiger Bereich in Zonen unterteilt ist, wobei jede Zone von einem Polygonenzug umschlossen ist. Durch diese

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Maßnahme können beispielsweise unterschiedliche Gebührentarife zugrundegelegt werden.

In Ausgestaltung des erfindungsgemäßen Verfahrens erweist sich als vorteilhaft, wenn Städte als relevante Flächen ausgewählt werden. Vorteilhafterweise wird bei dem erfindungsgemäßen Verfahren die Erfassung des Fahrzeugs erst bei Eintritt des GPS-Koordinatensignals in den flächigen Bereich aktiviert. Entsprechend wird die Erfassung des Fahrzeugs bei Austritt des GPS-Koordinatensignals aus dem flächigen Bereich deaktiviert. Durch diese Maßnahme spricht das Erfassungssystem nur dann an, wenn es benötigt wird. Dadurch werden Kapazitäten in der Rechnereinheit des Erfassungssystems frei. Dies wirkt sich auf die Verarbeitungsgeschwindigkeit aus.

Ferner wird in geeigneter Weise das Identifizierungssignal zum eindeutigen Identifizieren eines erfaßten Fahrzeugs an das Erfassungssystem gesendet. Neben dem Identifizierungssignal besteht zudem die Möglichkeit, eine Klassifikationsinformation mitzusenden, um beispielsweise im Erfassungssystem festzustellen, ob es sich um einen Lastkraftwagen, einen Personenwagen, ein Motorrad oder um ein landwirtschaftlich genutztes Fahrzeug handelt, welches in den zu überwachenden Bereich einfährt.

Bevorzugterweise werden bei dem erfindungsgemäßen Verfahren Gebühren einem durch das Erfassungssystem erfaßten Fahrzeug zugeordnet. Das erfindungsgemäße Verfahren läßt sich dadurch ausgestalten, daß ein flächiger Bereich in Zonen unterteilt wird, wobei jede Zone von einem Polygonenzug umschlossen ist. Hierdurch läßt sich insbesondere jeder Zone ein eigener Gebührentarif zuordnen.

Das erfindungsgemäße Verfahren enthält vorteilhafterweise eine Datenoptimierung bzw. Datenreduzierung. Hierdurch können die Datenmengen reduziert werden, die bei dem Rechner des Erfassungssystems anfallen. Die Geschwindigkeit des Systems wird damit erhöht. Um eine einfachere Verarbeitung im Rechner mit zu erhalten, wird die digitale Karte und/oder der, eine Fläche umschließende, Polygonenzug als Vektordaten im Speicher der Rechnereinheit abgespeichert.

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Ferner wird in einer bevorzugten Variante des erfindungsgemäßen Verfahrens ein Toleranzbereich festgelegt, in dem die Aktivierung bzw. Deaktivierung der Erfassung eines Fahrzeugs erfolgt. Hierdurch wird erreicht, daß Fahrzeuge, die den zu erfassenden Bereich beispielsweise nur tangieren, nicht notwendigerweise diesem zugeordnet werden. Es zeigt sich als besonders vorteilhaft bei einem erfindungsgemäßen Verfahren, wenn der, eine Fläche umschließende, Polygonenzug als Rechteck ausgebildet wird.

Weitere Vorteile ergeben sich aus dem Gegenstand der Unteransprüche.

Kurze Beschreibung der Zeichnung

Fig. 1 zeigt einen flächigen Bereich, der von einem Rechteck zur Überwachung abgedeckt wird.

Fig. 2 zeigt einen flächigen Bereich, der von einem Polygonenzug zur Überwachung abgedeckt wird.

Fig. 3 zeigt einen flächigen Bereich, der von mehreren Polygonenzügen als Zonen zur Überwachung abgedeckt wird.

Fig. 4 zeigt den prinzipiellen Verfahrensablauf eines erfindungsgemäßen Verfahrens.

Bevorzugtes Ausführungsbeispiel

In Fig. 1 wird mit 10 ein flächiger Bereich bezeichnet. Der flächige Bereich 10 ist mit einem gestrichelten Polygonenzug 12 gekennzeichnet. Dieser flächige Bereich 10 kann beispielsweise die Fläche einer Stadt sein. Um Fahrzeuge zu erfassen, die in die Stadt

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fahren, um diesem eine Gebühr dafür zu berechnen, wird ein erfindungsgemäßes Erfassungssystem verwendet.

Das Erfassungssystem verfügt über eine Straßenkarte in Vektordarstellung, wie sie beispielsweise auch in dem Speicher einer Rechnereinheit eines erfindungsgemäßen Erfassungssystems vorliegt. Prinzipiell wird von Vektordarstellung dann gesprochen, wenn die Straßenkarte aus lauter Koordinaten besteht, die zur Darstellung lediglich mit Linien verbunden werden. Die Koordinaten der Karte werden in Tabellen gespeichert. Durch geeignete Koordinatentransformation können so Ausschnitte in beliebiger Größe dargestellt werden, ohne bei der Vergrößerung oder Verkleinerung Informationen zu verlieren, wie es beispielsweise bei einer Pixelgrafik der Fall wäre.

Ein erfindungsgemäßes Erfassungssystem dient insbesondere dazu, diejenigen Kraftfahrzeuge zu erfassen, die gebührenpflichtige Flächen, wie es beispielsweise Innenstädte bilden können, nutzen. Andere Anwendungsmöglichkeiten bestehen beispielsweise in der polizeilichen Observierung von bestimmten Fahrzeugen. Gleichzeitig kann ein solches Erfassungssystem als Diebstahlschutz dienen, da die Position und die Identifikation des Fahrzeugs kontinuierlich gesendet werden. Ferner kann ein solches Erfassungssystem grundsätzlich auch z.B. zur Verkehrskontrolle und/oder -regulierung dienen.

Fahrzeuge des vorliegenden Ausführungsbeispiels von Fig. 1 sind mit einem Satellitennavigationssystem (GPS= "Global Positioning System") ausgerüstet. Über das Satellitennavigationssystem werden die Koordinaten der augenblicklichen Position des Fahrzeugs ermittelt. Solche Fahrzeuge sind in der Lage, beispielsweise über Funk, kontinuierlich die Koordinaten ihrer Position an das Erfassungssystem zu senden. Neben den Koordinatensignalen müssen die Fahrzeuge jedoch auch Identifikationssignale senden, mit denen das Fahrzeug eindeutig durch das Erfassungssystem identifiziert werden kann. Das Erfassungssystem weist eine geeignete Empfangs- und Verarbeitungseinrichtung auf, um die Koordinaten- und Identifikationssignale zu empfangen und zu verarbeiten. Die Verarbeitungseinrichtung besteht aus einem oder mehreren Rechnern, die ggf. untereinander vernetzt sind. In den Speichern der Rechner

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liegt das digitale Kartenmaterial vor, das u.a. von kommerziellen Anbietern angeboten wird. In Fig. 1 wird somit quasi ein digitales Abbild eines Kartenausschnitts als Polygonenzug 12 in Vektorform dargestellt.

Über den flächigen Bereich 10, der überwacht werden soll, wird in der einfachsten Form ein digitales Rechteck 14 gelegt. Die Fläche des digitalen Polygonenzug 12 ist in vorliegendem Ausführungsbeispiel schraffiert dargestellt. Diese Geometrie des Rechtecks hat den Vorteil, daß möglichst wenig Speicherplatz verbraucht wird. Ferner kann diese Geometrie sehr leicht verarbeitet werden. Sobald die an das Erfassungssystem übermittelten Koordinaten eines Fahrzeugs in dieses Rechteck 14 gelangen, wird eine Erfassung für dieses Fahrzeug aktiviert. Sobald das Fahrzeug dann in den Polygonenzug 12 gelangt, werden dann die Straßennutzungsgebühren fällig. Erst beim Verlassen des Rechtecks 14 wird die Gebührenerfassung deaktiviert. Anhand des Identifikationssignals, welches von dem Fahrzeug übermittelt wird, kann dem Fahrzeug nun eindeutig die Gebühr für den Aufenthalt in dem Polygonenzug 12 berechnet werden. Die Gebühr kann sich z.B. über die Dauer des Aufenhalts in dem Polygonenzug 12 berechenen.

Ein kleinerer Polygonenzug 16 und ein größerer Polygonenzuge 18 gegenüber dem Polygonenzug 12 bilden einen Toleranzbereich 20, in dem die Gebührenerfassung das Erfassungssystem anspricht. Die Polygonenzüge 16 und 18 sind durch gestrichelte Linien kenntlich gemacht. In Kombination mit anderen Parametern, wie z.B. Aufenthaltsdauer in dem Toleranzbereich 20, kann ein Kriterium geschaffen werden, ob ein Fahrzeug in diesem Bereich erfaßt werden soll, um Gebühren zu zahlen oder nicht.

Fig. 2 zeigt, daß auch eine andere Geometrie zur Abdeckung einer zu überwachenden Fläche 10, als die des Polygonenzug 14 – siehe Fig. 1 – möglich ist. Eine zu überwachende Fläche 22 wird von einem Polygonenzug 24 umgeben. Das besondere in diesem Ausführungsbeispiel, welches ansonsten auf gleiche Weise funktioniert wie das Ausführungsbeispiel von Fig. 1, ist, daß ein flächiger Bereich 26 von der Überwachung durch das erfindungsgemäße Erfassungssystem ausgespart werden kann. Der ausgesparte flächige Bereich 26 ist schraffiert dargestellt und mit einem Polygonenzug 28 umgeben.

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Fig. 3 zeigt einen flächigen Bereich 30, der von mehreren Polygonenzügen 32, 34, 36, 38 zur Überwachung abgedeckt wird. Grundsätzlich funktioniert dieses Ausführungsbeispiel wie die vorherigen Ausführungsbeispiele von Fig. 1 und 2. Im Unterschied zu den vorherigen Ausführungsbeispielen werden, wenn man einmal von der Geometrie der Polygonenzüge absieht, Zonen gebildet. Jeder der Polygonenzüge 32, 34, 36, 38 bildet zum nächsten Polygenenzug eine Zone 40, 42, 44. Der innerste Polygonenzug bildet eine eigene Zone 46, welche schraffiert dargestellt ist. Jeder Zone 40, 42, 44, 46 kann eine eigene Tarifstruktur für eine Gebührenberwachung zugeordnet werden. Auf diese Weise kann einem Fahrzeug, je nach dem in welcher Zone 40, 42, 44, 46 es sich aufhält, eine entsprechende Aufenthaltsgebühr auferlegt werden.

Anhand von Fig. 4 soll kurz die prinzipielle Funktionsweise des erfindungsgemäßen Erfassungssystems bzw. des Verfahrens zum Erfassen von Fahrzeugen erläutert werden, wie bereits weiter oben angedeutet. Ein Fahrzeug 48 erhält von einem Satellitennavigationssystem 50 Daten bezüglich seiner genauen Position. Über Funk 52 sendet das Fahrzeug 48 die Positionskoordinaten, Pfeil 54, und ein individuelles Identifizierungssignal, Pfeil 56. Diese Positionskoordinaten 54 und das Identifizierungssignal 56 werden von einer Empfangseinrichtung 58 eines Erfassungssystems 60 empfangen. In dem Erfassungssystem wird anhand einer geographischen Karte 62 in Vektordarstellung festgestellt (wie zu Fig. 1 bis 3 beschrieben), ob für die augenblickliche Position des Fahrzeugs 48 Gebühren fällig sind, Kasten 64. Wenn Gebühren fällig sind, werden dem Konto des Fahrzeugs, welches durch das Identifizierungssignal 56 identifiziert wurde, Flächennutzungsgebühren zugeordenet, Kasten 66. Anschließend kann automatisch dem Halter des Fahrzeugs eine Rechnung zugestellt werden, Kasten 68.

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Patentansprüche

1. Erfassungssystem (60) zum Erfassen von Fahrzeugen (48) mit digitalem Satellitennavigationssystem (50) bei der Benutzung von flächigen Bereichen (10); mit den Merkmalen

   a) Mittel (52, 58), mit denen ein Fahrzeug (48) sein empfangenes GPS-Koordinatensignal an das Erfassungssystem (60) übermittelt,

   b) wobei das Erfassungssystem (60) eine Rechnereinheit enthält;

   c) in einem Speicher der Rechnereinheit eine digitale Karte vorliegt,

   d) wobei eine ausgewählte Fläche (10) der Karte mit einem Polygonenzug (12) eingegrenzt ist;

   gekennzeichnet durch

   e) Mittel, zum Erfassen von Fahrzeugen (48), sobald ein Fahrzeug (48) in den Polygonenzug (12) der ausgewählten Fläche (10) gelangt.

2. Erfassungssystem (60) zum Erfassen von Fahrzeugen (48) mit Satellitennavigationssystem (50) bei der Benutzung von flächigen Bereichen (10) nach Anspruch 1, **dadurch gekennzeichnet, daß** Mittel (14) vorgesehen sind, die die Erfassung des Fahrzeugs bei Eintritt des GPS-Koordinatensignals in den ausgewählten flächigen Bereich aktiviert.

3. Erfassungssystem (60) zum Erfassen von Fahrzeugen (48) mit Satellitennavigationssystem (50) bei der Benutzung von flächigen Bereichen (10) nach einem der Ansprüche 1 oder 2, **dadurch gekennzeichnet, daß** Mittel (14)

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vorgesehen sind, die die Erfassung des Fahrzeugs bei Austritt des GPS-Koordinatensignals aus dem flächigen Bereich (10) deaktiviert.

4. Erfassungssystem (60) zum Erfassen von Fahrzeugen (48) mit Satellitennavigationssystem (50) bei der Benutzung von flächigen Bereichen (10) nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, daß** die ausgewählten Bereiche (10) Städte oder Teile von Städten sind.

5. Erfassungssystem (60) zum Erfassen von Fahrzeugen (48) mit Satellitennavigationssystem (50) bei der Benutzung von flächigen Bereichen (10) nach einem der Ansprüche 1 bis 4, **gekennzeichnet durch** Identifizierungsmittel, welche ein Identifizierungssignal (56) zum eindeutigen Identifizieren eines erfaßten Fahrzeugs (48) an das Erfassungssystem (60) senden.

6. Erfassungssystem (60) zum Erfassen von Fahrzeugen (48) mit Satellitennavigationssystem (50) bei der Benutzung von flächigen Bereichen (10) nach einem der Ansprüche 1 bis 5, **dadurch gekennzeichnet, daß** Mittel (66) für eine Gebührenzuordnung für die erfaßten Fahrzeuge (48) vorgesehen sind.

7. Erfassungssystem (60) zum Erfassen von Fahrzeugen (48) mit Satellitennavigationssystem (50) bei der Benutzung von flächigen Bereichen (10) nach einem der Ansprüche 1 bis 6, **gekennzeichnet durch** Mittel zum Optimieren bzw. Reduzieren der Datenmengen.

8. Erfassungssystem (60) zum Erfassen von Fahrzeugen (48) mit Satellitennavigationssystem (50) bei der Benutzung von flächigen Bereichen (10) nach einem der Ansprüche 1 bis 7, **dadurch gekennzeichnet, daß** der eine Fläche (10) umschließende Polygonenzug als Rechteck (14) ausgebildet ist.

9. Erfassungssystem (60) zum Erfassen von Fahrzeugen (48) mit Satellitennavigationssystem (50) bei der Benutzung von flächigen Bereichen (10) nach einem der Ansprüche 1 bis 8, **dadurch gekennzeichnet, daß** Mittel zum

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Festlegen eines Toleranzbereiches (20) vorgesehen sind, in dem die Aktivierung bzw. Deaktivierung der Erfassung des Fahrzeugs (48) erfolgt.

10. Erfassungssystem (60) zum Erfassen von Fahrzeugen (48) mit Satellitennavigationssystem (50) bei der Benutzung von flächigen Bereichen (10) nach einem der Ansprüche 1 bis 9, **dadurch gekennzeichnet, daß** die digitale Karte als Vektordaten vorliegt.

11. Erfassungssystem (60) zum Erfassen von Fahrzeugen (48) mit Satellitennavigationssystem (50) bei der Benutzung von flächigen Bereichen (10) nach einem der Ansprüche 1 bis 10, **gekennzeichnet durch** Mittel zum Ermitteln der Aufenthaltsdauer eines erfaßten Fahrzeugs (48) in dem relevanten flächigen Bereich (10).

12. Erfassungssystem (60) zum Erfassen von Fahrzeugen (48) mit Satellitennavigationssystem (50) bei der Benutzung von flächigen Bereichen (30) nach einem der Ansprüche 1 bis 11, **dadurch gekennzeichnet, daß** ein relevanter flächiger Bereich (30) in Zonen (40, 42, 44, 46) unterteilt ist, wobei jede Zone (40, 42, 44, 46) von einem Polygonenzug (32,34, 36, 38) umschlossen ist.

13. Erfassungssystem (60) zum Erfassen von Fahrzeugen (48) mit Satellitennavigationssystem (50) bei der Benutzung von flächigen Bereichen (10) nach Anspruch 12, **dadurch gekennzeichnet, daß** jeder Zone (40, 42, 44, 46) ein eigener Gebührentarif zugeordnet ist.

14. Verfahren zum Erfassen von Fahrzeugen (48) mit Satellitennavigationssystem (50) bei der Benutzung von flächigen Bereichen, mit folgenden Verfahrensschritten:

a) Übermitteln des empfangenen GPS-Koordinatensignals (54) an ein Erfassungssystem (60) mit einer Rechnereinheit, in dessen Speicher eine digitale Karte (62) vorliegt;

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b) Eingrenzen der ausgewählten Fläche (20) in der digitalen Karte mit einem Polygonenzug (12),

gekennzeichnet durch

c) Erfassen eines Fahrzeugs (48) mit dem Erfassungssystem (60), sobald die so erhaltenen GPS-Koordinaten des Fahrzeugs (48) über den Polygonenzug (12) in die ausgewählte Fläche (10) gelangen.

15. Verfahren zum Erfassen von Fahrzeugen (48) mit Satellitennavigationssystem (50) bei der Benutzung von flächigen Bereichen (10) nach Anspruch 14, **dadurch gekennzeichnet, daß** Städte als relevante Flächen ausgewählt werden.

16. Verfahren zum Erfassen von Fahrzeugen (48) mit Satellitennavigationssystem (50) bei der Benutzung von flächigen Bereichen (10) nach einem der Ansprüche 14 oder 15, **dadurch gekennzeichnet, daß** die Erfassung des Fahrzeugs (48) erst bei Eintritt des GPS-Koordinatensignals in den flächigen Bereich (14) aktiviert wird.

17. Verfahren zum Erfassen von Fahrzeugen (48) mit Satellitennavigationssystem (50) bei der Benutzung von flächigen Bereichen (10) nach einem der Ansprüche 14 bis 16, **dadurch gekennzeichnet, daß** die Erfassung des Fahrzeugs (48) bei Austritt des GPS-Koordinatensignals aus dem flächigen Bereich (14) deaktiviert wird.

18. Verfahren zum Erfassen von Fahrzeugen (48) mit Satellitennavigationssystem (50) bei der Benutzung von flächigen Bereichen (10) nach einem der Ansprüche 14 bis 17, **dadurch gekennzeichnet, daß** ein Identifizierungssignal (56) zum eindeutigen Identifizieren eines erfaßten Fahrzeugs (48) an das Erfassungssystem (60) gesendet wird.

19. Verfahren zum Erfassen von Fahrzeugen (48) mit Satellitennavigationssystem (50) bei der Benutzung von flächigen Bereichen (10) nach einem der Ansprüche 14 bis

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18, **dadurch gekennzeichnet, daß** Gebühren einem erfaßten Fahrzeug (48) zugeordnet werden.

20. Verfahren zum Erfassen von Fahrzeugen (48) mit Satellitennavigationssystem (50) bei der Benutzung von flächigen Bereichen (30) nach einem der Ansprüche 14 bis 19, **dadurch gekennzeichnet, daß** ein flächiger Bereich in Zonen (40, 42, 44, 46) unterteilt wird, wobei jede Zone (40, 42, 44, 46) von einem Polygonenzug (32, 34, 36, 38) umschlossen ist.

21. Verfahren zum Erfassen von Fahrzeugen (48) mit Satellitennavigationssystem (50) bei der Benutzung von flächigen Bereichen (10) nach Anspruch 20, **dadurch gekennzeichnet, daß** jeder Zone (40, 42, 44, 46) ein eigener Gebührentarif zugeordnet wird.

22. Verfahren zum Erfassen von Fahrzeugen (48) mit Satellitennavigationssystem (50) bei der Benutzung von flächigen Bereichen (10) nach einem der Ansprüche 14 bis 21, **dadurch gekennzeichnet, daß** eine Datenoptimierung bzw. Datenreduzierung erfolgt.

23. Verfahren zum Erfassen von Fahrzeugen (48) mit Satellitennavigationssystem (50) bei der Benutzung von flächigen Bereichen (10) nach einem der Ansprüche 14 bis 22, **dadurch gekennzeichnet, daß** die digitale Karte und/oder der eine Fläche (10) umschließende Polygonenzug (12) als Vektordaten im Speicher der Rechnereinheit abgespeichert werden.

24. Verfahren zum Erfassen von Fahrzeugen (48) mit Satellitennavigationssystem (50) bei der Benutzung von flächigen Bereichen (10) nach einem der Ansprüche 14 bis 23, **dadurch gekennzeichnet, daß** ein Toleranzbereich (20) festgelegt wird, in dem die Aktivierung bzw. Deaktivierung der Erfassung eines Fahrzeugs (48) erfolgt.

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25. Verfahren zum Erfassen von Fahrzeugen (48) mit Satellitennavigationssystem (50) bei der Benutzung von flächigen Bereichen (10) nach einem der Ansprüche 14 bis 24, **dadurch gekennzeichnet, daß** der eine Fläche (10) umschließende Polygonenzug als Rechteck (14) ausgebildet wird.

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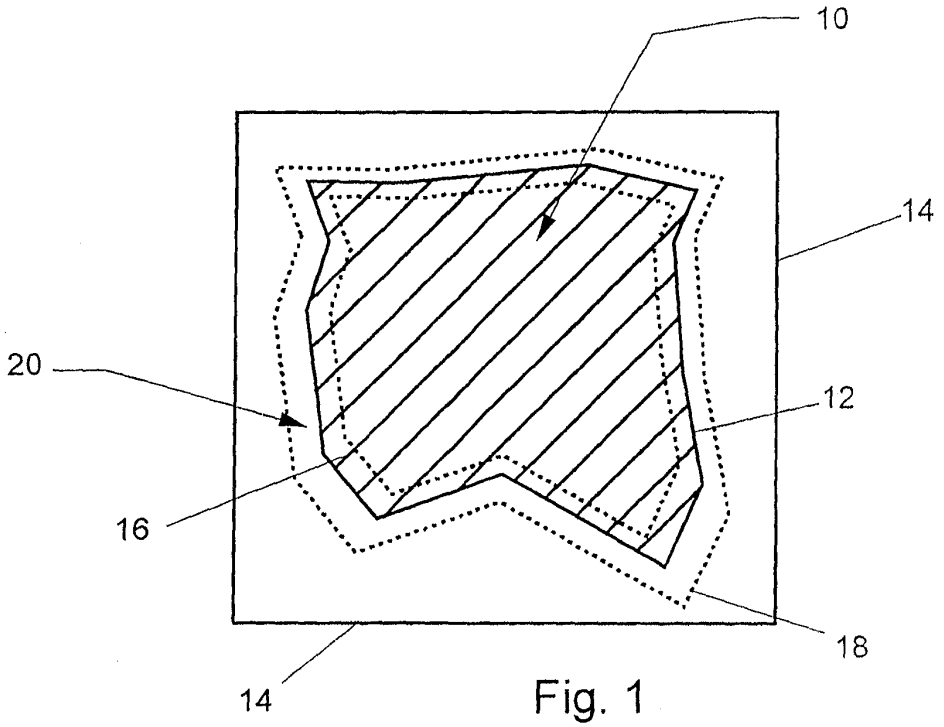

Fig. 1

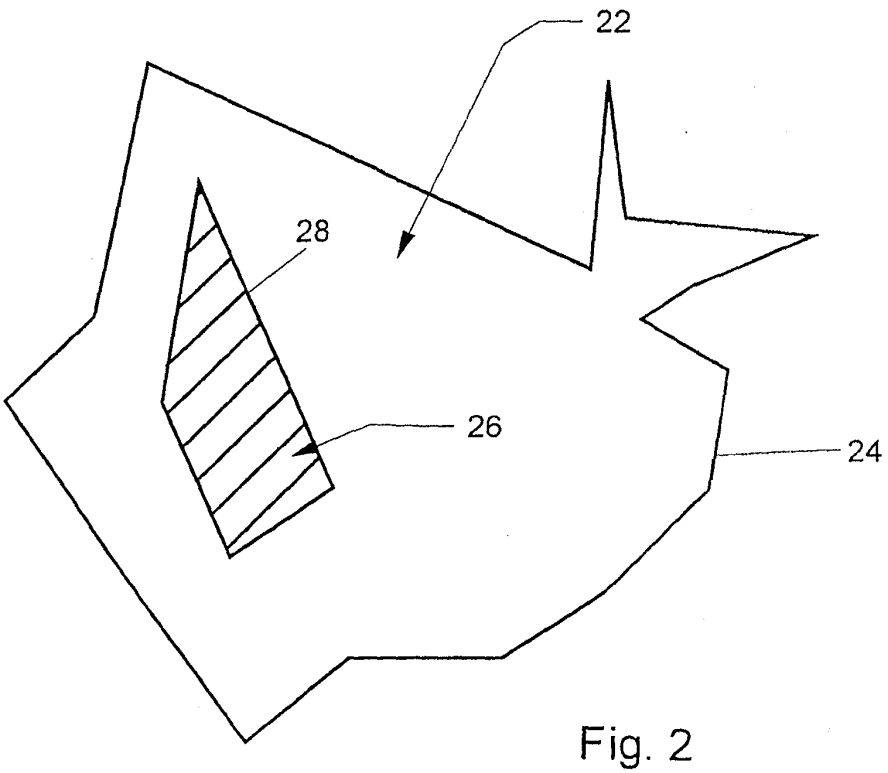

Fig. 2

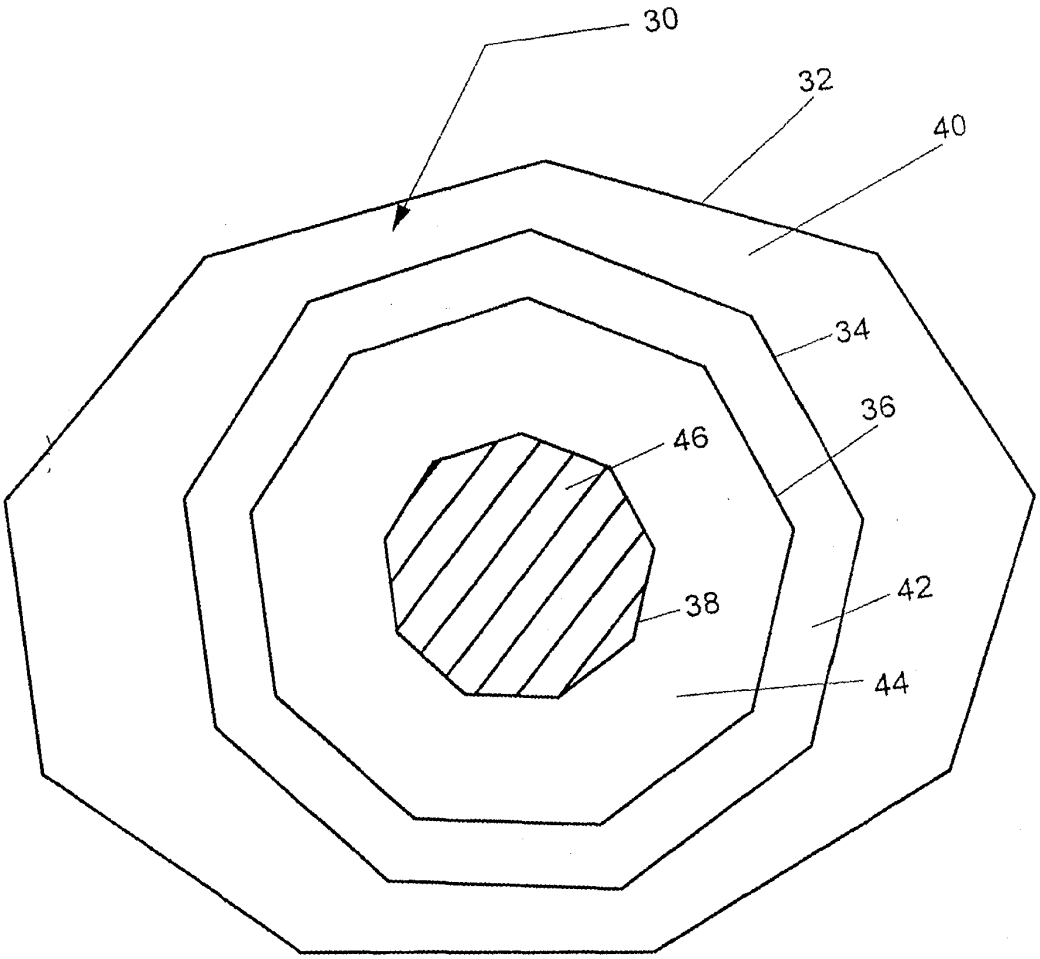

Fig. 3

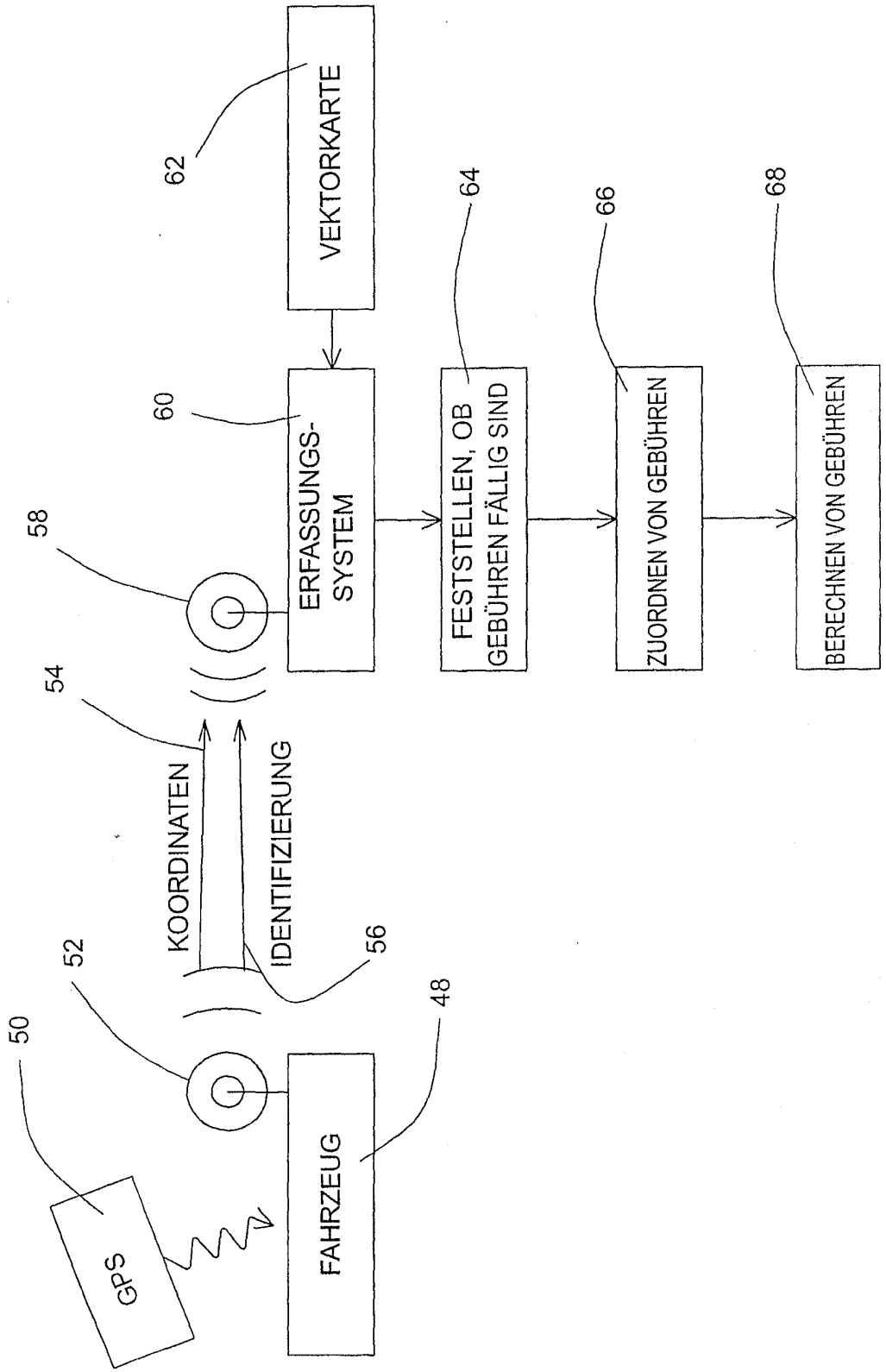

Fig.4

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 02/10774

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G07B15/00 G08G1/123

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G07B G08G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 050 853 A (TOYOTA MOTOR CO LTD ;AISIN SEIKI (JP)) 8 November 2000 (2000-11-08) abstract; figures 1-8 paragraph '0197! - paragraph '0243! ---	1-25
Y	EP 0 730 728 A (MANNESMANN AG) 11 September 1996 (1996-09-11) cited in the application abstract; figures page 6, last paragraph ---	1-25
Y	US 5 694 322 A (KENNEDY III WILLIAM C ET AL) 2 December 1997 (1997-12-02) abstract; figures 1,2 column 1, line 45 -column 2, line 2 column 3, line 38 -column 4, line 52 column 8, line 49 - line 52 column 9, line 7 -column 10, line 60 --- -/--	1-25

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

'A' document defining the general state of the art which is not considered to be of particular relevance

'E' earlier document but published on or after the international filing date

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'P' document published prior to the international filing date but later than the priority date claimed

'T' later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

'X' document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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'&' document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27 March 2003	03/04/2003

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Buron, E

Form PCT/ISA/210 (second sheet) (July 1992)

Google Exhibit 1004, Page 664 of 1125

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 02/10774

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	WO 01 11571 A (BARKER RONALD ;HERTLE JOCHEN (DE); MANNESMANN AG (DE); WIDL ANDREA) 15 February 2001 (2001-02-15) abstract page 1, line 32 -page 2, line 35 page 4, line 15 - line 17	1-25

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

Google Exhibit 1004, Page 665 of 1125

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/EP 02/10774

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INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen
PCT/EP 02/10774

A. KLASSIFIZIERUNG DES ANMELDUNGSGEGENSTANDES
IPK 7 G07B15/00 G08G1/123

Nach der Internationalen Patentklassifikation (IPK) oder nach der nationalen Klassifikation und der IPK

B. RECHERCHIERTE GEBIETE

Recherchierter Mindestprüfstoff (Klassifikationssystem und Klassifikationssymbole)
IPK 7 G07B G08G

Recherchierte aber nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Gebiete fallen

Während der internationalen Recherche konsultierte elektronische Datenbank (Name der Datenbank und evtl. verwendete Suchbegriffe)
EPO-Internal, WPI Data

C. ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie°	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
X	EP 1 050 853 A (TOYOTA MOTOR CO LTD ;AISIN SEIKI (JP)) 8. November 2000 (2000-11-08) Zusammenfassung; Abbildungen 1-8 Absatz '0197! - Absatz '0243! ---	1-25
Y	EP 0 730 728 A (MANNESMANN AG) 11. September 1996 (1996-09-11) in der Anmeldung erwähnt Zusammenfassung; Abbildungen Seite 6, letzter Absatz ---	1-25
Y	US 5 694 322 A (KENNEDY III WILLIAM C ET AL) 2. Dezember 1997 (1997-12-02) Zusammenfassung; Abbildungen 1,2 Spalte 1, Zeile 45 -Spalte 2, Zeile 2 Spalte 3, Zeile 38 -Spalte 4, Zeile 52 Spalte 8, Zeile 49 - Zeile 52 Spalte 9, Zeile 7 -Spalte 10, Zeile 60 --- -/--	1-25

[X] Weitere Veröffentlichungen sind der Fortsetzung von Feld C zu entnehmen

[X] Siehe Anhang Patentfamilie

° Besondere Kategorien von angegebenen Veröffentlichungen :
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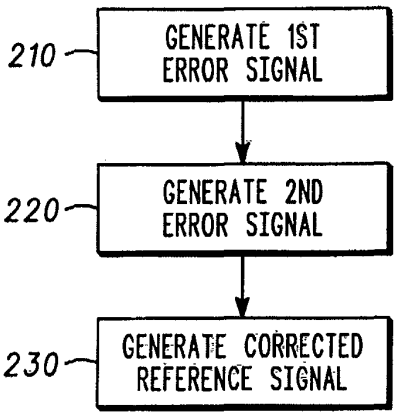

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(57) Abstract: Methods in radio communications devices having a transmitter with an integral control loop, and in other integral control systems, including generating a first error signal (210) based upon an amplifier output signal and a corrected reference signal, generating a second error (220) signal based on a closed loop integral control signal applied to a control input of the amplifier and based on an integral control reference signal, and generating the corrected reference signal (230) by correcting a reference signal based upon the first and second error signals.

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RF TRANSMITTERS WITH SATURATION DETECTION AND CORRECTION AND METHODS THEREFOR

FIELD OF THE INVENTIONS

The present inventions relate generally to radio frequency transmitters with integral control, and more particularly to saturation detection and correction in transmitters, for example TDMA transmitters in mobile radio communication devices, and methods therefor.

BACKGROUND OF THE INVENTIONS

U.S. Patent No. 4,458,209 entitled "Adaptive Power Control Circuit", assigned commonly with the present application, discloses a dual band analog control loop having an integrator with a variable response time provided by switching first and second resistors of an RC time constant. The faster time constant applies to transient operation and the slower time constant to steady-state operation. See also, U.S. Patent No. 5,697,074 entitled "Dual Rate Power Control Loop For a Transmitter".

In digital control circuits, the peak detect circuit output is filtered and converted to a digital format before being input to a processor, which provides an output control signal based on a comparison of the digitized input signal with a reference signal. Like the analog control circuits discussed above, digital control circuits control the amplifier in a manner that tends to match the digitized peak-detect circuit signal with the reference signal. See for example, U.S. Patent No. 5,287,555 entitled "Power Control Circuitry for A TDMA Radio Frequency Transmitter".

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In GSM and other time division multiple access (TDMA) based cellular radio communication devices, a closed loop digital integral control system sets the RF power level and controls the turn-on on turn-off response of the transmitter, which operates in a burst mode. In these radio communication applications, it is important to maintain power control throughout transmission in order to comply with telecommunication standards specifications. For example, the transmitter must ramp-up and ramp-down in a manner prescribed by the telecommunications standards to minimize spectral splatter.

In the exemplary radio communications application, when the transmitter output power becomes saturated, the integral control loop loses lock and the control signal grows excessively resulting in an uncontrolled open loop, a phenomenon known as integral windup. Under these uncontrolled open loop conditions, when the transmitter is required to ramp-down after a delay dependent upon the degree of the preceding integral windup, the control line goes low rapidly and the control loop attempts to re-lock, resulting in severe transients and spectral splatter. Another adverse result of the uncontrolled, open loop condition is the inability of the transmitter to turn off within the time interval specified by the telecommunications standards. The integral windup phenomenon is also prevalent in other closed loop integral control systems.

The various aspects, features and advantages of the present invention will become more fully apparent to those having ordinary skill in the art upon careful consideration of the following Detailed Description of the Invention with the accompanying drawings described below.

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BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exemplary closed loop integral control radio communications transmitter.

FIG. 2 is an exemplary process flow diagram for an exemplary embodiment of the invention.

FIG. 3 is an exemplary digital implementation of a portion of a saturation detection and correction circuit.

FIG. 4 is an exemplary digital implementation of another portion of the saturation detection and correction circuit.

FIG. 5 is an exemplary logic block truth table.

DETAILED DESCRIPTION OF THE INVENTIONS

FIG. 1 is a radio communications transmitter 10, for example a time division multiple access (TDMA) transmitter, with closed loop integral control. The exemplary transmitter comprises generally a Cartesian or polar vector modulator 12 with an output coupled to an input of an amplifier 14, which typically comprises multiple, cascaded amplifiers, as illustrated.

The closed integral control loop includes a peak-detector 13 at the transmitter output for detecting an output signal that is compared or summed with a reference signal to produce a first error signal used by an integral control device 20 for controlling the transmitter, and particularly the amplifier thereof. Generation of the first error signal is illustrated in the process flow diagram of FIG. 2, at block 210.

In FIG. 1, an error signal circuit 26 produces the first error signal at a first error output (1st EO) thereof by summing a difference, or subtracting, an output of the peak-detector 13, applied to the error signal circuit 26, from a

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corrected reference signal applied to a corrected error input (CRI) of the error signal circuit 26. The first error signal of the error signal circuit 26 is applied to an error input (EI) of the integral control device 20.

In FIG. 1, the integral control device 20 has an integral control output (ICO) coupled either directly or indirectly to a control input (CI) of the amplifier 14. In operation, the integral control device 20 tends to match the transmitter output, as measured by the peak-detector 13, with the corrected reference signal applied to the error signal circuit 26 by applying an appropriate closed loop integral control signal, which is based upon the first error signal of the error signal circuit 26, to the control input of the amplifier.

The exemplary transmitter may be implemented with analog or digital circuitry. In a digital implementation, the peak detect circuit 13 output is filtered and converted to a digital format before being input to a digital integral control device, which may be implemented with clocked accumulator and register for providing the output control signal based the first error signal.

The details of digital and analog implementations of closed loop integral control circuits for radio communications transmitters are beyond the scope of the instant patent application and will be discussed only as required to practice the inventions disclosed herein. An exemplary digital TDMA transmitter is disclosed in U.S. Patent No. 5,287,555 entitled "Power Control Circuitry for A TDMA Radio Frequency Transmitter", the subject matter of which is incorporated herein by reference.

The integral control loop saturation detection and correction implementations of the present inventions, which are discussed more fully below, are applicable more generally to closed loop systems other than the exemplary radio transmitter applications disclosed herein, including for example, applications in cruise, guidance and climate control environments, among many others. Also, the integral control device may be of a more general nature, including for example those with proportional, integral and derivative actions,

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also known as PID controllers. These and other closed loop control systems with integral control devices are ubiquitous and will benefit as well from the saturation detection and correction inventions disclosed herein.

In FIG. 2, in one embodiment, a second error signal is generated at block 220 based upon the closed loop integral control signal applied by the integral control device 20 to the control input of the amplifier or some other controlled device, and based upon an integral control reference signal.

In FIG. 1, the second error signal is generated by integral control device controller 40 that compares the closed loop integral control signal, applied to the integral control input (ICI) thereof by the integral control device 20, with the integral control reference signal applied to a limit reference input (AOC_MAX) of the integral control device controller 40.

In one mode of operation, the second error signal is produced by the integral control device controller 40 only when the closed loop integral control signal is greater than the integral control reference signal applied to a limit reference input (AOC_MAX) of the integral control device controller 40.

In one embodiment, the integral control device controller 40 includes a control output (CO) coupled to the amplifier control input (CI), or more generally to the control input of some other controlled device. The integral control device controller 40 limits the closed loop integral control signal applied to the controlled device, the amplifier in the exemplary embodiment, when the closed loop integral control signal produced by the integral control device 20 exceeds the integral control reference signal applied to the limit reference input (AOC_MAX) of the integral control device controller 40. In other alternative embodiments, without integral control signal limiting, the integral control output of the integral control device 20 is coupled directly to the control input of the amplifier or other controlled device. The configuration for limiting the integral control signal applied to the controlled device is preferred for the exemplary radio transmitter

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application since the transmitter may operate outside the communications standard specification without the limiting control.

In FIG. 1, a reference signal control circuit 30 comprises a first input (HI) coupled to the first error output (1st EO) of the error signal circuit 26 and a second input (SI) coupled to the second an error output (2nd EO) of the integral control device controller 40. The reference signal control circuit 30 also comprises a reference control output (RCO) coupled to a reference control input (RCI) of a reference signal correction circuit 36 having a reference input (PWR). The reference signal correction circuit 36 also has a corrected reference output (CRO) coupled to the corrected reference input (CRI) of the error signal circuit 26.

In FIG. 2, at block 230, the corrected reference signal is generated by correcting a reference signal based upon the first and second error signals. In FIG. 1, for example, the reference signal correction circuit 36 sums or computes a difference between the reference control signal from the reference signal control circuit 30 and a reference signal provided to the reference input (PWR) of the reference signal correction circuit 36. The corrected reference signal is applied to the error signal circuit 26.

The reference control signal of the reference signal control circuit 30 is proportional generally to the first error signal produced by the error signal circuit 26. In one mode of operation, the reference signal input to the reference signal correction circuit 36 is corrected by subtracting therefrom an amount approximately equal to the first error signal. This correction scheme works particularly well in systems where the controlled device, the transmitter in the exemplary embodiment, has relatively constant gain.

In another mode of operation, the reference signal is corrected by subtracting therefrom an amount greater than the first error signal, for example "[Error 1 + Step]", where the "Step" term is determined empirically for the particular control system under consideration. This alternative scheme is useful for TDMA transmitters applications where the transmitter output tends to

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decrease during bursts. In this and other applications, the "Step is selected to ensure that the transmitter remains unsaturated throughout the burst.

In yet another mode of operation, the reference signal is corrected by subtracting therefrom an amount less than the first error signal, for example "[(Error 1/DIV) + step], where the "DIV" and "step" terms are determined empirically for the particular control system under consideration.

In one embodiment, in FIG. 1, the reference control signal is applied by the reference signal control circuit 30 to the reference signal correction circuit 36 only when the integral control signal of the integral control device 20 exceeds the integral control reference signal of the integral control device controller 40, for example based upon the presence of the second error signal at the input (SI) of the reference signal control circuit 30.

In another embodiment of the invention, the reference signal (PWR) is corrected based upon the first error signal, without regard for the second error signal, for example if the first error signal exceeds a saturation threshold (SAT_TH). In FIG. 1, the saturation threshold signal (SAT_TH) is input to the reference signal control circuit 30 and a comparison is made between the saturation threshold signal and the first error signal for this purpose.

In operation, when the first error signal of the error signal circuit 26 exceeds the saturation threshold, the corrected reference signal applied to the corrected reference signal input (CRI) of the error signal circuit 26 is generated by subtracting the first error signal, or some variation thereof, from the reference signal (PWR) at the reference signal correction circuit 36. In one mode of operation, the reference signal (PWR) input to the reference signal correction circuit 36 is corrected by subtracting therefrom an amount approximately equal to the first error signal, as discussed above. In other modes of operation, the reference signal is corrected by subtracting therefrom an amount that is more than or less than the first error signal, as discussed above. As discussed above, for TDMA transmitter applications where the transmitter output decreases during the

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course of the burst, it is desirable to reduce the reference signal by an amount, greater than the first error signal, sufficient to keep the transmitter out of saturation throughout the burst.

Integral windup of the integral control device may be controlled based upon the integral control reference signal applied to the limit reference input (AOC_MAX) of the integral control device controller 40 alone or in combination with the saturation reference signal (SAT_TH) applied to the reference signal control circuit 30.

Integral windup control based upon the saturation threshold signal (SAT_TH) of the reference signal control circuit 30 is coarse in comparison to control based upon the integral control reference signal (AOC_MAX) of the integral control device controller 40. Integral windup control based on the integral control reference signal applied to the limit reference input (AOC_MAX) of the integral control device controller 40 provides relatively precise control when the control system operates within the saturation threshold, but when the integral control signal exceeds the integral control reference signal (AOC_MAX).

In one embodiment, the integral control reference signal limit, input at the AOC_MAX input of the integral control device controller 40, is reduced at least temporarily when the first error signal exceeds the saturation threshold (SAT_TH). In applications where the transmitter operates in a burst transmission mode, for example in GSM and other TDMA based communications transmitter applications, the integral control reference signal (AOC_MAX) is maintained at the reduced limit until the end of a transmission burst during which the limit was reduced. Thereafter, the integral control reference signal limit is changed back to a default value upon completion of the transmission burst during which the limit was reduced.

In implementations where the integral control device comprises clocked accumulator and register circuits, in some applications, the clock of the integral control device is inhibited when the first error signal exceeds the

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saturation threshold (SA_TH). The inhibition of the clock prevents continued windup of the accumulator and/or register during saturation, thus eliminating the requirement or resetting the accumulator and register and any attending delay associated therewith.

FIG. 3 is portion of an exemplary digital soft saturation detection implementation that determines whether the closed loop integral control signal of the integral control device 20 has exceeded an integral control reference (AOC_MAX) in a TDMA transmitter application. The closed loop integral control signal is compared with the integral control reference signal (AOC_MAX) at a comparator 310, the output of which is the second error signal (2nd ERROR_sig), which is clocked into a multiplexer 320 that provides an output to the control input of the amplifier. The integral control reference signal (AOC_MAX) is provided to the comparator 310 by a clocked register 330.

In FIG. 3, the second error signal (2nd ERROR_sig) is input to a logic block 410, which also has input thereto a SAT-DET output from a comparator 420. The saturation detection output (SAT_DET) is enabled when the first error signal exceeds the saturation threshold (SAT_TH). The first error signal (1st ERROR_sig) is compared to the saturation reference (SAT_TH) at the comparator 420. In some embodiments, as noted above, the first error signal is increased by an incremental "Step" term at a summer 430, the output of which is input to a register 440 by a summer 450 having an input coupled to the register output.

The logic block 410 has a first output (SAT_REG_CLK) to the clock input (Ck) of the register 440. The logic block 410 has a second output (ACCM_CLK), which may also be considered a clock signal, to the accumulator of an integral control device. FIG. 5 is a logical look-up table for the operation of the logic block 410. When the clocks (SAT_REG_CLK& ACCM_CLK) are active, their respective registers can update based on the register input values. When the clocks are inhibited, the registers hold at their current values.

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In TDMA transmitter applications, saturation is monitored at the end of ramp-up. Hard saturation is detected when the first error signal, at the output of the error signal circuit 26, exceeds an unacceptable positive value as set by the saturation threshold (SAT_TH). Soft saturation is detected when the integral control device accumulator value exceeds an unacceptable maximum value set by the integral control reference (AOC_MAX), which may be changed dynamically as discussed above. In FIG. 4, when hard or soft saturation is detected, the reference signal is reduce by a value of the error signal plus an addition offset as determined by SAT_STEP at summer 460. The referenced back-off occurs before the next measured RF power sample is obtained. In one embodiment, when hard saturation occurs, the integral control reference (AOC_MAX) is updated with current accumulator value, and upon completion of the burst the integral control reference (AOC_MAX) is reset to a default value.

While the present inventions and what is considered presently to be the best modes thereof have been described in a manner that establishes possession thereof by the inventors and that enables those of ordinary skill in the art to make and use the inventions, it will be understood and appreciated that there are many equivalents to the exemplary embodiments disclosed herein and that myriad modifications and variations may be made thereto without departing from the scope and spirit of the inventions, which are to be limited not by the exemplary embodiments but by the appended claims.

What is claimed is:

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CLAIMS

1. A radio communications device, comprising:

a transmitter having a modulator with an output coupled to an input of an amplifier;

an integral control device having an integral control output coupled to a control input of the amplifier;

an error signal circuit having an feedback input coupled to an output of the amplifier, the error signal circuit having a corrected reference input and an error output coupled to an error input of the integral control device;

an integral control device controller having an input coupled to the integral control output of the integral control device, the integral control device controller having a controlled output coupled to the amplifier control input, the integral control device controller having a limit reference input;

a reference signal control circuit having a first input coupled to the first error output of the error signal circuit, an error output of the integral control device controller coupled a second reference control input of the reference signal control circuit;

a reference signal correction circuit having a reference input,

a reference control output of the reference signal control circuit coupled to a reference control input of the reference signal correction circuit.

2. The radio communications device of Claim 1, the reference signal control circuit having a threshold input.

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3. The radio communications device of Claim 2, the reference signal control circuit for providing a corrected reference signal to the reference signal correction circuit if an error signal of the error signal circuit exceeds a saturation threshold of the reference signal control circuit.

4. The radio communications device of Claim 1, the reference signal control circuit and the reference signal correction circuit for adjusting a corrected reference signal to the error signal circuit by an amount approximately equal to an error signal of the error signal circuit.

5. The radio communications device of Claim 1, the reference signal control circuit and the reference signal correction circuit for adjusting a corrected reference signal to the error signal circuit by an amount greater than an error signal of the error signal circuit, or by an amount less than an error signal of the error signal circuit.

6. The radio communications device of Claim 1, the integral control device controller for limiting a control signal input to the amplifier based on a limit reference input of the integral control device controller.

7. The radio communications device of Claim 1, the transmitter has a digital control loop, the reference signal control circuit and the reference signal correction circuit for adjusting a corrected reference signal to the error signal circuit based upon an error signal of the integral control device controller and an error signal the error signal circuit.

8. A method in a radio communications device having a transmitter with an integral control loop, comprising:

generating a first error signal based upon an amplifier output signal and a corrected reference signal;

generating a second error signal based on a closed loop integral control signal applied to a control input of the amplifier and based on an integral control reference signal;

generating the corrected reference signal by correcting a reference signal based upon the first and second error signals.

9. The method of Claim 8,

applying the closed loop integral control signal to the amplifier control input with an integral control device,

providing the first error signal to the integral control device,

generating the first error signal by subtracting the amplifier output signal from the corrected reference signal,

generating the second error signal only when the closed loop integral control signal is greater than the integral control reference signal;

correcting the reference signal by subtracting therefrom a quantity based upon the first and second error signals.

10. The method of Claim 8, correcting the reference signal by subtracting therefrom an amount approximately equal to the first error signal, or an amount greater than the first error signal, or an amount less than the first error signal.

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11. The method of Claim 8, limiting the closed loop integral control signal applied to the amplifier control input if the closed loop integral control signal exceeds a limit set by the integral control reference signal.

12. The method of Claim 8, correcting the reference signal based upon the first error signal, without regard for the second error signal, if the first error signal exceeds a saturation threshold.

13. The method of Claim 12, limiting the closed loop integral control signal applied to the amplifier control input if the closed loop integral control signal exceeds a limit set by the integral control reference signal.

14. The method of Claim 12, at least temporarily reducing the integral control reference signal limit if the first error signal exceeds the saturation threshold.

15. The method of Claim 14, the transmitter operates in a burst transmission mode, maintaining the integral control reference signal at the reduced limit until the end of a transmission burst during which the limit was reduced, increasing the limit to a default value upon completion of the transmission burst during which the limit was reduce.

16. The method of Claim 12, the integral control device comprises clocked accumulator and register circuits, inhibiting a clock of the integral control device if the first error signal exceeds the saturation threshold.

17. A method in a closed loop integral control system, comprising:

generating a first error signal based on an output signal of the controlled device and a corrected reference signal;

providing the first error signal to an integral control device applying a closed loop integral control signal to a control input of the controlled device,

generating a second error signal based on the closed loop integral control signal and based on an integral control reference signal;

generating the corrected reference signal by correcting a reference signal based upon the first and second error signals.

18. The method of Claim 17,

generating the first error signal by subtracting the amplifier output signal from the corrected reference signal,

generating the second error signal only when the closed loop integral control signal is greater than the integral control reference signal;

correcting the reference signal by subtracting therefrom a quantity based upon the first and second error signals.

19. The method of Claim 17, limiting the closed loop integral control signal if the closed loop integral control signal exceeds a limit set by the integral control reference signal.

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20. The method of Claim 17, correcting the reference signal based on the first error signal, without regard for the second error signal, if the first error signal exceeds a saturation threshold.

21. The method of Claim 20, limiting the closed loop integral control signal if the closed loop integral control signal exceeds a limit set by the integral control reference signal.

22. The method of Claim 20, at least temporarily reducing the integral control reference signal limit if the first error signal exceeds the saturation threshold.

23. The method of Claim 20, the integral control device comprises clocked accumulator and register circuits, inhibiting a clock of the integral control device if the first error signal exceeds the saturation threshold.

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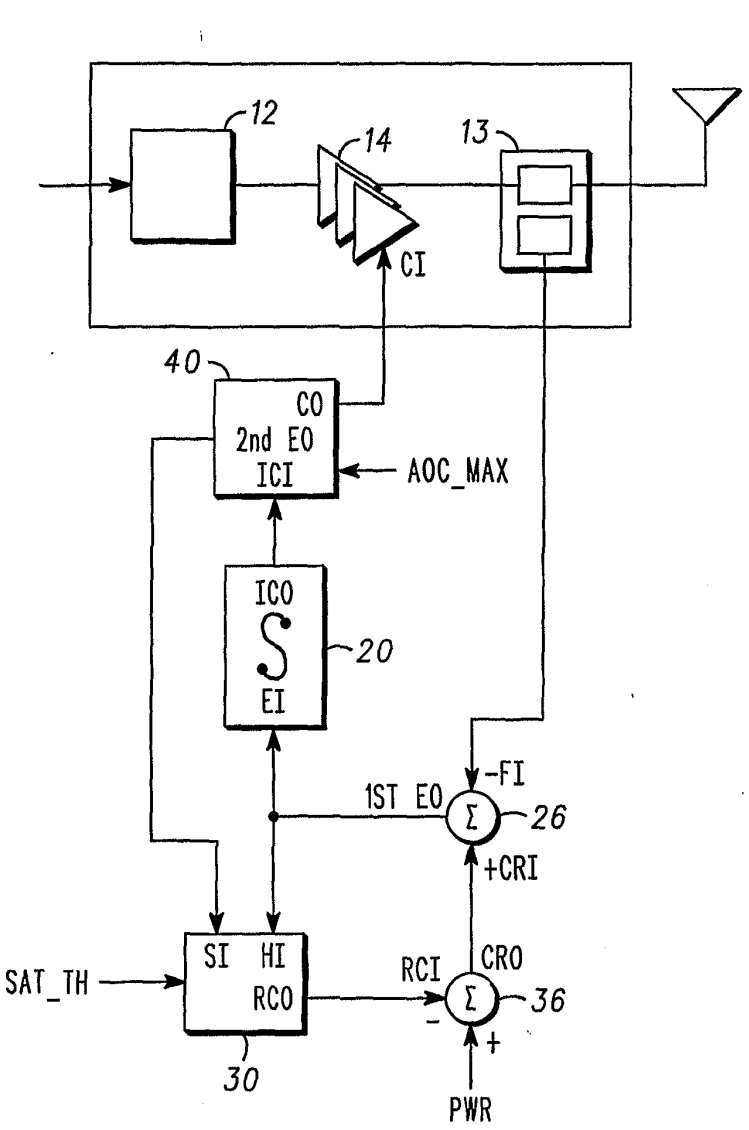

FIG. 1

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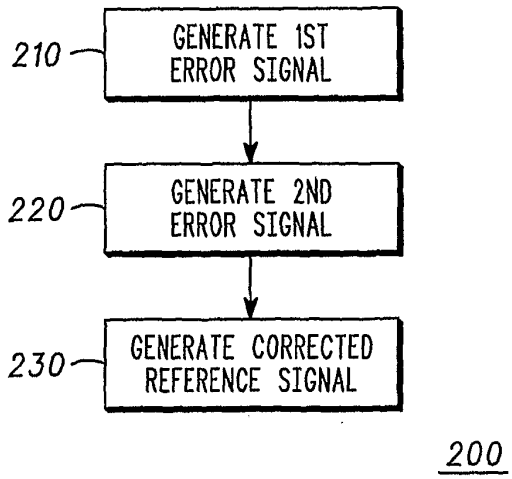
210
GENERATE 1ST ERROR SIGNAL
220
GENERATE 2ND ERROR SIGNAL
230
GENERATE CORRECTED REFERENCE SIGNAL
200

FIG.2

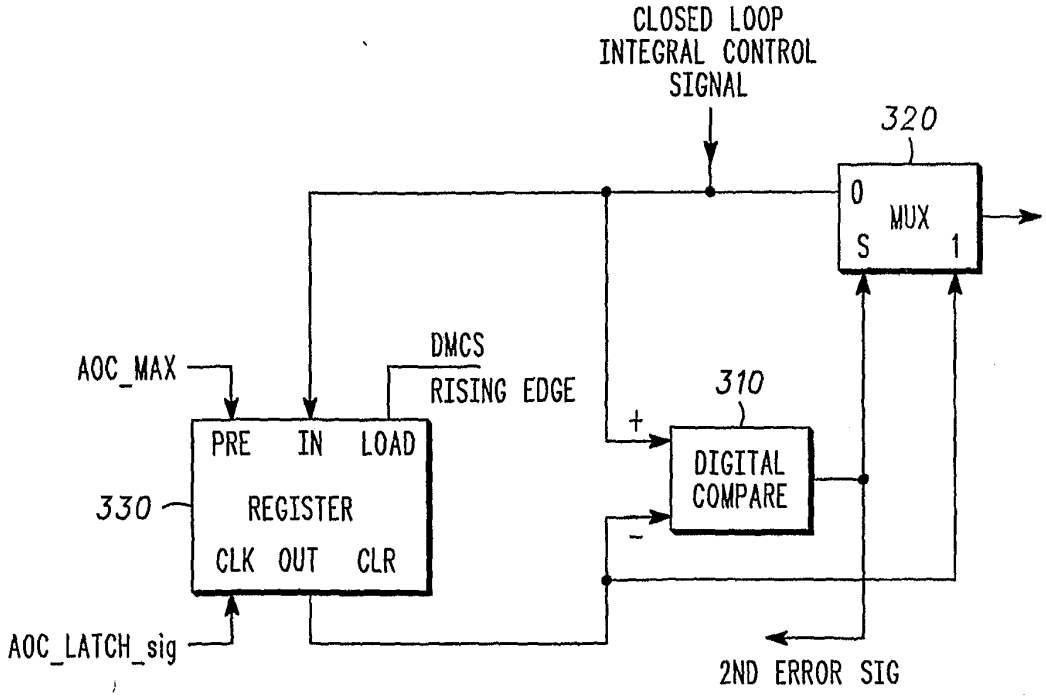
CLOSED LOOP INTEGRAL CONTROL SIGNAL
320
0
MUX
S
1
AOC_MAX
DMCS
RISING EDGE
310
+
PRE IN LOAD
330
REGISTER
CLK OUT CLR
DIGITAL COMPARE
-
AOC_LATCH_sig
2ND ERROR SIG

FIG.3

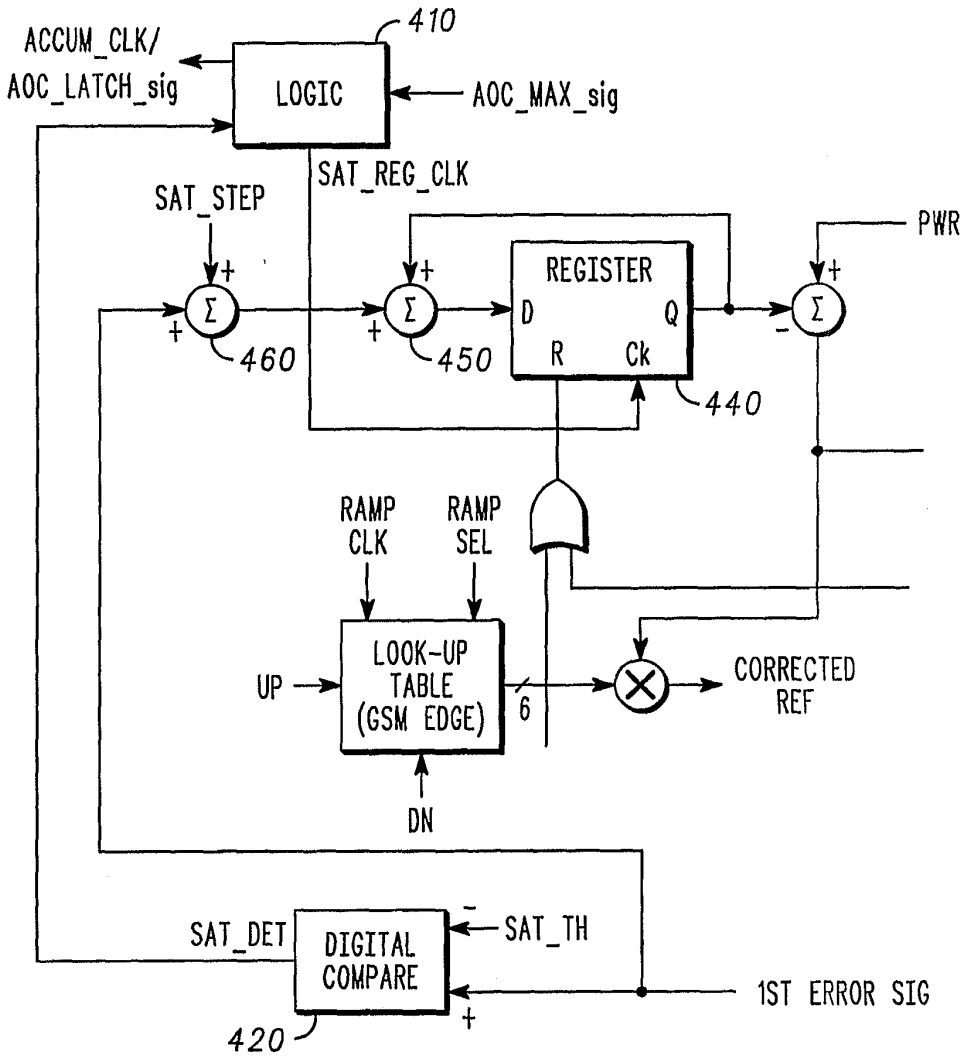

FIG.4

AOC_MAX_sig	SAT_DET	ACCM_CLK	SAT_REG_CLK
FALSE	FALSE	ACTIVE	INHIBITED
FALSE	TRUE	INHIBITED	ACTIVE
TRUE	FALSE	ACTIVE	ACTIVE
TRUE	TRUE	INHIBITED	ACTIVE

FIG.5

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US03/05684

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) :H04B 15/00; H04N 7/00
US CL : 455/126, 127, 115, 91
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 455/126, 127, 115, 91

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6,281,935 B1 (TWITCHELL et al) 28 August 2001, whole document.	1-23
Y	US 5,748,677 A (KUMAR) 05 March 1998, whole document.	1-23
A	US 5,448,203 A (MATUI et al) 05 September 1995, whole document.	1-23
A	US 5,163,159 A (RICH et al) 10 November 1992, whole document.	1-23

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 16 APRIL 2003	Date of mailing of the international search report 13 MAY 2003
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Form PCT/ISA/210 (second sheet) (July 1998)★

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(11) EP 1 050 853 A1

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19.02.1998 JP 3771498
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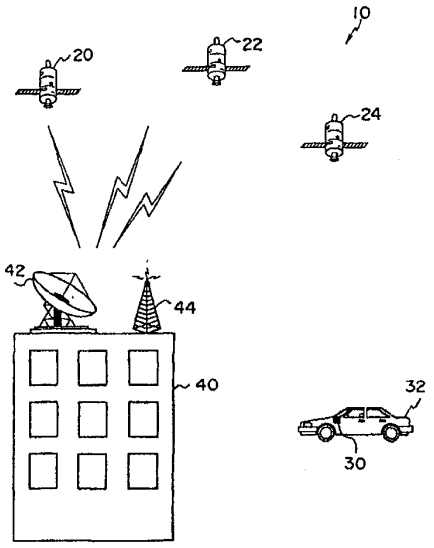
(54) ACCOUNTING APPARATUS, ACCOUNTING SYSTEM, AND ACCOUNTING CARD

(57) Charge processing is performed using a system whose overall structure has been simplified, and in which the burden on the user of a vehicle decreased.

A device mounted in a vehicle 30 detects the position of a vehicle 32 mounting the device mounted in a vehicle using GPS signals from GPS satellites 20, 22, and 24, and transmits this via ground wave communication to a general center 40. The general center 40 performs charge processing (calculation) for an area in which a charge is applied based on the position of the vehicle 32 received by ground wave communication, and transmits the result thereof to the device mounted in a vehicle 30. The device mounted in a vehicle 30 collects a toll from a prepaid card or IC card or the like on the basis of the received charge processing result.

FIG. 1



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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a charge processing device, a charge processing system, and a charge processing card. In particular, the present invention relates to a charge processing device, a charge processing system, and a charge processing card for carrying out the receipt and transfer of information such as the receipt and payment of fare or the like by wireless communication between a moving body such as a vehicle and the ground, and for performing processing relating to the charge processing the user of the moving body.

Description of the Related Art

[0002] A moving body such as a vehicle travels along a road or the like. A vehicle that travels on a toll paying installation such as a toll road is charged in accordance with the type of the vehicle as well as the distance traveled on the toll road. In order to automatically collect the toll at an entry gate or exit gate of the toll road, a road - vehicle intercommunication system for performing wireless information transfer between an in-vehicle device and an on-road device is used. In this system, a communication device having an antenna for sending and receiving electrical waves (i.e. the on-road device) is provided on the road as an interrogator for seeking information on the relevant vehicle. In addition, a communication device having an antenna (i.e. the in-vehicle device) is provided in the vehicle as a responder for responding to the sought information.

[0003] Technology is proposed in, for example, Japanese Patent Application Laid-Open (JP-A) No. 9-212794, in which a toll is collected from a vehicle based on the location where the vehicle entered the toll road, the location where the vehicle exited from the toll road, and the history of the route traveled by the vehicle.

[0004] However, when this type of road - vehicle intercommunication system is used to transfer information, it is necessary to install an on-road device at the entries and exits of the area for which a toll is to be charged, such as the entry gates and exit gates of a toll road. If the area for which a toll is to be charged, such as a toll road, is one-dimensional, the installation of the on-road devices is easy, however, if the area in which a charge is applied is set as a zone or the like covering a wide range, it is necessary to install on-road devices at all of the entries and exits, so consequently, the cost increases in accordance with the number of entry and exit locations.

[0005] A road - vehicle intercommunication system also exists in which charge processing is performed by the wireless transfer of information between an in-vehicle device and an on-road device. In this system, balance information is stored in advance in a prepaid card or IC card or the like, and the charge processing is performed by subtracting the toll to be collected from this balance information.

[0006] When the toll collection is performed automatically in this way, if the vehicle user does not possess a prepaid card or IC card or the like, or if the balance of the card is insufficient, it is not possible for the toll collection to be properly performed. Therefore, technology is proposed in which an external notification lamp is provided inside the vehicle, and when it is not possible for the proper toll to be collected from a vehicle this fact is notified to the exterior of the vehicle by the external notification lamp (see JP-A No. 8-7131). In this technology, when the proper toll cannot be collected from a vehicle that is fitted with the above road - vehicle intercommunication system and the vehicle passes over an entry gate or exit gate, the exterior facing lamp of the in-vehicle device is either turned on or turned off, thereby enabling an observer to easily observe that the proper toll has not been collected.

[0007] However, in this road-vehicle intercommunication system, although information is transferred by installing on-road devices at entries and exits of the area in which a charge is applieduch as at the entry gates and exit gates of a toll road, when the area in which a charge is applied is set as a zone or the like covering a wide range where the entry and exit points cannot be specified, it is necessary to install on-road devices at all of the foreseeable entry and exit locations, and to establish a large number of observers.

[0008] A further example of a road - vehicle intercommunication system for performing charge processing by the wireless transfer of information between an in-vehicle device and an on-road device is proposed in JP-A No. 8-221617. In this technology, a toll is collected from a vehicle that passes over the communication area of an on-road antenna installed on the road.

[0009] However, in this road - vehicle intercommunication system, although information is transferred by installing on-road devices at entries and exits of the area in which a charge is applieduch as at the entry gates and exit gates of a toll road, when the area in which a charge is applied is set as a zone or the like covering a wide range where the entry and exit points cannot be specified, it is necessary to install on-road devices at all of the foreseeable entry and exit locations.

[0010] Moreover, a charge processing system is proposed in JP-A No. 9-153156 in order for the charge processing

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to be more easily performed. In this system, balance information is stored in advance in an IC card or the like and the charge is processed by subtracting the toll to be collected from this balance information.

[0011] However, in this system, although information is transferred by installing on-road devices at entries and exits of the area in which a charge is applieduch as at the entry gates and exit gates of a toll road, when the area in which a charge is applied is set as a zone or the like covering a wide range where the entry and exit points cannot be specified, it is necessary to install on-road devices at all of the foreseeable entry and exit locations. Moreover, this system cannot be applied when the area in which a charge is applied varies.

[0012] A further system is proposed in which vehicle transit determining devices are installed on a plurality of routes, and the charge is made by determining which route of the plurality of routes the vehicle traveled over. An example of this system is given in JP-A No. 9-212794. The system installation of this system is simple on toll roads network on which there are a few branch routes or entries and exits (interchanges) and having comparatively long distances between interchanges as only a few vehicle transit determining devices need to be installed.

[0013] However, if the toll road network is one having many branch routes and entries and exits (interchanges), and is one in which, although there are many sections with short distances between interchanges, the total distance of the road network as a whole is large, in cases such as this, the number of vehicle transit determining devices installed increases and the installation costs and maintenance costs are great. Moreover, in the above cases, it is only possible to obtain charge information of the toll road network within the area of control of the toll road network or directly in front of the entries thereto. Thus, it is difficult in the area a sufficient distance before the interchange for allowing such a detour route selection to be made to obtain information for deciding whether to use a toll road (i.e. to enter the toll gate) or whether to make a detour and use a surface non-toll road.

[0014] It is also possible to consider charges or traffic regulations in a specific area as a means of easing traffic congestion, reducing atmospheric pollution, reducing noise, obtaining regional revenue, or the like. In this case, if the road network of the subject area is complex and intricate, in the above charge system, it is necessary to install vehicle transit determining devices on a large number of the roads within the area. Consequently, the resulting high density installation is high in cost while the physical installation may be difficult depending on the location. Furthermore, if a charge is made or not made depending on the season (or month or day) or the time of day, or if the amount charged is changed, this information needs to be made known throughout the large number of roads running in and out of the area.

[0015] Conventionally, notification is made using a notice board or art electric sign board, however, in order to make the notification as wide as possible so as to enable a driver to avoid the area and choose a detour route, it is necessary to provide the notice board or the like some distance outside of the relevant area, which becomes a colossal undertaking. Moreover, the expense required for the work involved when tolls are revised or an area is altered is also great. To this can be added the burden of accurately informing a driver at the proper time the notification information of the notice board or the like.

[0016] When a driver exits a toll road using a balance renewable prepaid card, information indicating the route traveled is transmitted from the vehicle to an antenna terminal. The antenna terminal then calculates the toll for the traveled route and transmits the toll to the vehicle, where the vehicle subtracts the toll from the prepaid card. There is accordingly no need to stop the vehicle in order to pay the toll.

[0017] However, if the toll road is one having many branch routes and entries and exits (interchanges), and is one in which, although there are many sections with short distances between interchanges, the total distance of the road network as a whole is large, in cases such as this, the number of vehicle transit determining devices installed increases and the installation costs and maintenance costs are great. Consideration may also be given to exacting charges in a specific area as a means of easing traffic congestion, reducing atmospheric pollution, reducing noise, obtaining regional revenue, or the like. In contrast to a charge area in which the highway network is a narrow continuous distribution, the charge area for a specific area such as that described above is an isolated area covering a large surface area. In this case, there is a high probability that the road network within the area will be complex, and the establishment of tollbooths for stopping a vehicle to collect charges is not feasible. Instead, the employing of an automatic charge processing system that uses a communication device and a prepaid card or some other electronic information storage medium is desirable.

[0018] The possibility of the prepaid card being illegally used needs to be considered, however. In fact, not only when prepaid cards are used, but when charge processing is performed using a storage medium or by telecommunication, the possibility exists that information on the storage medium will be illegally altered, or that illegal communication information will be sent, or that the storage medium will be used illegally or intentionally not used. Thus, it can be seen that there is a need for measures against illegalities in automatic charge processing in a non-stop automatic charge processing system in which it is not practically possible for the controller to observe or examine the storage medium or communication device.

[0019] The present invention was conceived in view of the above, and it is an object thereof to provide a charge processing device, a charge processing system, and a charge processing card which have a simple structure and which enable the processing of a charge to the user of a moving body such as a vehicle or the like to be performed with ease.

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[0020] It is a further object of the present invention to provide a charge processing device, a charge processing system, and a charge processing card which enable confirmation of the charge condition, for example, whether or not a toll has been collected, in a area in which a charge is applied to be made with ease.

[0021] It is a further object of the present invention to allow the following to be performed. Namely, the automatic notification to a person of control information for a specific area and of that person's positional relationship relative to that specific area; the simplification of the transmission of information of the specific area and the altering of that information; the comparative simplification of the installation of system elements and the enhancement of the reliability of the control information notification; and the simplification of the charge processing of a vehicle that has entered into the area in which a charge is applied and of the charge information control.

[0022] It is a further object of the present invention to allow the following to be performed. Namely, doing away with the need for the large scale installation of a fixed facility without causing any problems in the toll payment; the simplification of the transmission of information of the specific area and the altering of that information; and the simplification of the charge processing of a vehicle that has entered into the area in which a charge is applied and of the charge information control.

[0023] It is a further object of the present invention to allow the following to be performed. Namely, the simplification of the automatic observation of an intentional attempt to render inoperable a device carried by a user or mounted on a vehicle in order to allow illegal use or to enable a charge to be avoided; the simplification of the data collection for that purpose; the doing away with the need for the large scale installation of a fixed facility without causing any problems in the toll payment; the simplification of the transmission of information of the specific area and the altering of that information; and the simplification of the charge processing of a vehicle that has entered into the area in which a charge is applied and of the charge information control.

SUMMARY OF THE INVENTION

[0024] The charge processing device, the charge processing method, and the charge processing card having the structures described below were invented in order to achieve the above objects.

[0025] The charge processing device according to claim 1 of the present invention comprises: detecting means for detecting position information indicating a position where a moving body is located; matching means for matching the position information with predetermined map information; deciding means for deciding, based on a result of a matching by the matching means, an entry state indicating whether or not the moving body has at least entered into an area in which a charge is applied that corresponds to a predetermined area set in advance in the map information; and generating means for generating, based on a result of a deciding by the deciding means, charge information for the moving body.

[0026] In the charge processing device according to claim 1 of the present invention, a detecting means detects position information representing the current position of a moving body. A navigation system for mounting in a vehicle serving as the moving body which enables the display of a map for aiding traveling and providing instructions on a route to a destination can be used as this detecting means. As is commonly known, this navigation system can use a GPS system to easily detect the position of the moving body in which it is mounted (i.e. the host moving body), for example, a position determined by latitude and longitude. It is also possible to provide in the moving body a sending means such as a sender unit or the like for sending a signal that contains identifying data for identifying the host moving body, and receiving on the ground side the sent signal so that the position information is detected on the ground side.

[0027] The matching means matches the position information detected by the detecting means with preset map information. Namely, because the position where the moving body is located can be pinpointed from the position information, at this position, for example, a position set as a latitude and longitude, the moving body is able to be matched with predetermined map information such as a map of a predetermined area from among maps of Japan or maps of the Tokyo area.

[0028] The deciding means decides, on the basis of the result of the matching by the matching means, an entry state representing at least whether or not the moving body has entered into an area in which a charge is applied that corresponds to a predetermined area set in advance in the map information. The current position of the moving body is matched with map information by the matching means. A predetermined area corresponding to a area in which a charge is applied that is set in advance is set on the map information. As a result, by determining whether or not the current position of the moving body matched to the map information is within the area in which a charge is applied, it is possible to determine whether or not the moving body has at least entered into the area in which a charge is applied. Consequently, the deciding means decides the representation of whether or not the moving body has at least entered into the area in which a charge is applied as an entry state.

[0029] The generating means generates charge information for a moving body based on the result of the deciding by the deciding means. For example, the toll that should be collected from a moving body within the area in which a charge is applied is determined in advance. Accordingly, because a predetermined toll should be charged when a mov-

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ing body enters into the area in which a charge is applied, the toll that should be charged on the moving body that has entered into the area in which a charge is applied is generated as charge information.

[0030] In this way, in the charge processing device of the present invention, because the position of a moving body detected by a detecting means is matched with map information, and the state of entry representing whether or not the moving body has entered into an area in which a charge is applied is decided, and charge information for the moving body is generated in accordance with the state of entry, it is possible to perform charge processing for the user of a moving body using a simple structure simply by generating charge information for a moving body in accordance with the entry state thereof, without having to install on-road devices in all the entry and exit locations such as entry and exit gates.

[0031] Claim 2 of the present invention is the charge processing device according to claim 1 of the present invention, the charge processing device further comprising location information detecting means for detecting, based on the position information, location information indicating date and time the moving body is located in the area in which a charge is applied, wherein the deciding means decides, based on the result of the matching by the matching means and a result of a detection by the location information detecting means, the entry state including a location state of the moving body within the area in which a charge is applied.

[0032] A constant charge is not applied in the area in which a charge is applied. Instead, the charge application depends on a predetermined time or time zone, the date or week, or a combination of these. Therefore, in claim 2, the charge processing device further comprises presence information detecting means for detecting, based on the position information, presence information representing the date and time the moving body is present in the area in which a charge is applied. It is possible to detect presence information representing the date and time the moving body is present within the area in which a charge is applied using the presence information detecting means. The deciding means decides, based on a result of a matching by the matching means and a result of a detection by the presence information detecting means, an entry state including a present state of the moving body within the area in which a charge is applied. As a result, it is possible to generate charge information for a moving body that only enters into the area in which a charge is applied when the charge is for the predetermined time or time period, the date or week, or combination of these.

[0033] In some cases, the driver is unaware that the area in which the moving body is currently traveling is a area in which a charge is applied or that the moving body is approaching and about to enter a area in which a charge is applied. Therefore, in the charge processing device, it is possible to further provide a notification means for giving advance information, when the moving body is approaching or has entered a area in which a charge is applied, expressing that the moving body is approaching a area in which a charge is applied or has entered a area in which a charge is applied based on the above position information. By further providing in this way a notification means for giving advance information, when the moving body is approaching or has entered a area in which a charge is applied, expressing that the moving body is approaching a area in which a charge is applied or has entered a area in which a charge is applied based on the above position information, it is possible to notify the driver when the moving body has entered a area in which a charge is applied or is approaching and is about to enter a area in which a charge is applied, thereby making it easy for the driver to decide on a course of action relating to their entry into a area in which a charge is applied or the like.

[0034] Moreover, in some cases, a constant charge is not applied in the area in which a charge is applied. Instead, the charge application depends on a predetermined time or time zone, the date or week, or a combination of these. Therefore, in the charge processing device, the notification means is able to give advance information including the time for which a charge is to be applied in the area in which a charge is applied when the moving body is approaching or has entered a area in which a charge is applied. If the notification means is able in this way to give advance information including the charge applicable time in the area in which a charge is applied when the moving body is approaching or has entered a area in which a charge is applied, it is possible to notify the driver of information including the charge applicable time in the area in which a charge is applied when the moving body has entered a area in which a charge is applied or is approaching and is about to enter a area in which a charge is applied, thereby making it easy for the driver to be aware that they have entered into a area in which a charge is applied or the like having times for which charges are applied.

[0035] In claim 3 of the present invention, in the charge processing device according to claim 1 or claim 2 of the present invention, the generating means decides the entry state including a congestion state caused by moving bodies located in the area in which a charge is applied.

[0036] In some cases, the charge application of the area in which a charge is applied is set in accordance with the largeness of number of moving bodies that have entered the area in which a charge is applied, namely, in accordance with the state of congestion. In other words, the charge application of the area in which a charge is applied is set in accordance with when a predetermined state of congestion has been exceeded. Therefore, in claim 3, the generating means decides a state of entry including a state of congestion caused by moving bodies present in the area in which a charge is applied. If the state of entry is decided in this way with the state of congestion included therein, then even

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when the toll differs in accordance with the state of congestion of the area in which a charge is applied, because the state of congestion is included in the state of entry, it is possible to easily generate charge information for a moving body in accordance with the state of congestion. Note that it claim 3 can also be applied when the toll differs for a predetermined time or time zone, the date or week, or a combination of these.

[0037] In claim 4 of the present invention, in the charge processing device according to any of claim 1 through claim 3 of the present invention, the generating means is further provided with storage means in which predetermined toll data corresponding to the entry state is stored in advance, and the generating means generates the charge information using the toll data in the storage means.

[0038] The toll for the charge processing is determined in advance. Therefore, as described in claim 4, the generating means is further provided with storage means in which predetermined toll data corresponding to the state of entry is stored in advance, and by generating the charge information using the toll data in the storage means, the generating means is able to generate the simplest and most appropriate charge information.

[0039] The charge processing device according to claim 5 of the present invention comprises: host moving body position detecting means for detecting a position of a host moving body; transceiving means for transmitting position information of the host moving body to the ground side, and for receiving charge data relating to a predetermined area in which a charge is applied, using wireless communication; and charge processing means for performing charge processing relating to the area in which a charge is applied, based on a result of a transmission and reception by the transceiving means.

[0040] In claim 5 of the present invention, the position of the host moving body is housed is detected by the host moving body detecting means. As a result, it is possible to detect in the moving body side the position of the host moving body. The aforementioned navigation system or the like, for example, can be employed for the host moving body detecting means. The transceiving means transmits position information of a host moving body to the ground side, and receives charge data relating to a predetermined area in which a charge is applied, using wireless communication. Namely, the detected position of the host moving body is transmitted to the ground side by a transceiving means, while the charge data obtained on the ground side, namely, predetermined charge data relating to the area in which a charge is applied is received. Data expressing the toll to be collected can be used for this charge data. The charge processing means performs charge processing relating to the area in which a charge is applied based on the results of transmissions and receptions by the transceiving means. Namely, charge processing is performed using charge data such as the toll to be collected and the like determined on the ground.

[0041] In claim 6 of the present invention, in the charge processing device according to claim 5 of the present invention, the charge processing means performs the charge processing using an IC card on which balance information is stored.

[0042] Namely, in the above charge processing, as is described in claim 6, an IC card on which balance information is stored can be used by the charge processing means.

[0043] Claim 7 of the present invention is a charge processing device comprising: detecting means for detecting position information representing a position where a vehicle is located; charge means for executing charge processing for the vehicle when the vehicle has entered into a predetermined area in which a charge is applied, based on a result of a detection by the detecting means; notification means which is mounted on the vehicle and which notifies the outside of the vehicle of a processing state of the charge processing in a notifying state corresponding to the processing state; and continuing means for continuing a notification by the notification means during the vehicle is located inside the area in which a charge is applied, based on a result of the detection by the detecting means.

[0044] In the charge processing device according to claim 7, detecting means detects position information representing the position where a moving body is present. A navigation system mounted in a vehicle that enables the display of a map for aiding traveling or indicating a route to a destination can be used for this detecting means. As is commonly known, this navigation system can use a GPS system to easily detect the position of the vehicle in which it is mounted, for example, a position determined by latitude and longitude. It is also possible that in the vehicle side, a sending means such as a sender unit or the like for sending a signal that contains identifying data for identifying the host vehicle is provided, and in the ground side, the sent signal is received so that the position information is detected on the ground side.

[0045] Because it is possible to detect the position of the presence of a vehicle from the position information, the vehicle can be matched with this position, for example, with a position determined by latitude and longitude, on map information determined in advance, such as a map of a predetermined region from among maps of Japan or maps of the Tokyo area.

[0046] The charge means executes charge processing for a vehicle when the vehicle has entered into a predetermined area in which a charge is applied, based on a result of a detection by the detecting means. For example, when a predetermined area in which a charge is applied is determined in advance on map information, by making a determination as to whether or not the position of the presence of a vehicle that has been matched to the map information is within the area in which a charge is applied, it is possible to determine whether or not the vehicle has at least entered into the area in which a charge is applied. Moreover, for example, the toll to be collected from a vehicle that is present

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within the area in which a charge is applied is determined in advance. Accordingly, when a vehicle enters the area in which a charge is applied, because a predetermined toll should be charged, the toll that should be charged for the vehicle that has entered the area in which a charge is applied is collected. The charge, namely, the collection of the toll is performed by settling the toll from a settlement account such as a card containing balance information such as a prepaid card or an IC card or the like, a bank account or credit card associated with the vehicle user, or the like.

[0047] The notification means mounted in the vehicle notifies the outside of the vehicle of the processing state of the charge processing in a notifying state corresponding to the processing state. The processing state may be at least a proper state that represents a state where a charge is properly made, or an improper state that represent a state where a charge is not made. If notification of one of these states is made, it is possible to confirm whether or not the charge has been properly made from outside the vehicle. Therefore, for example, by corresponding a notification state where notification is being made with the processing state being a proper state, and by corresponding a notification state where no notification is being made with the processing state being an improper state, it is possible to confirm that a charge has been properly made from outside the vehicle simply by determining whether notification is being made or not being made. It is not always certain that this notification for confirming the processing state will be made at a location where an observer or the like is stationed. Therefore, the continuing means continues a notification by the notification means while the vehicle is present inside the area in which a charge is applied, based on a result of a detection by the detecting means.

[0048] Thus, in the charge state notification device for a vehicle of the present invention, because the processing state of the charge processing performed when a vehicle has entered a area in which a charge is applied, which is known from the position of the vehicle detected by the detecting means, can be notified continuously within the area in which a charge is applied, the processing state can be confirmed from an arbitrary position within the area in which a charge is applied without installing on-road devices at every likely location of entry and exit such as entry and exit gates.

[0049] In claim 8 of the present invention, in the charge processing device according to claim 7 of the present invention, the notification means is a radiation means for radiating electromagnetic waves towards the outside of a vehicle.

[0050] As is described in claim 8, a radiation means for radiating electromagnetic waves towards the outside of a vehicle can be used as the notification means. These electromagnetic waves may be light in the visible wavelength band or infrared light, microwaves or radio waves including faint waves. By using electromagnetic waves in this way, the notification state can be expressed using predetermined frequencies and cycles, and amplitude waveforms.

[0051] In claim 9 of the present invention, in the charge processing device according to claim 7 or claim 8 of the present invention, the notification means is constructed as a light source disposed on the detecting means, or on a number plate of a vehicle, or in an area around a number plate of a vehicle.

[0052] If the notification means is disposed at a location inside the vehicle that is difficult to observe from the outside, the confirmation of the processing state of the charge processing, namely, the confirmation of the notification state is difficult from outside the vehicle. Therefore, as described in claim 9, the notification means is formed from a light source disposed on the detecting means, or on a number plate of a vehicle, or in an area around a number plate of a vehicle. As a result, it is easy for an observer or the like to visually confirm the processing state of the charge processing.

[0053] In claim 10 of the present invention, in the charge processing device according to any of claim 7 through claim 9 of the present invention, the notification means performs notification in a predetermined operating pattern in which the notification state is altered as in a time series.

[0054] When notification of either one of a proper state expressing a state where a charge has been properly made, and an improper state representing a state where a charge has not been made is made by the notification means, in some cases the notification, namely, the radiation of electromagnetic waves or the turning on of a light source, of a single notification state may be recognized by a third party other than the observer. Therefore, as described in claim 10, the notification means performs notification in a predetermined operating pattern in which the notification state is altered in the manner of a time series. This operating pattern may be a pattern formed from a combination of a plurality of operating states, with the notification states indicated by predetermined electromagnetic wave frequencies, predetermined radiation intensities, and turning on or off of the light source at a predetermined timing and the like. By making a notification in a predetermined operating pattern in this way, it is possible to make it difficult for a third party to recognize the notification.

[0055] In claim 11 of the present invention, in the charge processing device according to claim 10 of the present invention, the notification means is further provided with receiving means for receiving a pattern signal representing the operating pattern, and notification of the processing state is made to the outside of a vehicle based on the pattern signal.

[0056] When the operating pattern is set inside the vehicle, it is possible for the operating pattern to be analyzed by a third party using reverse engineering or the like. Therefore, as described in claim 11, the notification means is farther provided with receiving means for receiving a pattern signal representing the operating pattern. The operating pattern is set in advance outside the vehicle and is transmitted to the vehicle. The notification means then notifies the outside

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of the vehicle as to the processing state, based on the received pattern signal. As a result, analysis or recognition of the it by a third party is made difficult.

[0057] In claim 12 of the present invention, in the charge processing device according to any of claim 7 through claim 11 of the present invention, the notification means is structured from a vehicle exterior notification mean for notifying the outside of the vehicle of the processing state, and a vehicle interior notification means for notifying the inside of the vehicle of the processing state, and notification of the processing state is made to the interior and exterior of the vehicle.

[0058] Confirmation of the processing state of the charge processing is easy from the outside of the vehicle, however, it is not possible for a driver who is inside the vehicle to be aware of the processing state of the charge processing. Therefore, as described in claim 12, the notification mean is structured from a vehicle exterior notification mean for notifying the outside of the vehicle of the processing state, and a vehicle interior notification means for notifying the inside of the vehicle of the processing state. By notifying the interior and exterior of the vehicle of the processing state, it is possible to notify both an observer outside the vehicle and the driver inside the vehicle as to the processing state. Note that, when the notification mean is structured using lamps or the like which emit light if the lamps are housed in predetermined housings and light is irradiated in directions opposite each other of the vehicle exterior notification means and the vehicle interior notification means, it is possible to easily notify the observer outside the vehicle and the driver inside the vehicle as to the processing state.

[0059] In claim 13 of the present invention, there is provided observation means for observing a notification from the notification means provided in the charge processing device according to any of the 7 through claim 12 of the present invention.

[0060] It is necessary to observe from outside the vehicle the processing state that has been notified to the outside of the vehicle. Therefore, in the charge state observation device of claim 13, there is provided observation means for observing a notification from the notification means provided in the charge state notification device for a vehicle. As described above, a device for detecting electromagnetic waves can be employed for this observation means. As a result, it is possible to easily observe the notification from outside the vehicle.

[0061] In claim 14 of the present invention, in the charge processing device according to claim 13 of the present invention, the observation means observes a notification by detecting at least brightness.

[0062] Notification of the processing state to the outside is often made by electromagnetic waves, however, it is preferable if a light source is used and the notification is made using changes in the amount of light or by flashing the light. Therefore, as described in claim 14, a notification is observed by the observation means detecting at least brightness. As a result, it is possible to make an observation corresponding to the processing state notified by changes in the amount of light or by flashing the light when a light source is used.

[0063] In claim 15 of the present invention, in the charge processing device according to claim 13 of the present invention, the observation means is an image pickup means capable of picking up either one or a plurality of images having at least brightness.

[0064] As described in claim 15, it is possible to use an image pickup means capable of picking up either one or a plurality of images having at least brightness as the observation means. For example, an apparatus having an image pickup element such as a TV camera or an image sensor or the like can be used. If this image pickup means is used, it is possible to easily detect the notification state when notification is made using variations in brightness.

[0065] In claim 16 of the present invention, in the charge processing device according to any of claim 13 through claim 15 of the present invention, the observation means observes a notification by detecting at least brightness in synchronization with an observation pattern determined in advance that varies in the manner of a time series.

[0066] In order to prevent a processing state notified to the outside of a vehicle from being recognized by, for example, a third party other than the observer, in some cases, the processing state is notified in a predetermined operating pattern in which the notification state is altered in the manner of a time series. Therefore, as was described in claim 16, the observation means observes a notification by detecting at least brightness in synchronization with an observation pattern determined in advance that varies in the manner of a time series. As a result because it is made in synchronization with the pattern of the notified processing state, the observation of the notification state can be simplified.

[0067] Namely, when an image pickup means is used, as is described above, the observation means is able to observe a notification by detecting at least brightness in synchronization with an observation pattern determined in advance that varies, in the manner of a time series. For example, in a notification state in which a lamp is flashed on and off for the proper state, if an image is picked up coinciding with this flashing on and off, it can be easily determined that the notification state is proper only when the obtained brightness is constantly bright. Moreover, when the flashing is not in synchronization with this flashing, the notification state includes dark moments, therefore, it can be easily determined that the notification state is not a proper state.

[0068] In claim 17 of the present invention, in the charge processing device according to claim 16 of the present invention, the observation means is further provided with reception means for receiving a pattern signal indicating an observation pattern, and the observation means observes a notification in synchronization with an observation pattern

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based on the pattern signal.

[0069] When the observation is synchronized with an observation pattern, if the same pattern is constantly used, it is possible that it will be recognized by a third party. Therefore, as described in claim 17, by further providing the observation means with reception means for receiving a pattern signal indicating an observation pattern, and the observation means observing a notification in synchronization with an observation pattern based on the pattern signal, it is possible to provide a degree of confidentiality to the observation pattern, and to easily increase the reliability of the observation of the processing state of the charge processing from outside the vehicle.

[0070] In claim 18 of the present invention, in the charge processing device according to any of claim 13 through claim 17 of the present invention, the charge processing device being further provided with deciding means for deciding the charge processing state based the result on an observation by the observation means.

[0071] If the result of an observation by the observation means is used, the processing state can be easily decided automatically. Therefore, as described in claim 18, the charge processing device is further provided with deciding means for deciding the processing state of the charge processing based the result on an observation by the observation means. As a result, it is possible to easily decide the processing state of the charge processing automatically from outside the vehicle, simplifying the observation.

[0072] In claim 19 of the present invention, in the charge processing device according to claim 18 of the present invention, the deciding means is provided with comparing means for comparing the state of a notification obtained by the observation means with a predetermined notification state, and processing deciding means for deciding the state of the charge processing based on the result of a comparison by the comparing means.

[0073] In order for a distinction to be made between a normal state and an abnormal state, the notification states are able to be distinguished between a predetermined notification state and notification states other than the predetermined notification state. Therefore, as described in claim 19, by providing the deciding means with comparing means for comparing the state of a notification obtained by the observation means with a predetermined notification state, and with processing deciding means for deciding the processing state of the charge processing based on the result of a comparison by the comparing means, the distinguishing of the notification state is simplified and it is possible to observe processing state of the charge processing easily from outside the vehicle.

[0074] Claim 20 of the present invention is a charge processing device comprising: receiving means for receiving a pattern signal indicating an observation pattern altered in the manner of a time series in order to observe a notification from a notification means provided in the charge processing device according to any of claim 7 through claim 12 of the present invention; and presenting means for presenting notification information corresponding to the observation pattern in synchronization with the observation pattern based on the pattern signal, wherein each of the above receiving means and display means is portable.

[0075] It is difficult to observe at an arbitrary location on an irregular time basis for a charge state observation device if the device itself is large and has little mobility. Therefore, as described in claim 20, a portable charge state observation device is formed comprising: receiving means for receiving a pattern signal indicating an observation pattern altered in the manner of a time series in order to observe a notification from a notification means and presenting means for presenting notification information corresponding to the observation pattern in synchronization with the observation pattern based on the pattern signal. As a result, the convenience and mobility of the charge state observation is improved.

[0076] In claim 21 of the present invention, in the charge processing device according to claim 20 of the present invention, the presenting means presents observation information via at least one of sound and light.

[0077] As is described in claim 21, by presenting notification information via at least one of sound and light, the presenting means is easily able to present observation information corresponding to an observation pattern.

[0078] Claim 22 of the present invention is a charge processing device comprising: detecting means for detecting position information indicating the position where a vehicle is located; making means for generating charge information for the vehicle in a predetermined area in which a charge is applied, as well as making a charge history of the generated charge information based on a result of a detection by the detecting means; and transmitting means for transmitting a charge history of charge information generated by the generating means to the ground side.

[0079] In the charge processing device according to claim 22 of the present invention, detecting means detects position information indicating the position where a vehicle is located. A navigation system for a vehicle capable of displaying a map for assisting driving and giving instructions on a route to a destination can be used for this detection means. The making means creates charge information for the vehicle in a predetermined area in which a charge is applied, and also makes a charge history of the created charge information, based on a result of a detection by the detecting means. For example, the toll that should be collected from a vehicle located in a area in which a charge is applied is determined such that the amount of the charge is determined from the number of times the vehicle enters the area in which a charge is applied and the length of time the vehicle is in the area in which a charge is applied. Consequently, the number of entries into the area in which a charge is applied and the length of stay in the area in which a charge is applied are generated as charge information. Because the charge is made in relation to the charge informa-

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tion from the entry and length of stay arid the like of the vehicle in the area in which a charge is applied, the charge history of the charge information generated by the generating means is transmitted to the ground side by transmitting means. As a result, at the ground side, it is possible to collect the toll that should be charged to the vehicle that entered or stayed in the area in which a charge is applied. The collection of this charge, namely, of the toll can be performed by settling the toll from an settled account such as a bank account or credit card or the like associated with the user of the vehicle, or from a card on which balance information is stored such as a prepaid card or IC card or the like.

[0080] In claim 23 of the present invention, in the charge processing device according to claim 22 of the present invention, the making means is formed from generating means for generating charge information for each of a plurality of existing area in which a charge is applied, and accumulating means for accumulating in sequence the created charge information as charge history.

[0081] As described in claim 23, the making means can be formed from generating means for generating charge information for each of a plurality of existing area in which a charge is applied, and accumulating means for accumulating in sequence the generated charge information as charge history. By using this construction, even when a plurality of area in which a charge is applied are scattered around or are grouped together, because the charge information of each area in which a charge is applied is accumulated as charge history in the accumulating means, the entry into or length stay or the like of a vehicle in a plurality of area in which a charge is applied can be easily ascertained.

[0082] In claim 24 of the present invention, in the charge processing device according to claim 22 or claim 23 of the present invention, the detecting means detects the position information using satellite signals from satellites.

[0083] In the detection of a vehicle, it is possible to provide in the vehicle a transmitting means such as a transmitter or the like for transmitting a signal that contains identification data for identifying the host vehicle, and to receive this transmitted signal on the ground so as to detect the position information on the ground, or to detect the position information in the vehicle via a navigation system. As is widely known, a navigation system uses a GPS system that uses satellite signals from satellites to easily detect the position of the host vehicle, for example, a position determined by latitude and longitude. Therefore, as described in claim 24, the detecting means is formed so as to be able to detect the position information using satellite signals from satellites. As a result of this, the position of a vehicle can be pinpointed in that host vehicle.

[0084] In claim 25 of the present invention, in the charge processing device according to any of claim 22 through claim 24 of the present invention, the making means is further provided with matching means for matching the position information with predetermined map information, and with deciding means for deciding, based on a matching result by the matching means, a state of entry indicating whether or not the vehicle has at least entered into a predetermined area in which a charge is applied in the map information, and wherein the charge information is created based on a result of a decision by the deciding means.

[0085] Almost all of the positions on the ground driven over by a vehicle can be pinpointed on a map. Therefore, as described in claim 25, the preparing means is further provided with matching means for matching the position information with predetermined map information, and with deciding means for deciding, based on a matching result by the matching means, a state of entry indicating whether or not the moving body has at least entered into a predetermined area in which a charge is applied in the map information. Because the position where the vehicle is located can be pinpointed from the position information, the matching means is able to match this position, for example, a position set as a latitude and longitude, with a vehicle on predetermined map information such as a map of Japan or a map of predetermined area from among Tokyo, Osaka, Kyoto, Hokkaido and others.

[0086] The deciding means decides, based on the result of a matching by the matching means, a state of entry indicating whether or not the vehicle has at least entered into a predetermined area in which a charge is applied in the map information. The location where the vehicle is present is matched by the matching means to the map information. Area in which a charge is applied are set on this map information. Consequently, if a determination as to whether or not the position where the vehicle matched to the map information is located is inside a area in which a charge is applied, it is possible to determine whether or not the vehicle has at least entered into the area in which a charge is applied.

[0087] As a result of this, the deciding means decides an entry state indicating whether or not a vehicle has at least entered into a area in which a charge is applied. The generating means generates charge information for the vehicle based on the result of the deciding by the deciding means. For example, the toll to be collected from a vehicle located within a area in which a charge is applied is set in advance. Accordingly, when a vehicle has entered into the area in which a charge is applied, the predetermined toll should be charged. Therefore, the toll that should be charged to the vehicle that has entered the area in which a charge is applied is created as charge information.

[0088] Claim 26 of the present invention is a charge processing system provided with: in-vehicle communication means which is provided with the charge processing device according to any of claim 22 through claim 25 of the present invention and in which the transmission means transmits charge history in accordance with an input transmission request: and on-road communication means having requesting means for performing the transmission request and processing means for performing charge settlement processing in a predetermined processing area and based on a transmitted charge history.

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[0089] The charge processing system according to claim 26 provided with in-vehicle communication means which is provided with the charge processing device according to any of claim 22 through claim 25 of the present invention having transmission means for transmitting charge history in accordance with an input transmission request. As a result, as was described above, if a transmission request is made from the ground side, the charge history is able to be transmitted from the vehicle side. This transmission request is performed by the requesting means of the transmission means on the ground side. In addition, the processing means performs charge settlement processing based on a predetermined processing area and a transmitted charge history. As a result, the charge history is held on the vehicle side and charge settlement processing can be performed in the processing area from the held charge history, and the area for the charge processing is not limited to being established within the area in which a charge is applied.

[0090] In claim 27 of the present invention, in the charge processing system according to claim 26 of the present invention, the on-road communication means is further provided with altering means for altering the amount of the charge settlement based on a time until an arrival in the processing area.

[0091] In the in-vehicle device, even if the charge history is held or accumulated, it is not possible to collect the actual toll if the charge processing is not performed. Therefore, as described in claim 27, the on-road communication means is further provided with altering means for altering the amount of the charge settlement based on a time until an arrival in the processing area. For example, for a set time, the toll collection of the charge amount corresponds to the above charge history, however, when the set time is exceeded and as the time becomes longer, it is possible to increase the charge amount, as is the case with arrears payments and the like. As a result, it is possible to do away with the loss that is incurred until the actual toll collection depending on the length of time involved.

[0092] Claim 28 of the present invention is a charge processing device comprising: detecting means for detecting position information indicating a position where a vehicle is located; storage means capable of being inserted and removed for storing a predetermined area in which a charge is applied; and generating means for generating charge information for the vehicle based on a result of a detection by the detecting means and an area in which a charge is applied stored in the loaded storage means.

[0093] In the charge processing device according to claim 28, the detecting means detects position information indicating the position where a vehicle is located. A navigation system for a vehicle capable of displaying maps to assist with driving and instruct as to a route to a destination can be used as the detecting means. Predetermined area in which a charge is applied are stored in the storage means capable of being inserted and removed, and the generating means generates charge information for the vehicle based on the result of the detection by the detecting means and the area in which a charge is applied stored in the storage means. For example, the toll that should be collected from a vehicle located in a area in which a charge is applied is determined such that the amount of the charge is determined from the number of times the vehicle entered the area in which a charge is applied and the length of time the vehicle was in the area in which a charge is applied. Consequently, the generating means generates the number of entries into and the length of stay in the area in which a charge is applied as charge information. The storage means is capable of being inserted and removed, therefore, when the area in which a charge is applied varies, it is possible to correctly collect the toll that should be charged for the vehicle that has entered or stayed in the area in which a charge is applied and the like simply by altering the area in which a charge is applied that should be stored in the storage means.

[0094] In claim 29 of the present invention, in the charge processing device according to claim 28 of the present invention, the generating means is provided with a reading means for reading a result of a detection by the detecting means and an area in which a charge is applied stored in the storage means, and generates charge information from the read position information and area in which a charge is applied.

[0095] As is described in claim 29, the generating means is provided with a reading means for reading a result of a detection by the detecting means and an area in which a charge is applied stored in the storage means, and generates charge information from the read position information and area in which a charge is applied. Because it is possible to read the result of a detection by the detecting means and the area in which a charge is applied stored in the storage means in this way using a reading means, the charge information can be easily generated.

[0096] In claim 30 of the present invention, in the charge processing device according to claim 28 or claim 29 of the present invention, the storage means is a toll card on which is stored an area in which a charge is applied for generating at least charge information.

[0097] Because the storage means is capable of being inserted and removed, as is described in claim 30, it is possible to use a toll card on which is stored an area in which a charge is applied for generating at least charge information as the storage means. An IC card or prepaid card can be used for this toll card.

[0098] Claim 31 of the present invention is a charge processing card provided with: a loading portion for loading in an in-vehicle device that detects position information indicating the position where a moving body is located, and generates charge information from the position information and a predetermined area in which a charge is applied; an area storage portion for storing the area in which a charge is applied; and a balance storage section for storing balance information.

[0099] The charge processing card described in claim 31 of the present invention can be used as the toll card. This

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charge processing card is provided with: a loading portion for loading in an in-vehicle device that detects position information indicating the position where a moving body is located, and generates charge information from the position information and a predetermined area in which a charge is applied; an area storage portion for storing the area in which a charge is applied; and a balance storage section for storing balance information. Consequently, the charge processing card is loaded in the in-vehicle device via the loading portion so that a area in which a charge is applied can be read from the area storage portion arid balance information can be read from the balance storage portion. It is thus possible to correctly collect the fare that should be charged to a vehicle that has entered into or stayed in the area in which a charge is applied.

[0100] Claim 32 of the present invention is a charge processing device (701) carried by a user or mounted on a moving body comprising: means for detecting a ground position (ANTg, 720 - 726); storage means (CRD) for storing area specifying information and inside-area control information; notification control means (702) for generating position relation information in a charge processing device for an area indicated by area specifying information, based on a ground position detected by the ground position detecting means (ANTg, 720 - 726) and area specifying information of the storage means; and notification means (710, 711, SP, 704, 724) for notifying a user as to information expressed by the area specifying information, and the inside-area control information and the position relation information.

[0101] Note that in order to make comprehension easier, symbols of corresponding elements shown in the drawings of the embodiments corresponding to the present invention are added for reference inside the brackets.

[0102] Consequently, the notification control means (702) generates position relation information in a charge processing device (701) that functions as a notification device for an area (charge area) expressed by area specifying information (charge area information) of the storage means (CRD). The notification means (710, 711, SP, 704, 724) reports this position relation information as well as information (area and charge amount) indicating control information within an area and area specifying information of the storage means (CRD). As a result, a user of this charge processing device is easily able to be aware of the existence and position of a specific area as well as what type of area the area is by the time the user enters into the area represented by the area specifying information. The user is thus able to easily decide in good time whether to enter the area or to alter their route.

[0103] Claim 33 of the present invention is a charge processing device (701) carried by a user or mounted on a moving body comprising: means for detecting a ground position (ANTg, 720 - 726); storage means (CRD) for storing charge area specifying information, inside-area charge information, and credit information; notification control means (702) for generating position relation information in a charge processing device for a charge area indicated by charge area specifying information, based on a ground position detected by the ground position detecting means (ANTg, 720 - 726) and charge area specifying information of the storage means, and updating credit information in the storage means in response to changes outside and inside a ground position relative to the charge area; and notification means (710, 711, SP, 704, 724) for notifying a user as to information expressed by the position relation information, the charge area specifying information, the charge information inside the area, and the credit information.

[0104] Consequently, the notification control means (702) generates position relation information in a charge processing device (701) that functions as a notification device for a charge area expressed by charge area specifying information (charge area information) of the storage means (CRD). The notification means (710, 711, SP, 704, 724) reports this position relation information as well as information (charge area and charge amount) indicating charge information within an area and charge area specifying information of the storage means (CRD). As a result, a user of this charge processing device is easily able to be aware of the existence and position of a charge area as well as the charge amount by the time the user enters into the charge area. The user is thus able to easily decide in good time whether to enter the charge area or to select a detour route.

[0105] Moreover, when a vehicle leaves a charge area after entering the area, the notification control means (702) updates the credit information in the storage means when the vehicle enters the charge area or departs from the charge area, and the notification means (710, 711, SP, 704, 724) reports information (balance information) indicating the credit information to the user, therefore, there is no manual involvement in the charge processing and the user is easily made aware of the balance.

[0106] Claim 34 of the present invention is a charge processing system provided with: a charge processing device (701) carried by a user or mounted on a moving body and includes a means for detecting a ground position (ANTg, 720-726), communication means for receiving area specifying information (ANTt, 708, 706), storage means for storing received area specifying information (CRD, 702), notification control means (702) for generating position relation information in a charge processing device for an area indicated by area specifying information based on a ground position detected by the ground position detecting means (ANTg, 720-726) and area specifying information of the storage means, and notification means (710,711,SP,704) for notifying a user as to the position relation information; and a transmitting station comprising public notification information storage means for storing area specifying information, and transmitting means for transmitting area specifying information of the public notification information storage means.

[0107] Consequently, the notification control means (702) generates position relation information in a charge processing device (701) that functions as a notification device for an area represented by area specifying information

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(charge area information) of the storage means (CRD). The notification means (710, 711, SP, 704, 724) reports this position relation information. As a result, a user of this charge processing device is easily able to be aware of the existence and position of a specified area by the time the user enters into the area represented by the area specifying information. The user is thus able to easily decide in good time whether to enter the charge area or to alter the route.

[0108] Moreover, the transmission means (740, 741, 732) of the transmitting station (730) transmits area specifying information of the public information storage means (FDB), and the communication means (ANTt, 708, 706) of the charge processing device (701) that is functioning as a public notification device receives the area specifying information, which is then stored by the storage means (CRD, 702). As a result if the transmitting station (30) alters the area specifying information of the public notification information storage means (FDB) in order to alter the position or size of the area, the area specifying information of the charge processing device (701) also automatically changes to altered information. The transmission of the area specifying information is simple and the altering of the information is also simple. Because it is possible to transmit area specifying information to all charge processing devices (701) that might possibly enter the area from a single transmitting station (730) covering the area and its environs, the installation of the system elements is comparatively simple and the reliability of the information notification is increased.

[0109] Claim 35 of the present invention is a charge processing system provided with: a charge processing device (701) carried by a user or mounted on a moving body and includes means for detecting a ground position (ANTg, 720-726), communication means for receiving charge area specifying information and inside-area charge information (ANTt, 708,706), storage means for storing received charge area specifying information (CRD, 702),, and credit information, notification control means (702) for generating position relation information in a charge processing device for a charge area, based on a ground position detected by the ground position detecting means (ANTg, 720-726) and charge area specifying information of the storage means, and updating credit information in the storage means in response to changes outside and inside a ground position relative to the charge area, and notification means (710,71,704,724) for notifying a user as to information expressed by the position relation information, the charge area specifying information, the charge information for inside the area, and the credit information; and a transmitting station (30) comprising public notification information storage means (FDB,TDB) for storing area specifying information and inside-area charge information, and transmitting means (740,731,732) for transmitting area specifying information and inside-area charge information of the public notification information storage means.

[0110] Consequently, the notification control means (702) generates position relation information in a charge processing device (701) that functions as a notification device for a charge area represented by charge area specifying information (charge area information) of the storage means (CRD). The notification means (710, 711, SP, 704, 724) reports this position relation information as well as information (charge area and charge amount) indicating charge information within an area and charge area specifying information of the storage means (CRD). As a result, a user of this charge processing device is easily able to be aware of the existence and position of a charge area as well as the charge amount by the time the user enters into the charge area. The user is thus able to easily decide in good time whether to enter the charge area or to select a detour route.

[0111] Moreover, when a vehicle leaves a charge area after entering the area, the notification control means (702) updates the credit information in the storage means when the vehicle enters the charge area or departs from the charge area, and the notification means (710, 711, SP, 704, 724) reports information (balance information) indicating the credit information to the user, therefore, there is no manual involvement in the charge processing and the user is easily made aware of the balance.

[0112] Moreover, the transmission means (740, 741, 732) of the transmitting station (730) transmits inside-area charge information area and area specifying information of the public information storage means (FDB), and the communication means (ANTt, 708, 706) of the charge processing device (701) that is functioning as a public notification device receives this information, which is then stored by the storage means (CRD, 702). As a result, if the transmitting station (730) alters the charge amount and the area specifying information of the public notification information storage means (FDB) in order to alter the position, size and/or the charge amount of the area, the information of the charge processing device (701) also automatically changes to altered information. The transmission of the area specifying information and the inside-area charge information is simple and the altering of the information is also simple. Because it is possible to transmit area specifying information and charge information for within the area to all charge processing devices (701) that might possibly enter the area from a single transmitting station (730) covering the area and its environs, the installation of the system elements is comparatively simple and the reliability of the information notification is increased.

[0113] In the charge processing system according to claim 35, as item 35A, the notification control means (702) transmits the updated credit card information as well as an ID of the charge processing device (701) that is functioning as a notification device to the transmission station (730) via the communication means (ANTt, 708, 706). The communication station (730) includes unpaid data storage means (CDB), and the information control means (732) of the transmission station (730) is able to make a record in accumulation manner of insufficient payment credit information, for received ID address, in the unpaid data storage means (CDB).

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[0114] Consequently, on the basis of the total recorded (unpaid) data of the unpaid data storage means (CDB), the area controller is able to issue a warning that an insufficient amount has been collected and/or to perform the collection of the outstanding debt. Thus, the task of controlling the area is simplified and made more economical.

[0115] In claim 35 or item 35A of the charge processing system, as item 35B, the notification control means (702) transmits the fact that an entry has been made into a charge area, when the ground position changes from outside the charge area to inside the charge area, to the transmission station (730) via the communication means (ANTt, 708, 706). The transmission station (730) includes accumulation storage means (TDB), and the information control means (732) of the transmission station (730) is able to update the data for the accumulated number of entries in the accumulation storage means (TDB) to data of a larger value, every time it receives a transmission to the fact that an entry has been made into a charge area.

[0116] Consequently, on the basis of the data stored in accumulation storage means (TDB), the area controller is able to calculate the number of entries (number of vehicles / time) into an area, estimates traffic volume parameters such as the congestion or changes in the congestion, and use this for traffic volume information collection and traffic control.

[0117] In the charge processing system of the above item 35B, when the ground position changes from inside the charge area to outside the charge area, the notification control means (702) transmits this departure from the charge area to the transmission station (730) via the communication means (NTt, 708, 706). Each time the information control means (732) of the transmission station (730) receives a transmission about the departure from the charge area, the information control means (732) is able to update the data for the accumulated number of departures in the accumulation storage means (TDB) to data of a larger value, every time it receives a transmission to the effect that a departure has been made from a charge area.

[0118] Consequently, the balance when the data for the accumulated number of departures in the accumulation storage means (TDB) is subtracted from the data for the accumulated number of entries in the accumulation storage means (TDB) shows the retention volume (or the volume of congestion when traffic is congested), inside the charge area, of vehicles in which the charge processing device (701) that is functioning as a notification device is mounted. The time differential value thereof shows the speed of change (i.e. a tendency towards congestion and a tendency towards easing of congestion) in the retention volume. Based on the data stored in the entry accumulation storage means (TDB), the area controller is able to estimate traffic volume parameters such as congestion within the area or changes in the congestion, and use this for traffic volume information collection and traffic control.

[0119] Note that instead of counting the number of entries into an area and the number of departures from an area separately, it is also possible to increment the retention volume data for an entry and decrement the retention volume data for a departure. In this case, the retention volume data shows the retention volume within an area directly, and the time differential value thereof shows the speed of change (i.e. a tendency towards congestion and a tendency towards easing of congestion) in the retention volume.

[0120] Claim 36 of the present invention is a charge processing device carried by a user or mounted on a moving body comprising: means (ANTg, 720 - 726) for detecting a ground position; storage means (CRD, 702) for storing area specifying information and credit information; relative position determining means (702) for calculating whether a ground position detected by the ground position detecting means is inside or outside an area represented by area specifying information in the storage means; interruption instruction means (IGsw); time measuring means (702) for measuring the time elapsed inside an area during a period in which there is no (Si = H) interruption instruction (Si = L) from the interruption instruction means; and charge processing means (702) for updating the credit information based on a value of a time measured by the time measuring means.

[0121] Note that, in order to make comprehension easier, symbols of corresponding elements shown in the drawings of the embodiments corresponding to the present invention are added for reference inside the brackets.

[0122] Consequently, because the toll payment medium is the storage means (CRD, 702), and the toll payment processing is performed by updating the credit information, the toll payment is not a complicated matter. Even if the road network inside the charge area is complicated, there is no need to provide tollbooths or vehicle transit determining devices on a plurality of routes within the area or at the entries and exits to the area, and neither there is any need for a large installation of a charge processing system fixed facility.

[0123] For example, if a simple charge is applied to a vehicle in which a charge processing device is mounted, when the charge is applied in proportion to the length of time the vehicle remained inside charge area, the charge is also increased for residents of the charge area, people working inside the charge area, and when vehicles are parked in locations where they have no effect on road congestion such as in a car park, which is unreasonable when the charge is supposed to be applied to a vehicle driving in the area. To counter this, a method in which the charge to residents of a charge area or people working inside the charge area is reduced by a fixed discount ratio may be considered, however, there are various relative ratios of parking time and traveling time depending on the person, and a person who parks for an extremely short time, for example, is treated extremely advantageously.

[0124] Therefore, in the present invention, there is provided interruption instruction means (IGsw), and time meas-

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uring means (2) for measuring the time elapsed inside an area during a period in which there is no (Si = H) interruption instruction (Si = L) from the interruption instruction means. In the case of a vehicle, the interruption instruction means (IGsw) generates an interruption instruction (SI = L) when the vehicle is parked and measures the elapsed time when the vehicle is not parked (Si = H). As a result, when the purpose is to charge for traveling on a road, a reasonable relationship is created between use of the road network and the amount of the toll to be paid.

[0125] Claim 37 of the present invention is a charge processing device carried by a user or mounted on a moving body comprising: means (ANTg, 720 - 726) for detecting a ground position; storage means (CRD, 702) for storing area specifying information and credit information; relative position determining means (702) for calculating whether a ground position detected by the ground position detecting means is inside or outside an area represented by area specifying information in the storage means; distance measuring means (702) for measuring a distance moved within an area; and charge processing means (702) for updating the credit information based on a distance measured by the distance measuring means.

[0126] Consequently, because the toll payment medium is the storage means (CRD, 702), and the toll payment processing is performed by updating the credit information, the toll payment is not a complicated matter. Even if the road network inside the charge area is complicated, there is no need to provide tollbooths or vehicle transit determining devices on a plurality of routes within the area or at the entries and exits to the area, and neither there is any need for a large installation of a charge processing system fixed facility.

[0127] When a charge processing device is used in a vehicle charge system for charging in accordance with the distance traveled inside a charge area, the charge is made on the distance traveled inside the charge area and the increase in the charge amount is automatically stopped when the vehicle is parked. Consequently, there are no inconsistencies between residents of the charge area or people working in the charge area and other people.

[0128] In claim 38 of the present invention, the charge processing device further comprises notification means (710, 711, SP, 704, 724) for notifying a user about information representing area specifying information and credit information. A user of the charge processing system can be made aware of the existence of a charge area before entering the area as well as of the credit information, simplifying the user's choice as to whether or not to enter the charge area.

[0129] In claim 39 of the present invention, the charge processing device further comprises: notification control means (702) for generating approach information that a charge processing device is approaching an area represented by area specifying information based on a ground position detected by the ground position detecting means and area specifying information of the storage means; and notification means (710, 711, SP, 704, 724) for notifying a user about information representing the approach information, the area specifying information, and the credit information. Because a notification is made to the effect that a vehicle is approaching the charge area, a user is able to choose more reliably and with more leeway whether or not to enter the charge area.

[0130] Claim 40 of the present invention is a charge processing system comprising: the charge processing device according to claims 36, 38 or 39, provided with communication means (ANTt, 708, 706) for receiving area specifying information, wherein storage means (CRD, 702) stores received area specifying information; and a transmitting station (730) that includes public notification information storage means ((FDB, TDB) for storing area specifying information, and communication means (740, 731, 732) for transmitting area specifying information of the public notification information storage means.

[0131] Consequently, the transmitting means (740, 731, 732) of the transmitting station (730) transmits area specifying information of the public notification information storage means (FDB). The communication means (NTt, 708, 706) of the charge processing device (701) receives the area specifying information which is then stored by the storage means (CRD, 702). As a result if the transmitting station (730) alters the area specifying information of the public notification information storage means (FDB) in order to alter the position and/or size of the area, the area specifying information of the charge processing device also automatically changes to altered information. The transmission of the area specifying information is simple and the altering of the information is also simple. Because it is possible to transmit area specifying information to all charge processing devices (701) that might possibly enter the area from a single transmitting station (730) covering the area and its environs, the installation of the system elements is comparatively simple and the reliability of the information notification is increased.

[0132] In claim 41 of the present invention, in the charge processing device according to claim 36 of the present invention or the charge processing system according to claim 40 of the present invention, the charge device is mounted in a vehicle, and the interruption instruction means performs an interruption instruction by being interconnected with the off operation of the ignition (IGsw) of the vehicle.

[0133] Consequently, because an interruption instruction (Si = L) is generated when the car is parked, and the time lapse is suspended, there is no charge for the length of time that the vehicle is parked and, when the purpose is to charge for traveling on a road, a reasonable relationship is created between use of the road network and the amount of the toll to be paid.

[0134] Claim 42 of the present invention is a charge processing system comprising: the charge processing device according to claim 37, 38 or 39, provided with communication means (ANTt, 708, 706) for receiving area specifying

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information, wherein storage means (CRD, 702) stores received area specifying information; and a transmitting station (730) that includes public notification information storage means (FDB, TDB) for storing area specifying information, and communication means (740, 731, 732) for transmitting area specifying information of the public notification information storage means. Consequently, the same operation and effects as in the above fortieth embodiment are obtained.

[0135] In the above charge processing system, as item 38A, the notification control means (702) transmits the updated credit information together with the ID of the charge processing device (701) to the transmission station (730) via the communication means (ANTt, 708, 706). The transmission station (730) includes unpaid data storage means (CDB), and the information control means (732) of the transmission station (730) makes a record of accumulated insufficient payment credit information that it has received at the ID address received in the unpaid data storage means (CDB).

[0136] Consequently, on the basis of the total recorded (unpaid) data of the unpaid data storage means (CDB), the area controller is able to issue a warning that an insufficient amount has been collected and/or to perform the collection of the outstanding debt. Thus, the task of controlling the area is simplified and made more economical.

[0137] In the charge processing system, as item 38B, the notification control means (702) transmits the fact that an entry has been made into a charge area when the ground position changes from outside the charge area to inside the charge area to the transmission station (730) via the communication means (ANTt, 708, 706). The communication station (730) includes accumulation storage means (TDB), and the information control means (732) of the transmission station (730) is able to update the data for the total number of entries in the accumulation storage means (TDB) to data showing a larger value, every time it receives a transmission to the effect that an entry has been made into a charge area.

[0138] Consequently, on the basis of the data stored in accumulation storage means, the area controller is able to calculate the number of entries (number of vehicles / time) into an area, estimates traffic volume parameters such as the congestion or changes in the congestion, and use this for traffic volume information collection and traffic control.

[0139] In the charge processing system, as above item 38C, when the ground position changes from inside the charge area to outside the charge area, the notification control means (702) transmits this departure from the charge area to the transmission station (730) via the communication means (ANTt, 708, 706). Each time the information control means (732) of the transmission station (730) receives a transmission about a departure from the charge area, the information control means (732) is able to update the data for the total number of departures in the accumulation storage means (TDB) to data showing a larger value, every time it receives a transmission to the effect that a departure has been made from a charge area.

[0140] Consequently, the balance when the data in the accumulation storage means (TDB) for the total number of departures is subtracted from the data for the total number of entries shows the retention volume (or the volume of congestion when traffic is congested) inside the charge area of vehicles in which the charge processing device (701) that is functioning as a notification device is mounted. The time differential value thereof shows the speed of change (i.e. a tendency towards congestion and a tendency towards easing of congestion) in the retention volume. Based on the data stored in the entry accumulation storage means (TDB), the area controller is able to estimate traffic volume parameters such as congestion within the area or changes in the congestion, and use this for traffic volume information collection and traffic control.

[0141] Note that instead of counting the number of entries into an area and the number of departures from an area separately, it is also possible to increment the retention volume data for an entry and decrement the retention volume data for a departure. In this case, the retention volume data shows the retention volume within an area directly, and the time differential value thereof shows the speed of change (i.e. a tendency towards congestion and a tendency towards easing of congestion) in the retention volume.

[0142] Claim 43 of the present invention is a charge processing device comprising: storage means (CRD) for storing credit information; read / write means (705) for reading credit information from the storage means (CRD) and writing credit information to the storage means (CRD); entry detecting means (720 - 726, 702) for detecting an entry into a charge area; charge processing means (702) for updating, in accordance with a charge toll, credit information in the storage means (CRD) via the read / write means (705) in response to traffic in a charge area; and communication means (2, ANTt, 708, 706) for transmitting information on a state of a charge device (i.e. card reader is normal, card is present) including whether or not reading and writing of the credit information in the storage means is possible while in a charge area.

[0143] Note that, in order to make comprehension easier, symbols of corresponding elements shown in the drawings of the embodiments corresponding to the present invention are added for reference inside the brackets.

[0144] Consequently, because the toll payment medium is the storage means (CRD), and the toll payment processing is performed by updating the credit information, the toll payment is not a complicated matter. The charge control staff on collects the charge device state information transmitted by the communication means (702, ANTt, 708, 706), and is able to know whether or not reading and writing by the storage means (CRD) is possible, namely, whether or not

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charge processing is possible, and it is possible to automatically check deductions caused by destruction or removal of the storage means (CRD) or read / write means (705) in order to avoid charge deductions and, naturally, charge errors caused by a breakdown in the charge device.

[0145] Claim 44 of the present invention is a charge processing device comprising: means (ANTg, 720 - 726) for detecting a ground position; storage means (CRD, 702) for storing credit information, charge areas, and charge tolls; charge processing means (702) for detecting whether a ground position detected by the ground position detecting means is within a charge processing area, and updating, in accordance with the charge toll, credit information in the storage means in response to the traffic in a charge area; and communication means (702, ANTt, 708, 706) for transmitting charge device state information including whether or not ground position detection by the ground position detecting means (ANTg, 720 - 726) is possible while in a charge area.

[0146] Consequently, even if the road network inside the charge area is complicated, there is no need to provide tollbooths or vehicle transit determining devices on a plurality of routes within the area or at the entries and exits to the area, and neither there is any need for a large installation of a charge processing system fixed facility. The charge control station collects the charge device state information transmitted by the communication means (702, ANTt, 708, 706), and is able to know whether or not recognizing the position of the charge device by the ground position detecting means (ANTg, 720 - 726) is possible, and it is possible to automatically check deductions caused by a halting in the operation or removal of the ground position detecting means (ANTg, 720 - 726) in order to avoid charge deductions and, naturally, charge errors caused by irregularities in the ground position detecting means (ANTg, 720 - 726).

[0147] Claim 45 of the present invention is a charge processing system comprising: a charge processing device (701) that includes storage means (CRD) for storing credit information, read / write means (705) for reading credit information from the storage means (CRD) and writing credit information to the storage means (CRD), entry detecting means (720 - 726, 702) for detecting an entry into a charge area, charge processing means (702) for updating, in accordance with the charge toll, credit information in the storage means (CRD) via the read / write means (705), in response to a traffic in the charge area, and first communication means (702, ANTt, 708, 706) for receiving a data request and transmitting charge device state information (card reader normal, card present) including whether or not reading and writing of credit information in the storage means (CRD) is possible while in a charge area; and a control station (730) that includes second communication means (740, 731, 733) for transmitting a data request to the charge processing device and receiving charge state information from the charge processing device, and retrieval means (733) for checking for erroneous use of a charge processing device based on received data.

[0148] Consequently, because the toll payment medium is the storage means (CRD), and the toll payment processing is performed by updating the credit information, the toll payment is not a complicated matter. The control station (730) collects the charge device state information transmitted by the first communication means (702, ANTt, 708, 706) of the charge device (701) via the second communication means (740m 731, 733), and is able to know whether or not reading and writing by the storage means is possible (CRD), namely, whether or not charge processing is possible, and it is possible to automatically check deductions caused by destruction or removal of the storage means (CRD) or read / write means (705) in order to avoid charge deductions and, naturally, charge errors caused by a breakdown in the charge device.

[0149] Note that the control station (730) transmits a charge request to the charge processing device (701) via the second communication means (740, 731, 733), and the charge processing means (702) of the charge processing device (701) is able to update the credit information in the storage means (CRD) in accordance with the charge toll. The following should also be noted.

[0150] It is possible for the charge device state information to include the ground position.

[0151] It is possible for the charge device state information to include the time.

[0152] It is possible for the charge device state information to include the credit information.

[0153] It is possible for the charge device state information to include the distance traveled inside the charge area.

[0154] It is possible for the charge device state information to include the length of time stayed in the charge area.

[0155] It is possible for the charge processing device to include interruption instruction means (IGsw) for interrupting the accumulation of the length of the time in a charge area (integral or fractional time) when the vehicle is not traveling.

[0156] According to claim 1 of the present invention, because the position of a vehicle detected by detecting means is matched with map information, and a state of entry which indicates whether or not a vehicle has entered into an area in which a charge is applied is decided, and charge information for the vehicle is generated in accordance with the state of entry, the effect is achieved that it is possible to perform charge processing for the user of a vehicle using a simple structure simply by generating charge information for a vehicle in accordance with the entry state thereof, without having to install on-road devices in all the entry and exit locations such as entry and exit gates.

[0157] According to claim 2 of the present invention, because location information indicating the date and time a vehicle was present inside a area in which a charge is applied is further detected, and an entry state that includes the state of the location of the vehicle inside the area in which a charge is applied is decided, the effect is achieved that it

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is possible to generate charge information for a vehicle that has only entered into the area in which a charge is applied when the charge was for the predetermined time or time period, the date or week, or combination of these.

[0158] According to claim 3 of the present invention, because the state of entry is decided with the state of congestion caused by vehicles located within a area in which a charge is applied included therein, the effect is achieved that it is possible to easily generate charge information for a vehicle in accordance with the state of congestion even when the toll differs depending on the state of congestion in the area in which a charge is applied.

[0159] According to claim 4 of the present invention, because predetermined toll data corresponding to the state of entry is stored in advance in the storage means, the effect is achieved that simple and appropriate charge information is able to be generated.

[0160] According to claim 7 of the present invention, because the processing state of the charge processing performed when a vehicle has entered a area in which a charge is applied, which is known from the position of the vehicle detected by the detecting means, can be notified continuously within the area in which a charge is applied, the effect is achieved that the processing state can be confirmed from an arbitrary position within the area in which a charge is applied without installing on-road devices at every likely location of entry and exit such as entry and exit gates.

[0161] According to claim 8 of the present invention, because a radiation means which radiates electromagnetic waves is used, the effect is achieved that the manufacturing of the device is simplified.

[0162] According to claim 9 of the present invention, because the notification means is formed from a light source disposed on the detecting means, or on a number plate of a vehicle, the effect is achieved that it is possible for an observer or the like to visually confirm the processing state of the charge processing with ease.

[0163] According to claim 10 of the present invention, because notification is made to a vehicle in a predetermined operating pattern in which the notification state is altered in the manner of a time series, the effect is achieved that it is possible to make it difficult for a third party to recognize the notification.

[0164] According to claim 11 of the present invention, the outside of the vehicle is notified as to the processing state based on a received pattern signal, the effect is achieved that it is possible to make it difficult for a third party to analyze or recognize the operating pattern.

[0165] According to claim 12 of the present invention, because it is possible to for the outside and inside of a vehicle to be notified as to the processing state, the effect is achieved that it is possible for an observer outside the vehicle and the driver of the vehicle to be notified as to the processing state.

[0166] According to claim 13 of the present invention, because it is possible for a notification from the notification means to be observed by observation means, the effect is achieved that it is possible to observe the processing state of the charge processing from outside the vehicle with ease.

[0167] According to claims 14, 15 of the present invention, because, as the observation means, it is possible to observe a notification by detecting brightness, the effect is achieved that, when a notification is made based on a variation in the brightness, that notification state can be easily detected.

[0168] According to claim 16 of the present invention, if an image pickup means is used, the effect is achieved that it is possible to observe a notification by detecting at least brightness in synchronization with a predetermined observation pattern that is altered in the manner of a time series, and it is possible to easily distinguish the processing state.

[0169] According to claim 17 of the present invention, because a pattern signal indicating an observation pattern is received, and a notification is observed by detecting at least brightness in synchronization with an observation pattern based on the pattern signal, the effect is achieved that it is possible to provide a degree of confidentiality to the observation pattern, and to easily increase the reliability of the observation of the processing state of the charge processing from outside the vehicle.

[0170] According to the charge state observation device of claim 18 of the present invention, because deciding means decides the processing state of the charge processing based on the result of an observation by the observation means, the effect is achieved that it is possible to observe the processing state of the charge processing from outside the vehicle with ease.

[0171] According to claim 19 of the present invention, because the deciding means compares the state of a notification obtained by the observation means with a predetermined notification state, and decides the processing state of the charge processing based on the results of the comparison, the effect is achieved that the distinguishing of the notification state is simplified and it is possible to observe the processing state of the charge processing from outside the vehicle with ease.

[0172] According to claim 22 of the present invention, because charge information for a vehicle in a area in which a charge is applied is generated by generating means from information on the position of the vehicle detected by the detecting means, and a charge history of the charge information is also generated, and these are transmitted to the ground by transmission means, the effect is achieved that it is possible on the ground to collect with ease a toll that should be charged to a vehicle that has entered or stayed in a area in which a charge is applied.

[0173] According to claim 23 of the present invention, because the preparing means can be formed from generating means for generating charge information for each of a plurality of existing area in which a charge is applied, and accu-

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mulating means for accumulating in sequence the charge information as charge history, the effect is achieved that, even when a plurality of area in which a charge is applied are scattered around or are grouped together, by using the charge history of the charge information of each area in which a charge is applied accumulated in the accumulating means, the entry into or stay of a vehicle in a plurality of area in which a charge is applied can be easily ascertained.

[0174] According to claim 24 of the present invention, because it is possible to detect position information using satellite signals from satellites, the effect is achieved that it is possible to pinpoint the position of a vehicle inside that same vehicle.

[0175] According to claim 25 of the present invention, because map information is matched with position information by matching means and a state of entry into a area in which a charge is applied in the map information is decided from the result of the matching, the effect is achieved that it is possible to match a vehicle with map information with ease and to decide a state of entry into a area in which a charge is applied with ease.

[0176] According to claim 26 of the present invention, because, in response to a transmission request from the ground side, a charge history is transmitted from an in-vehicle communication means provided with transmitting means for transmitting a charge history in response to an input transmission request, the effect is achieved that a charge settlement can be processed from the charge history held in the vehicle in a processing area that is not limited to being inside an area in which a charge is applied.

[0177] According to claim 27 of the present invention, because the amount of the charge settlement is altered in the on-road communication means based on the time until arriving in the processing area, the effect is achieved that it is possible to do away with the loss that is incurred until the actual toll collection depending on the length of time involved.

[0178] According to claim 28 of the present invention, because the storage means is capable of being inserted and removed, the effect is achieved that when the area in which a charge is applied varies, it is possible to collect the proper toll that should be charged for the vehicle that has entered or stayed or the like in the area in which a charge is applied-imply by altering the area in which a charge is applied that should be stored in the storage means.

[0179] According to claim 29 of the present invention, because a reading means is able to read the result of a detection by the detecting means and the area in which a charge is applied stored in the storage means in this way using a reading means, the effect is achieved that the charge information can be easily generated.

[0180] According to claim 31 of the present invention, because a charge processing card can be loaded in the in-vehicle device via the loading portion so that area in which a charge is applied can be read from the area storage portion and balance information can be read from the balance storage portion, the effect is achieved that is possible to collect the proper toll that should be charged to a vehicle that has entered into or stayed in the area in which a charge is applied.

[0181] According to claim 32 of the present invention, because notification control means generates position relation information in a charge processing device that functions as a notification device for an area (charge area) expressed by area specifying information (charge area information) of the storage means, and notification means reports this position relation information as well as information (area and charge amount) indicating control information within an area and area specifying information of the storage means, a user of this charge processing device is easily able to be aware of the existence and position of a specific area as well as what type of area the area is by the time the user enters into the area represented by the area specifying information, and is thus able to easily decide in good time whether to enter the area or to alter their route.

[0182] According to claim 33 of the present invention, because the notification control means generates position relation information in a charge processing device for a charge area expressed by charge area specifying information (charge area information) of the storage means, and the notification means reports this position relation information as well as information (charge area arid charge amount) indicating charge information within an area and charge area specifying information of the storage means, a user of this charge processing device is easily able to be aware of the existence and position of a charge area as well as the charge amount by the time the user enters into the charge area. The user is thus able to easily decide in good time whether to enter the charge area or to select a detour route.

[0183] According to claim 34 of the present invention, because the notification control means generates position relation information in a charge processing device for an area represented by area specifying information (charge area information) of the storage means, and the notification means reports this position relation information, a user of this charge processing device is easily able to be aware of the existence and position of a specified area by the time the user enters into the area represented by the area specifying information, and is thus able to easily decide in good time whether to enter the charge area or to alter the route.

[0184] According to claim 35 of the present invention, the notification control means generates position relation information in a charge processing device for a charge area represented by charge area specifying information (charge area information) of the storage means, and the notification means reports this position relation information as well as information (charge area and charge amount) indicating charge information within an area and charge area specifying information of the storage means, a user of this charge processing device is easily able to be aware of the existence and position of a charge area as well as the charge amount by the time the user enters into the charge area, and the

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user is thus able to easily decide in good time whether to enter the charge area or to select a detour route.

[0185] According to claim 36 of the present invention, because the toll payment medium is the storage means, and the toll payment processing is performed by updating the credit information, the toll payment is not a complicated matter. Even if the road network inside the charge area is complicated, there is no need to provide toll booths or vehicle transit determining devices on a plurality of routes within the area or at the entries and exits to the area, and neither there is any need for a large installation of a charge processing system fixed facility.

[0186] According to claim 37 of the present invention, because the toll payment medium is the storage means, and the toll payment processing is performed by updating the credit information, the toll payment is not a complicated matter. Even if the road network inside the charge area is complicated, there is no need to provide toll booths or vehicle transit determining devices on a plurality of routes within the area or at the entries and exits to the area, and neither there is any need for a large installation of a charge processing system fixed facility.

[0187] In claim 38 of the present invention, because the charge processing device further comprises notification means for notifying a user about information representing area specifying information and credit information, a user of the charge processing system can be made aware of the existence of a charge area before entering the area as well as of the credit information, simplifying the user's choice as to whether or not to enter the charge area.

[0188] In claim 39 of the present invention, because the charge processing device further comprises: notification control means for generating approach information that a charge processing device is approaching an area represented by area specifying information based on a ground position detected by the ground position detecting means and area specifying information of the storage means; and notification means for notifying a user about information representing the approach information, the area specifying information, and the credit information, and because a notification is made to the effect that a vehicle is approaching the charge area, a user is able to choose more reliably and with more leeway whether or not to enter the charge area.

[0189] According to claim 40 of the present invention, because the transmitting means of the transmitting station transmits area specifying information of the public notification information storage means, and the communication means of the charge processing device receives the area specifying information which is then stored by the storage means, if the transmitting station alters the area specifying information of the public notification information storage means in order to alter the position and/or size of the area, the area specifying information of the charge processing device also automatically changes to altered information. The transmission of the area specifying information is simple and the altering of the information is also simple. Because it is possible to transmit area specifying information to all charge processing devices that might possibly enter the area from a single transmitting station covering the area and its environs, the installation of the system elements is comparatively simple and the reliability of the information notification is increased.

[0190] According to claim 41 of the present invention, because an interruption instruction is generated when the car is parked and the time lapse is suspended, there is no charge for the length of time that the vehicle is parked and, when the purpose is to charge for traveling on a road, a reasonable relationship is created between use of the road network and the amount of the toll to be paid.

[0191] In claim 42 of the present invention, because there is a charge processing system comprising: a charge processing device further provided with communication means receiving area specifying information, wherein storage means stores received area specifying information; and a transmitting station that includes public notification information storage means for storing area specifying information, and communication means for transmitting area specifying information of the public notification information storage means, the installation of the system elements is comparatively simple and the reliability of the information notification is increased.

[0192] According to claim 43 of the present invention, because the toll payment medium is the storage means, and the toll payment processing is performed by updating the credit information, the toll payment is not a complicated matter. The charge control station collects the charge device state information transmitted by the communication means, and is able to know whether or not reading and writing by the storage means is possible, namely, whether or not charge processing is possible, and it is possible to automatically check deductions caused by destruction or removal of the storage means or read / write means in order to avoid charge deductions and, naturally, charge errors caused by a breakdown in the charge device.

[0193] According to claim 44 of the present invention, even if the road network inside the charge area is complicated, there is no need to provide toll booths or vehicle transit determining devices on a plurality of routes within the area or at the entries and exits to the area, and neither there is any need for a large installation of a charge processing system fixed facility. The charge control station collects the charge device state information transmitted by the communication means, and is able to know whether or not recognizing the position of the charge device by the ground position detecting means is possible, and it is possible to automatically check deductions caused by a halting in the operation or removal of the ground position detecting means in order to avoid charge deductions and, naturally, charge errors caused by a irregularities in the ground position detecting means.

[0194] According to claim 45 of the present invention, because the toll payment medium is the storage means, and

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the toll payment processing is performed by updating the credit information, the toll payment is not a complicated matter. The control station collects the charge device state information transmitted by the first communication means of the charge device via the second communication means, and is able to know whether or not reading and writing by the storage means is possible, namely, whether or not charge processing is possible, and it is possible to automatically check deductions caused by destruction or removal of the storage means or read / write means in order to avoid charge deductions and, naturally, charge errors caused by a breakdown in the charge device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0195]

Fig. 1 is a block diagram showing the conceptual structure of an automatic charge system 10 according to an embodiment of the present invention.
Fig. 2 is a block diagram showing the schematic structure of a general center established on the ground in the automatic charge system of the first embodiment.
Fig. 3 is a block diagram showing the schematic structure of an in-vehicle device in the automatic charge system of the first embodiment.
Fig. 4 is a flow chart showing the flow of information transmission processing executed in the general center in the first embodiment.
Fig. 5 is a flow chart showing the flow of processing to decide a area in which a charge is applied executed in the in-vehicle device of the first embodiment.
Fig. 6 is a flow chart showing the flow of charge processing executed in the in-vehicle device of the first embodiment.
Fig. 7 is an image diagram showing a area in which a charge is applied.
Fig. 8 is an explanatory diagram for explaining an example for determining a area in which a charge is applied.
Fig. 9 is an image diagram showing an example of a charge applicable zone of the second embodiment.
Fig. 10 is a flow chart showing the flow of processing to decide a charge applicable zone executed in the in-vehicle device of the second embodiment.
Fig. 11 is a flow chart showing the flow of charge processing executed in the in-vehicle device of the second embodiment.
Fig. 12 is a flow chart showing the flow of information storage processing executed in the in-vehicle device of the third embodiment.
Fig. 13 is a flow chart showing the flow of charge processing executed in the general center of the third embodiment.
Fig. 14 is a flow chart showing the flow of communication processing of the in-vehicle device of the third embodiment.
Fig. 15 is a block diagram showing the conceptual structure of an automatic charge system according to the fourth embodiment of the present invention.
Fig. 16 is a block diagram showing the schematic structure of a relay device established on the ground in the automatic charge system of the fourth embodiment of the present invention.
Fig. 17 is a block diagram showing the schematic structure of an in-vehicle device in the automatic charge system of the fourth embodiment of the present invention.
Figs. 18A and 18B are perspective views showing examples of the installation housing of a lamp used for observation. Fig. 18A shows the front surface while Fig. 18B shows the rear surface.
Fig. 19 is an image diagram showing a area in which a charge is applied.
Fig. 20 is a flow chart showing the flow of charge processing executed in the in-vehicle device of the fourth embodiment of the present invention.
Fig. 21 is a flow chart of the showing the flow of the in-vehicle device operation processing.
Fig. 22 is a flow chart showing the flow of charge area entry processing of the in-vehicle device.
Fig. 23 is a line diagram showing an example of a normal pattern.
Fig. 24 is a flow chart showing the flow of charge area entry processing in the on-ground installation.
Fig. 25 is a flow chart showing the flow of ID inquiry processing of the in-vehicle device.
Fig. 26 is a flow chart showing the flow of ID inquiry processing (checkpoint processing) in the on-ground device.
Fig. 27 is a flow chart showing the flow of position inquiry processing in the in-vehicle device.
Fig. 28 is a flow chart showing the flow of position inquiry processing in the on-ground device.
Fig. 29 is a flow chart showing the flow of charge area departure processing in the in-vehicle device.
Fig. 30 is a flow chart showing the flow of charge area departure processing in the on-ground device.
Fig. 31 is a perspective view showing another example of the installation housing of an observation lamp.

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Fig. 32 is an explanatory view showing an example in which the observation lamp is installed on a vehicle number plate outside the vehicle compartment.

Fig. 33 is an explanatory for explaining an observation lamp on a vehicle number plate.

Fig. 34 is a flow chart showing the flow of violation detection processing in the on-ground installation.

Fig. 35 is a block diagram showing the schematic structure of an observation device of the fifth embodiment.

Figs. 36A and 36B are line drawings showing an observation lamp. Fig. 36A shows a state where the lamp is on, while Fig. 36B shows a state where the lamp is off.

Fig. 37 is a flow chart showing the flow of observation device processing.

Figs. 38A, 38B, 38C, and 38D are line drawings showing an observation device display screen. Fig. 38A shows a display screen when the observation lamp is turned on in a normal pattern; Fig. 38B shows an example of a display screen when the observation lamp is turned on in a non-normal pattern; Fig. 38C shows another example of a display screen when the observation lamp is turned on in a non-normal pattern; and Fig. 38D shows yet a further example of a display screen when the observation lamp is turned on in a non-normal pattern.

Fig. 39 is a block diagram showing the schematic structure of a supporting device.

Fig. 40 is an image diagram showing a area in which a charge is applied according to the sixth embodiment of the present invention.

Fig. 41 is a flow chart showing the flow of charge processing executed in an in-vehicle device of the sixth embodiment of the present invention.

Fig. 42 is an explanatory diagram for explaining the area of a checkpoint.

Fig. 43 is a flow chart showing the flow of processing to operate an in-vehicle device.

Fig. 44 is a flow chart showing the flow of processing to operate a relay device.

Fig. 45 is an image diagram showing separated area in which a charge is applied.

Fig. 46 is an image diagram showing a area in which a charge is applied that can be altered and moved.

Fig. 47 is a block diagram showing the schematic structure of an in-vehicle device in an automatic charge system according to the seventh embodiment of the present invention.

Figs. 48A and 48B show examples of an IC card. Fig. 48A shows a magnetic storage type card having a magnetic storage area, while Fig. 48B shows an IC storage type card having an IC storage portion.

Figs. 49A, 49B, and 49C are perspective views showing an example of the installation housing of an observation lamp. Fig. 49A shows the front surface, Fig. 49B shows the rear surface, and Fig. 49C shows a front surface formed from a plurality of lamps.

Fig. 50 is an image diagram showing a area in which a charge is applied.

Fig. 51 is a flow chart showing the flow of processing to operate the in-vehicle device.

Fig. 52 is a is a block diagram showing an outline of the system structure according to the eighth embodiment of the present invention.

Fig. 53 is a block diagram showing the structure of the vehicle notification device shown in Fig. 52.

Fig. 54 is a block diagram showing the structure of the notification station shown in Fig. 52.

Fig. 55 is a flow chart showing a portion of the notification control operation of the notification control ECU shown in Fig. 53.

Fig. 56 is a flow chart showing the remaining portions of the notification control operation of the notification control ECU shown in Fig. 53.

Fig. 57 is a flow chart showing the operation of the public notification processing of the controller 32 shown in Fig. 54.

Fig. 58 is a plan view showing a charge area set in a road network.

Fig. 59 is a flow chart showing a portion of the charge control operation of a charge control ECU of the ninth embodiment.

Fig. 60 is a flow chart showing the remaining portion of the charge control operation of the charge control ECU.

Fig. 61 is a flow chart showing the operation of public notification processing of a controller.

Fig. 62 is a flow chart showing a portion of the charge control operation of a charge control ECU according to the tenth embodiment of the present invention.

Fig. 63 is a flow chart showing the remaining portion of the charge control operation of the charge control ECU according to the tenth embodiment of the present invention.

Fig. 64 is a flow chart showing the contents of vehicle entry processing.

Fig. 65 is a flow chart showing the contents of intermediate processing.

Fig. 66 is a flow chart showing the contents of vehicle exit processing.

Fig. 67 is a flow chart showing the contents of interrupt processing in response to wave signal reception of a charge control ECU.

Fig. 68 is a flow chart showing the contents of interrupt processing in response to an incoming signal from a communication device or modem unit of the controller unit.

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Fig. 69 is a flow chart showing the contents of repeatedly executed "fare collection and movement history collection" of the controller unit.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0196] The embodiments of the present invention will now be described in detail with reference made to the drawings.

(First Embodiment)

[0197] In the first embodiment, the present invention is applied to an automatic charge system for performing charge processing automatically for a vehicle that has entered (i.e. driven into) a toll facility (i.e. an area in which a charge is applied) using road - vehicle intercommunication carried out between an in-vehicle device and an on-road device. Note that the automatic charge system used in the present embodiment is a system for settling a toll or the like through communication between an in-vehicle device mounted in a vehicle and an on-road device installed on the road.

[0198] Fig. 1 shows the concept of the structure of an automatic charge system 10 of the present embodiment. The automatic charge system 10 of the present embodiment comprises: an in-vehicle device 30 mounted in a vehicle 32 and provided with a GPS antenna for receiving signals from GPS satellites 20,22, and 24, and a ground wave antenna for ground wave communication (described below in detail); and a general center 40 serving as an on-road device that is fixed on the ground and is provided with a GPS antenna 42 for receiving GPS signals from the GPS satellites 20, 22, and 24. The general center 40 also has a ground wave antenna 44 for ground wave communication.

[0199] The in-vehicle device 30 detects the position of the vehicle 32 in which it is mounted using GPS signals from the GPS satellites 20, 22, and 24, and transmits this by ground wave communication to the general center. The general center 40 performs the charge processing (calculations) for the area in which a charge is applied based on the received position of the vehicle 32, and transmits the result thereof to the in-vehicle device 30. The in-vehicle device 30 performs toll PR based on the received result of the charge processing. Note that it is also possible for the toll PR to be performed at the general center, and only the result of the toll PR transmitted.

[0200] As is shown in Fig. 2, the general center 40 established on the ground has a center control device 100. The center control device 100 is structured from a microcomputer comprising a CPU 102, RAM 104, ROM 106, and an input / output port (I/O) 108. Each of these is connected together by a bus 110 so that commands and data can be transferred between each. Note that a processing routine that is described below is stored in the ROM106.

[0201] A GPS communication device 120 having a GPS antenna 42 is connected to the input / output port 108, as is a ground wave communication device 122 having a ground wave antenna 44. The GPS communication device 120 is intended to detect its own position, namely, the position of the general center 40 using the GPS signals from the GPS satellites 20, 22, and 24. The ground wave communication device 122 is intended to exchange signals or to provide information by communicating with the in-vehicle device 30 mounted in the vehicle, and employs a wireless communication device. Note that an example of this wireless communication device is an FM broadcast or an FM character broadcast, a known wave communication, and telephone circuit communication such as in a moving body communication device.

[0202] Memory 124 is also connected to the input / output port 108. This memory 124 includes a toll table 124A in which toll information representing tolls of the area in which a charge is applied is stored, a map database 124B in which map information for determining the area in which a charge is applied is stored, and a user control database 124C which is connectable to the general center and in which individual information of the user to be controlled is stored.

[0203] Note that, a floppy disk unit (FDU) 112 into which a floppy disk (referred to below as FD) can be inserted as a recording medium and also removed is connected to the center control device 100. Note also that the processing routine described below is able to be written to or read from an FD using the FDU 112. Accordingly, it is also possible to record in advance the processing routine described below on an FD without storing it inside the center control device 100, and to execute the processing program recorded on the FD via the FDU 112. Alternatively, it is also possible to connect an (unillustrated) large volume storage device such as a hard disk to the center control device 100, and to store (install) a processing program recorded on the FD on the (unillustrated) large volume storage device and then execute the processing program. There are also optical disks such as CD-ROMs and the like, and magnetooptical disks such as MD, MO and the like as a recording medium, and if these are used, a CD-ROM device, an MD device, an MO device or the like may be used instead of or in conjunction with the above FDU.

[0204] Next the in-vehicle device 30 will be described. The in-vehicle device 30 used in the present embodiment is one in which the present invention has been applied to a navigation system for providing route assistance information using images and sound to a driver. The in-vehicle device 30 including a navigation system is mounted on the instrument panel of the vehicle 32 in order to exchange signals with the on-road device.

[0205] As is shown in Fig. 3, the in-vehicle device 30 including a navigation system of the present embodiment is

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provided with a device main body 200 formed from a microcomputer comprising a CPU 202, RAM 204, ROM 206, and an input / output (I/O) port 208 each of which is connected together by a bus 210 such that commands and data can be transferred between each. Note that the RAM 204 is backup RAM so that, even if the power supply thereto is cut, the contents of the information stored therein are backed up (stored). A floppy disk unit 236 (FD device) into which a floppy disk (FD) can be inserted and also removed is connected to the input / output port 208. Note that the processing routine described below and various image data are stored in the ROM 206.

[0206] This various data and the processing routine described below are able to be written to or read from an FD using the FD device 236. Accordingly, it is also possible to record in advance the processing routine described below on an FD without storing it ROM 206, and to execute the processing program recorded on the floppy disk FD via the FD device 236. Alternatively, it is also possible to connect an (unillustrated) large volume storage device such as a hard disk to the control main body 200, and to store (install) a processing program recorded on the floppy disk FD on the (unillustrated) large volume storage device and then execute the processing program. There are also optical disks such as CD-ROMs and the like, and magnetooptical disks such as MD, MO and the like as a recording medium, and if these are used, a CD-ROM device, an MD device, an MO device or the like may be used instead of or in conjunction with the above FD device 236.

[0207] Note that the in-vehicle device 30 including a navigation system of the present embodiment can be connected via an input / output port to (unillustrated) a local area network for vehicle.

[0208] A GPS device 220 for being mounted on a vehicle having a GPS antenna 220A mounted on the vehicle is connected to the input / output port 208, as is a ground wave communication device 222 having a ground wave antenna 222A. The GPS device 220 for being mounted on a vehicle is intended to detect the position of the vehicle 32 in which it is mounted using GPS signals from the GPS satellites 20, 22, and 24. The ground wave communication device 222 is intended to exchange signals or to provide information by communicating with the ground, and employs a wireless communication device. Note that an example of this wireless communication device is an FM broadcast or an FM character broadcast, a known wave communication, and telephone circuit communication such as in a moving body communication device. Accordingly, a communication device for a moving body such as a portable telephone or a car phone or the like may be used as the ground wave communication device 222, so that wireless communication (conversation via a telephone circuit) cart be made possible via the in-vehicle device 30 between the vehicle and a telephone device outside the vehicle.

[0209] Memory 230 is also connected to the input / output port 208. This memory 230 includes a toll table 230A in which toll information representing tolls of the area in which a charge is applied is stored, and a map database 230B in which map information for providing route assistance information with images to the driver is stored.

[0210] Also connected to the above input / output port 208 are a display device 224 for providing route assistance information images to the driver, a speaker device comprising a sound device 228 provided with a speaker 228A for providing sound information to the driver, and an input device 226 such as a keyboard or switch device. The display device 224 can display map information. The sound device 228 converts either a digital or analog sound signal output from the device main body 12 into a drive signal for the speaker 228A.

[0211] Note that the data arid the like to be stored in the above memory 230 may also be stored on a storage medium such as a floppy disk using the floppy disk device 236 or on a hard disk device.

[0212] In addition to these, an IC card read / write device 234 capable of inserting and detaching an IC card on which toll balance information and the like is stored is provided for the input / output port 208. In the in-vehicle device 30, an ID code comprising a vehicle number and the like as well as fixed data such as information on the vehicle model and the like is stored in advance in the RAM 204 and ROM 206. The in-vehicle device 30 refers to the toll balance information on the IC card 232 loaded into the IC card read / write device 234, and writes toll balance information on the IC card 232. As the IC card, prepaid card or credit card is applied.

[0213] Note that the mounting position (attachment position) of the in-vehicle device 30 is not limited to being on the vehicle instrument panel as described above, and it is sufficient if it is in a position where it is able to exchange signals with the ground using the antenna. For example, it may be mounted inside the vehicle at the rear seat or the like. Moreover, the in-vehicle device 30 may be formed with separate structures comprising an in-vehicle device main body and an antenna. If the in-vehicle device is structured in this way with a separate in-vehicle device main body and antenna, it is possible to install the antenna only on the instrument panel or at a position towards the rear seat or the like, as described above, and the position where the antenna has been mounted is registered as the mounting position information.

[0214] Moreover, when the ignition is on, power is supplied at all times from the vehicle battery to the in-vehicle device. It is also possible to enable the in-vehicle device to acquire date and time information such as the year, month, date, as well as the current time from an unillustrated clock built into the vehicle 32.

[0215] Note that, in the above description, toll tables are stored in memory in both the in-vehicle device 30 and the general center 40, however, it is also possible for the toll tables to be stored in the device that performs the calculation of the toll to be charged or to be stored in another device when toll information is obtained by communication, namely,

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the toll tables may be stored in the memory of one of the in-vehicle device 30 and the general center 40.

[0216] The operation of the present embodiment will now be described.

[0217] Firstly, the operation of the ground side, namely, of the general center will be described in detail. In the present embodiment, the general center 40 transmits information for charge processing to the in-vehicle device 30 mounted on a vehicle 32.

[0218] As is shown in Fig. 4, in step 300, the general center 40 receives GPS signals from GPS satellites 20, 22, and 24. In the next step 302, the general center 40 determines its own reference position (a reference latitude and longitude Po), and generates GPS correction information. When the size of an error in the GPS signals from the GPS satellites 20, 22, and 24 is large, the GPS correction information is used to correct the error. Because the general center 40 is fixed in place, the GPS correction information is able to detect any variation in the GPS signals of the GPS satellites 20, 22, and 24.

[0219] In the next step 304, information of a predetermined area in which a charge is applied (area in which a charge is applied) is read, and the GPS correction information is transmitted together with the area in which a charge is applied information in the next step 306. This transmission can be performed by FM broadcast or by a telephone circuit.

[0220] The area in which a charge is applied information is set for a area in which a charge is applied (Area) formed from a plurality of predetermined areas. For example, areas might be formed between a city center area and the suburbs and these areas become smaller the closer they are to the city center area. An example of area in which a charge is applied (Area) of this type is shown in Fig. 7. The ground is divided into 7 areas. In the center portion is a circular area A. Next are areas B, C, D, and E, into which substantially donut shaped circle concentric around and adjacent to the outer periphery of the area A is divided 4 areas. Next is a substantially donut shaped circle F concentric around and adjacent to the outer periphery of the areas B, C, D, and E. Last is the area G which is an area other than the areas A, B, C, D, E, and F. These areas can be specified by their latitude and longitude as well as by their shape.

[0221] As is shown in Fig. 8, the area A can be determined by forming a closed space by setting a plurality of positions on the boundaries of the area A with the areas B, C, D, and E, and setting a straight line passing through adjacent point positions. Specifically, if an position on a boundary line of the area A with the areas B, C, D, and E is defined as A_i (a_{Xi}, a_{Yi}), then a straight line passing through the points A_i and A_{i+1} can be expressed using the following formula.

$$(y - a_{Yi}) / (x - a_{Xi}) = (a_{Yi+1} - a_{Yi}) / (a_{Xi+1} - a_{Xi}) \quad (1)$$

[0222] Accordingly, it is sufficient if the area A fulfills the following conditions

$$(y - a_{Yi}) / (x - a_{Xi}) = (a_{Yi+1} - a_{Yi}) / (a_{Xi+1} - a_{Xi}) < 0$$

wherein, i=1 ~ (m-1)

m: a number representing a point of the last position on the boundary line.

[0223] Moreover, the area in which a charge is applied information is set for a area in which a charge is applied (Area) formed from a plurality of areas, however, it is possible to set a different charge amount for each area. For example, it is possible to increase the charge amount in accordance with the proximity to the city center, or to alter the charge amount in accordance with the number of times of use, or to alter the charge amount in accordance with the level of congestion, or to alter the charge amount in accordance with the length of time of use. In the description given below, these conditions for setting the charge amount are called calculation conditions for a charge (charge calculation conditions).

[0224] The first charge calculation condition is the number of entries into an area shown in a table indicating the tolls for each area in Table 1.

Table 1

Area	Charge Amount
A	¥300 / entry
B	¥100 / entry
C	¥100 / entry
D	¥100 / entry

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Table 1 (continued)

Area	Charge Amount
E	¥100 / entry
F	¥10 / entry
G	¥0 / entry

[0225] If the charge condition is set in this way, the charge amount increases as the number of entries into the central portion of the area in which a charge is applied increases.

[0226] The second charge calculation condition is the length of time staying in an area shown in a table indicating the tolls for each area in table 2.

Table 2

Area	Charge Amount
A	¥150 / entry
B	¥90 / entry
C	¥90 / entry
D	¥90 / entry
E	¥90 / entry
F	¥10 / entry
G	¥5 / entry

[0227] If the charge condition is set in this way, the charge amount increases as the length of time staying in central portion of the area in which a charge is applied increases.

[0228] The third charge calculation condition is the level of congestion shown in a table indicating the tolls for each area, while the fourth charge calculation condition is the speed at which a vehicle traveled inside an area (alternatively, the average speed within the area) shown in a table indicating the tolls for each area, and the fifth charge calculation condition is the total distance traveled inside an area when traveling inside an area shown in a table indicating the tolls for each area.

[0229] By including tables based on the above charge calculation conditions in the area in which a charge is applied information, it is possible to specify both the area and the toll for the area in which a charge is applied.

[0230] Next the operation of the in-vehicle device 30 will be described.

[0231] As is shown in Fig. 5, the following interrupt processing is performed at predetermined times (every 1 minute in the present embodiment) in the in-vehicle device 30 mounted in a vehicle. In step 400, information is received from the ground side, namely, from the general center 40. As was described above, the information from the general center 40 is area in which a charge is applied information and GPS correction information, and in step 402, a determination is made as to whether or not the received information is the most recent information. If the received information is the most recent information, the determination in step 402 is affirmative and, in the next step 404, the area in which a charge is applied (Area) is brought out and the GPS correction data is stored.

[0232] If, however, the received information is not the most recent information, the determination in step 402 is negative and, in the next step 406, GPS signals from the GPS satellites 20, 22, and 24 are received. In the next step 408, the current date and time (year, month, date, time) are read and, in step 410, the in-vehicle device's own position, namely, the position of the vehicle 32 (latitude and longitude P (t)) is determined. Note that the when determining the latitude and longitude P (t), the stored GPS correction information can be used.

[0233] In the next step 412, the determined latitude and longitude P (t) is matched with a map database stored in advance and, in the next step 414, the area to which the latitude and longitude P (t) belongs is decided. Next in step 416, the latitude and longitude p (t), the time (t), and the area are stored as vehicle location history. In table 3 below, an example of a vehicle location history list is shown.

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Table 3

Time t					Latitude and Longitude P (t)		Area A (t)	Charge
Year	Month	Date	Hour	Minute	Longitude	Latitude		
1997	11	05	08	13	E135-30-25	N35-20-13	G	*
1997	11	05	08	14	E135-30-49	N35-19-58	G	*
1997	11	05	08	15	E135-30-55	N35-19-32	F	*
1997	11	05	08	16	E135-31-01	N35-19-25	F	
• • •	• • •	• • •	• • •	• • •	• • •	• • •	• • •	
1997	11	05	11	24	E135-39-25	N35-15-18	B	
1997	11	05	11	25	E135-39-50	N35-15-25	B	
• • •	• • •	• • •	• • •	• • •	• • •	• • •	• • •	

[0234] Note that the "charge" column in the above table is for identification data representing whether or not the charge processing described below has been performed. The [*] symbol indicates that the charge processing has been performed.

[0235] In this way, the area in which the vehicle 32 was present every predetermined time is stored together with the date and time as history.

[0236] Next, the charge processing in the in-vehicle device 30 will be described. The charge processing is performed at predetermined times. The predetermined times when the processing may be performed include every hour, a predetermined day of every week, a predetermined date and time of every month, or a predetermined year, month, date, and time. Note that the execution of this charge processing may also be performed in response to an instruction from the general center 40.

[0237] As is shown in Fig. 6, in step 420, by making a determination as to whether or not it is the above predetermined time or whether or not an instruction has been given by the general center 40, it is possible to determine whether or not the conditions are matched. If the conditions do not match, the determination in step 420 is negative, and the routine is ended.

[0238] If, however, the conditions do match, the determination in step 420 is affirmative and, in the next step 422, the history information is acquired. This history information is the vehicle location history list (Table 3) stored in step 416 in Fig. 5. In the next step 424, a calculation formula (charge calculation formula) is set. The charge calculation formula is determined by the above calculation conditions. These calculation conditions are conditions for determining a charge amount (charge calculation conditions) and may be madee up of the number of entries into an area, the length of time staying in an area, or the like. The charge calculation formula is determined by the calculation conditions. In formula (2) below, a charge calculation formula is shown as a general formula considering areas.

$$(\text{charge amount}) = f(N_A, N_B, N_C, N_D, N_E, N_F, N_G, N_H, N_I, N_J, t) \quad (2)$$

wherein,

N_A, N_B, N_C, N_D, N_E, N_F, N_G: the evaluation of the areas A - G (i.e. the number of entries and length of stay for each area determined by the charge calculation conditions)

N_H : the level of congestion

N_I : the speed (average speed)

N_J : the total distance traveled within the area

t : the date and time

[0239] In the next step 426, the charge is calculated using the calculation formula set above and the history information. When the charge calculation is ended, the routine proceeds to step 428 where the charge processing is performed. This charge processing is processing to subtract the charge amount determined above from the balance of the IC card 232.

[0240] For example, when the calculation condition is only the number of entries into an area and the history information is from the start point STP to the end point EDP, as shown in Fig. 7, the charge amount is found as shown below

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for the two routes Ra and Rb.

Ra charge amount = 300 x 1 + 100 x 1 + 100 x 0 + 100 x 1 + 100 x 0 + 10 x 1 + 0 x 1 = ¥510

Rb charge amount = 300 x 0 + 100 x 0 + 100 x 0 + 100 x 1 + 100 x 0 + 10 x 1 + 0 x 1 = ¥110

[0241] Thus, a route that avoids the central portion has a cheaper charge amount.

[0242] If the calculation condition is the only length of time staying in an area and the history information is from the start point STP to the end point EDP, as shown in Fig. 7, the charge amount is found as shown below for the two routes Ra and Rb.

Ra charge amount = 150 x 2 + 90 x 4 + 90 x 0 + 90 x 2 + 90 x 0 + 10 x 2 + 5 x 2 = ¥870

Rb charge amount = 150 x 0 + 90 x 0 + 90 x 0 + 90 x 2 + 90 x 0 + 10 x 7 + 5 x 2 = ¥260

[0243] Thus, a route that avoids the central portion has a cheaper charge amount.

(Second Embodiment)

[0244] Next, the second embodiment will be described. Note that, because the present embodiment has substantially the same structure as the above embodiment, the same descriptive symbols are used for the same portions and a detailed description thereof is omitted.

[0245] In the above embodiment a description was given of charge processing for a vehicle that has entered into a area in which a charge is applied, however, in some cases, a vehicle does not move after making an entry but is parked instead. In some cases, the toll on such a parked vehicle is increased. For example, it is necessary to increase the charge to a car that has parked in a no-parking zone. Moreover, if the toll on all vehicles is increased, because the increase is applied to vehicles that should not properly have had the increase applied to them, such as vehicles belonging to residents of the neighborhood, or vehicles in company car parks or independent fee system car parks, there needs to be some relief available in cases such as these. In the present embodiment, the toll is increased on parked vehicles and relief is given to vehicles whose toll should not be increased.

[0246] In the present embodiment, charge applicable zone information for charging a parking toll is set for a charge applicable zone formed from a plurality of predetermined zones.

[0247] Fig. 9 shows an example of a charge applicable zone. This charge applicable zone is made up of a rank 1 zone L1 in the area in the vicinity of the intersection of the intersecting roads 51 and 53 (the area indicated by the diagonal lines in Fig. 9), a rank 2 zone L2 in the areas around the roads 51 and 53 adjacent to the outer periphery of the zone L1, a rank 3 zone L3 in the area of the alley 54 that connects with the road 51 and is also substantially parallel with the road 53, and a rank 3 zone L3 in the area of the alley 56 that connects with the road 53 and also connects with the alley 54 and is also substantially parallel with the road 51. Each of these zones can be specified by their latitude and longitude and also by their shape.

[0248] A residential area 64 which is a reserved zone removed from the charge application zone is located in the area surrounded by the roads 51 and 53 and the alleys 54 and 56. An area 64 of the parking lot of the OO building which is a reserved zone is located on the opposite side across the road 53 from the residential area 64. There is also an area 62 of the parking lot of the XX department store which is also a reserved zone which is on the opposite side across the intersection from the residential area 64. The area 62 of the department store parking lot implements a charge independently and is exempted from the charge application. Note that there are also additional public car parks, contract car parks, store car parks, leisure area car parks, and the like. Moreover, the area 64 of the OO building car park and the residential area 64 are matched with a user ID and the parked vehicles can be specified in advance. In addition to these, there are residential car parks, office car parks, and the like.

[0249] The charge applicable zone information is set for a charge applicable zone formed from a plurality of zones, however, it is also possible to set a different charge amount for each zone. For example, it is possible to increase the charge amount in accordance with the volume of traffic. In the present embodiment, these conditions for setting the charge amount are called parking conditions for a charge.

[0250] An example of the parking conditions is the ranking shown in a table indicating the toll for each zone in Table 4 below.

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Table 4

Rank	Charge Amount	Zone
1	¥500 / minute	L1
2	¥100 / minute	L2
3	¥50 / minute	L3

[0251] If the charge condition is set in this way, the charge amount increases as the number of times the vehicle parks in a high volume traffic zone increases.

[0252] The operation of the present embodiment will now be described.

[0253] Firstly, the operation of the general center will be described in detail. The general center 40 transmits information for charge processing to the in-vehicle device 30 mounted on a vehicle 32. Note that, in the present embodiment, when the area in which a charge is applied information determined in advance in the above embodiments is read (step 304 in Fig. 4), and the GPS correction information is transmitted together with this area in which a charge is applied information (step 306 in Fig. 4), the charge applicable zone information is used in addition to these. The rest of the structure is the same as in the above embodiment and a detailed description thereof is omitted.

[0254] The operation of the in-vehicle device 30 will now be described.

[0255] Because the processing is the same as far as the processing of step 414 in Fig. 5, a detailed description thereof is omitted.

[0256] As is shown in Fig. 10, when it is decided to which area the current latitude and longitude P (t) belong (step 414 of Fig. 5), then, in the next step 430, a determination is made as to whether or not the vehicle ignition switch is off. This determination is made because the definition of the vehicle 32 being parked is assumed as being when the engine is stopped. When the ignition switch is on, because it is possible for the vehicle to move, it is determined that the vehicle is not parked and the determination in step 430 is negative. The routine then proceeds to step 440 where the latitude and longitude P (t), the date and time t, and the area are stored as vehicle location history in the same way as in the above embodiment (step 416 of Fig. 5).

[0257] If, however, the vehicle ignition switch is off, it is determined that the vehicle is parked, and the determination in step 430 is affirmative. In the next step 432, the latitude and longitude P (t) determined above are matched with a map database that has already been stored in the lit-vehicle device, and to which zone the latitude and longitude P (t) belong is decided. In the next step 434, a determination is made as to whether or not a reserve zone is contained in the decided zone and whether or not the latitude and longitude P (t) are contained within the reserve zone. If the latitude and longitude P (t) are not contained within a reserve zone, there is no need to reserve the parking toll. Therefore, the determination in step 434 is negative and the routine proceeds to step 440 where together with the decided zone, the latitude and longitude P (t), the date and time t, and the area are stored as vehicle location history. Table 5 shows an example of a vehicle location history list.

Table 5

Time t					Latitude and Longitude P(t)		Area A(t)	Zone	Charge
Year	Month	Date	Hour	Minute	Longitude	Latitude			
1997	11	05	08	13	E135-30-25	N35-20-13	G		*
1997	11	05	08	14	E135-30-49	N35-19-58	G		*
1997	11	05	08	15	E135-30-55	N35-19-32	F	L1	*
1997	11	05	08	16	E135-31-01	N35-19-25	F	L1	
• • •	• • •	• • •	• • •	• • •	• • •	• • •	• • •		
1997	11	05	11	24	E135-39-25	N35-15-18	B	Reserve	
1997	11	05	11	25	E135-39-50	N35-15-25	B	Reserve	
• • •	• • •	• • •	• • •	• • •	• • •	• • •	• • •		

[0258] Note that the rank of the zone and the word "reserve" (when the zone is reserved as described below) is

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entered in the zone column in the above table.

[0259] If, however, the latitude and longitude P (t) are included in a reserve zone, the determination in step 434 is affirmative and, in the next step 436, a determination is made as to whether or not the ID of the vehicle 32 (or the user ID) is an ID intended for the reserve zone. If the ID of the vehicle 32 is not an ID intended for the reserve zone, there is no-need to reserve the parking toll. Therefore, the determination in step 436 is negative and the routine proceeds to step 440 where the vehicle location history is stored in the same way as described above. If the ID of the vehicle 32 is an ID intended for the reserve zone, it is necessary to reserve the charge toll. Therefore, the determination in step 436 is affirmative and, in the next step 438, the zone decided above (step 432) is altered to information indicating a reserve zone and the routine proceeds to step 440 where the vehicle location history is stored in the same way as described above.

[0260] As described above, the areas and zones where the vehicle 32 is located at predetermined times are stored as history together with the date and time.

[0261] Next the charge processing in the in-vehicle device 30 will be described. The charge processing is performed at predetermined times. The processing may be performed at predetermined times such as every hour, a predetermined day of every week, a predetermined date and time of every month, or a predetermined year, month, date, and time. Note that the execution of this charge processing may also be performed in response to an instruction from the general center 40. Because the charge processing of the present embodiment is substantially the same as the charge processing of Fig. 6, those portions that are the same are omitted.

[0262] As is shown in Fig. 11, a determination is made as to whether or not the conditions match (step 420) and if the conditions do not match, the current routine is ended. If the conditions do match, the history information is acquired (step 422). This history information is the list of the vehicle location history (Table 5) including the zone stored in step 440 of Fig. 10 above. Next the charge calculation formula is set (step 424, formula (2)), and the toll for the area is calculated using the calculation formula and the history information (step 426).

[0263] In the next step 450, a determination is made as to whether or not a rank of the same zone is continuously present for a predetermined time (5 minutes in the present embodiment) as history (i.e. continues in the manner of a time series). If a rank of the same zone is not continuously present as history, the determination in step 450 is negative and the routine proceeds to step 456 without the parking toll being calculated. In step 456, the charge is processed using only the toll obtained from the calculation formula for the area (step 428 of Fig. 6), in the same way as in the above embodiment.

[0264] If, however, a rank of the same zone is continuously present as history, the determination in step 450 is affirmative and the routine proceeds to step 452 where the parking calculation formula is set. In the following formula (3), the parking calculation formula is shown as a general formula considering the area.

$$(\text{parking toll amount}) = g(W_1, W_2, W_3 \ldots\ldots, W_z, t) \quad (3)$$

wherein, W_1, W_2, W_3, ..., W_z: an evaluation for the zones L1 to Lz (z: maximum number of zones)
(namely, a value that is a number existing continuously as history from which ⌈5⌋ has been subtracted)

[0265] Note that the reserve zones have been removed from this parking calculation formula.

[0266] Moreover, the parking toll amount may also be altered in the above parking calculation formula in accordance with the level of congestion or in accordance with the date and time t.

[0267] In the next step 454, the parking toll is calculated using the parking calculation formula set above and the values in the zone column of the history information. When the toll calculation has ended, the routine proceeds to step 456 where charge processing is performed for the parking toll and the entry toll into the area. This toll processing is processing to subtract the above determined charge amount from the balance of the IC card 232.

[0268] In this way, it is possible, in the present embodiment, to charge a parking toll for each predetermined zone. Moreover, the parking toll is not increased for all vehicles and it is possible to provide relief for vehicles whose toll should not be increased, such as the vehicles of residents, vehicles in company car parks, vehicles in independent fee system car parks and the like, by reserving the increase for such vehicles.

[0269] Note that, in the present embodiment, it is desirable that the user is informed by images and sound or the like, when the vehicle has entered a area in which a charge is applied, when the vehicle is approaching a area in which a charge is applied, when the vehicle has entered a parking toll charge applicable zone, and when the vehicle is approaching a parking toll charge applicable zone. By informing the user in this way, it is possible to prevent a charge being processed for the user without the user being aware of the fact. It is also preferable that the user is informed before or after the charge processing of the estimated charge amount or of the charged amount.

(Third Embodiment)

[0270] The third embodiment of the present invention will now be described.

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[0271] In the above embodiments, a description was given of when processing is performed in the in-vehicle device, however, in the present embodiment the charge processing is performed at the general center. Note that because the structure of the present embodiment is substantially the same as that of the above embodiments, the same portions are given the same descriptive symbols and a detailed description thereof is omitted.

[0272] In the present embodiment, because the processing associated with charge processing is performed at the general center, there is no need to generate area in which a charge is applied information in the in-vehicle device. Namely, the in-vehicle device is used for storing and transmitting the latitude and longitude P (t) and the date and time t as history information.

[0273] As is shown in Fig. 12, the following interrupt processing is performed at predetermined times (every 1 minute in the present embodiment) in the in-vehicle device 30. GPS signals are received from GPS satellites 20, 22, and 24 (step 406), the current date and time (year, month, date, and time) are read (step 408), and the position of the in-vehicle device, namely, the position (latitude and longitude P (t)) of the vehicle 32 is determined. Note that when determining this latitude and longitude P (t), it is also possible to acquire and use GPS correction information from the general center.

[0274] In the next step 460, the date and time t and the latitude and longitude P (t) are stored as history information. Note that the information history corresponds to the vehicle location history shown in Fig. 3 with the area and charge columns removed therefrom.

[0275] The communication processing of the in-vehicle device 30 will now be described.

[0276] As is shown in Fig. 14, the communication processing routine shown in Fig. 14 is executed at predetermined times in the in-vehicle device. In step 500, a determination is made as to whether or not there has been an inquiry from the general center. If there has been an inquiry from the general center, the determination in step 500 is affirmative and, in the next step 502, the history information stored above is transmitted and the current routine is ended. When the history information is transmitted, signal includes an ID code or the like which is an identification code that includes vehicle model information specifying this vehicle.

[0277] If however, there has been no inquiry from the general center, the determination in step 500 is negative and, in the next step 504, a determination is made as to whether or not there has been a charge information notification instruction (described below in detail) from the general center. If there has been a notification instruction, the determination in step 504 is affirmative and, in the next step 506, notification is made of the charge information from the general center.

[0278] The processing at the general center will now be described.

[0279] As is shown in Fig. 13, in step 470, the general center 40 receives GPS signals from GPS satellites 20, 22, and 24 and determines the reference position of the general center 40 (a reference latitude and longitude Po). After GPS correction information has been generated, initial processing to read the area in which a charge is applied information is performed (steps 300 to 304 in Fig. 4).

[0280] In the next step 472, an inquiry is made to obtain a response from the in-vehicle device and a determination is made in the next step 474 as to whether or not the in-vehicle device 30 has responded. If there has been no response, the routine proceeds to step 492 where the inquiry is repeatedly performed until a predetermined time has passed.

[0281] When the in-vehicle device 30 responds, the determination in step 474 is affirmative and, in step 476, a request is made to transmit history information including the ID code. The determination of step 478 is repeated until the history information including the ID code is transmitted by the in-vehicle device 30 and is received by the general center 40. Once this information is received, the routine proceeds to step 480. In step 480, each of the latitudes and longitudes P (t) included in the history information is matched with a map database stored in advance and, in the next step 482, the areas to which the latitudes and longitudes P (t) belong are determined. Next in step 484, the calculation formula (charge calculation formula) is set and the charge is calculated using the set calculation formula, in the same way as above.

[0282] In the next step 486, a determination is made from the result of the calculation in step 484 as to whether or not there is a charge. If no charge is generated, the routine proceeds to step 492. If, however, a charge is generated, then, in the next step 488, the generated charge, namely, the toll is transmitted to the in-vehicle device as charge information. By this action, an instruction is given to the in-vehicle device to notify the charge information. In the next step 490, the toll is settled from an settled account such as a bank account or credit card or the like associated with the user of the vehicle determined by the ID code.

[0283] Thus, in the present embodiment, because the area and the like are determined at the general center, it is possible to reduce the calculation load on the in-vehicle device. Moreover, because the in-vehicle device only has to transmit the position of its host vehicle, it is also possible to lighten the transmission load.

[0284] Note that, in the above embodiments, when a card or bank account for which charge processing can be performed automatically is determined, because it is possible to make a notification before a toll is deducted from this toll deductible card or bank account, it is possible for the user to easily determine whether or not the card or bank account

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they possess is able to be used for the payment of the charge of the car park for which a charge is applicable and is generated.

(Fourth Embodiment)

[0285] In the present embodiment the present invention is applied to an automatic charge system for automatically performing charge processing for a vehicle that has entered (i.e. been driven into) into a toll facility (i.e. a area in which a charge is applied). Note that the automatic charge system used in the present embodiment is a system for settling a toll charge (a driving toll) based on information transfer between an in-vehicle device installed in a vehicle and an on-road device installed on the ground. Note also that the structure of the present embodiment is substantially the same as the structure and identical portions are given the same descriptive symbols and a detailed description thereof is omitted.

[0286] The concept of the structure of the automatic charge system 10 of the present embodiment is shown in Fig. 15. The automatic charge system 10 of the present embodiment comprises: an in-vehicle device 30 mounted in a vehicle 32 and provided with a GPS antenna for receiving signals from GPS satellites 20, 22, and 24, and a ground wave antenna for ground wave communication (described below in detail); and a general center 40 serving as an on-road device that is fixed on the ground and is provided with a GPS antenna 42 for receiving GPS signals from the GPS satellites 20, 22, and 24. The general center 40 also has a ground wave antenna 44 for ground wave communication.

[0287] Note that one or a plurality of relay devices 50 that work in cooperation with the general center 40 are included in the structure of the present embodiment. A detailed description thereof is given below, however, in short, the relay device 50 is structured in substantially the same way as the general center 40 and governs various types of processing including charge related processing for the in-vehicle device 30.

[0288] The in-vehicle device 30 detects the position of the host vehicle 32 using GPS signals from the GPS satellites 20, 22, and 24, and transmits this via ground wave communication to the general center. The general center 40 performs the charge processing (calculations) for the area in which a charge is applied based on the received position of the vehicle 32, and transmits the result thereof to the in-vehicle device 30. The in-vehicle device 30 performs toll collection based on the received result of the charge processing. Note that it is also possible for the toll collection to be performed at the general center, and only the result of the toll collection transmitted.

[0289] The general center 40 according to the present embodiment that is established on the ground has the same structure as in the above embodiments and a description thereof is omitted (see Fig. 2).

[0290] A description will next be given of a relay device 50. The relay device 50 has substantially the same structure as the general center 40, however, it has the function of an observation device for observing that the charge has been properly made.

[0291] As is shown in Fig. 16, the relay device 50 has a relay control device 130. The relay control device 130 is structured from a microcomputer comprising a CPU 132, RAM 134, ROM 136, and an input / output port (I/O)138. Each of these is connected together by a bus 140 so that commands and data can be transferred between each. Note that a processing routine that is described below is stored in the ROM136.

[0292] A GPS communication device 150 having a GPS antenna 150A is connected to the input / output port 138, as is a ground wave communication device 152 having a ground wave antenna 152A. The GPS communication device 150 is intended to pinpoint its own position, namely, the position of the general center 40 using the GPS signals from the GPS satellites 20, 22, and 24. The ground wave communication device 152 is intended to exchange signals or to provide information by communicating with the in-vehicle device 30 mounted in the vehicle, and employs a wireless communication device. Note that an example of this wireless communication device is an FM broadcast or an FM character broadcast, a known wave communication, and telephone circuit communication such as in a moving body communication device.

[0293] A vehicle measuring device 154 provided with an image pickup device 154A, a vehicle number image pickup device 156 provided with an image pickup device 156A, and a lamp image pickup device provided with an image pickup device 158A are also connected to the input / output port 108. TV cameras or image processors or the like can be used for the image pickup devices 154A to 158A.

[0294] Note that, a floppy disk unit (FDU) 142 into which a floppy disk (referred to below as FD) can be inserted as a recording medium and also removed is connected to the relay control device 130. Note also that the processing routine described below is able to be written to or read from an FD using the FDU 142. Accordingly, it is also possible to record in advance the processing routine described below on an FD without storing it inside the relay control device 130, and to execute the processing program recorded on the FD via the FDU 442. Alternatively, it is also possible to connect an (unillustrated) large volume storage device such as a hard disk to the relay control device 130, and to store (install) a processing program recorded on the FD on the (unillustrated) large volume storage device and then execute the processing program. There are also optical disks such as CD-ROMs and the like, and magnetooptical disks such as MD, MO and the like as a recording medium, and if these are used, a CD-ROM device, an MD device, an MO device

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or the like may be used instead of or in conjunction with the above FDU.

[0295] Next, the in-vehicle device 30 will be described. Note that the in-vehicle device 30 used in the present embodiment has a structure in which an observation lamp 227 is further connected to the in-vehicle device of the above embodiments (see Fig. 3).

[0296] As is shown in Fig. 17, the observation lamp 227 is connected to the input / output port 208 of the in-vehicle device 30 of the present embodiment. The observation lamp 227 is intended to notify the outside of the vehicle as to the charge processing state.

[0297] As is shown in Fig. 18A, the observation lamp 227 is provided in a front surface portion 229A of a housing 229 which can be positioned such that it is on the dashboard of a vehicle, and light from the observation lamp 227 is emitted towards the outside of the vehicle. By using this type of structure, it is a simple matter to confirm that the observation lamp 227 is flashing from outside the vehicle.

[0298] Note that, by providing a display lamp that flashes in synchronization with the observation lamp 227 at a different position to the observation lamp 227, for example, at a position opposite the observation lamp 227 (i.e. at the rear surface portion 229B of the housing 229), it is possible for the driver inside the vehicle to confirm the flashing of the observation lamp 227 by the flashing of the display lamp. For example, as is shown in Fig. 18B, it is possible to install a display panel 227S in the rear surface portion 229B of the housing 229 thus providing a structure in which it is an easy matter for the driver of the vehicle to confirm the current state of the charge processing. In this case, it is possible to display the following on the display panel 227S as the current state, namely, that the vehicle is approaching a area in which a charge is applied, a standard charge amount for the area in which a charge is applied, the amount of the current charge processing, that charge processing has begun, that charge processing has ended, that charge processing has not been performed (i.e. that a violation has been committed), and the like.

[0299] The operation of the present embodiment will now be described.

[0300] Firstly, the operation of the on-ground device (in this case, the general center 40) will be described in detail In the present embodiment, the general center 40 is intended to perform the same processing as in Fig. 4, and transmits information for charge processing to an in-vehicle device 30 mounted on a vehicle 32.

[0301] The general center 40 receives GPS signals from GPS satellites 20, 22, and 24 (step 300 of Fig. 4). The general center 40 then determines its own, namely, the general center reference position (a reference latitude and longitude Po), and generates GPS correction information (step 302). Next predetermined area in which a charge is applied information is read (step 304), and GPS correction information is transmitted together with area in which a charge is applied information by FM broadcast or telephone circuit or the like (step 306).

[0302] As described above, the area in which a charge is applied information is set for a area in which a charge is applied formed from a predetermined plurality of areas. An example of a structure is one in which the size of the areas between the city center and the suburbs becomes smaller the closer to the city center. An example of area in which a charge is applied according to the present embodiment is shown in Fig. 19. The ground is divided into three areas, namely, a circular central area A, a donut shaped area B that is substantially concentric around and adjacent to the outer periphery of the area A, and an area C outside the areas A and B. It is possible to specify these areas by latitude and longitude as well as by their shape.

[0303] Moreover, the area in which a charge is applied information is set for the area in which a charge is applied A formed from a plurality of areas, however, it is possible to set a different charge amount for each area. For example, it is possible to increase the charge amount in accordance with the proximity to the city center, or to alter the charge amount in accordance with the number of times of use, or to alter the charge amount in accordance with the level of congestion, or to alter the charge amount in accordance with the time of use. These are determined by the charge calculation conditions.

[0304] The charge calculation conditions have been described in the above embodiments and a detailed description thereof is omitted, however, the first charge calculation condition is the number of entries into an area, shown in the table indicating the tolls for each area. The second charge calculation condition is the length of stay in an area, shown in the table indicating the tolls for each area. The third condition is the level of congestion in the area, shown in the table indicating the tolls for each area. The fourth condition is speed when traveling inside an area (or, alternatively, the average speed inside an area), shown in the table indicating the tolls for each area. The fifth condition is total area travel distance traveled inside an area, shown in the table indicating the tolls for each area.

[0305] By including these tables based on the charge calculation conditions in the area in which a charge is applied information, it is possible to specify the area in which a charge is applied and the toll for that area.

[0306] Note that, in the present embodiment, the area A is set as the area in which a charge is applied (the charge area), and the area B surrounding the area A is set as an area for canceling out any error of the area in which a charge is applied (a buffer area). The reason for this is to counter any errors caused by the GPS system when the position of the vehicle is detected using a GPS system. The area C outside the areas A and B is outside area in which a charge is applied.

[0307] Next, the operation of the in-vehicle device 30 will be described. In the present embodiment, the in-vehicle

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device 30 is intended to perform identical to that in Fig. 5.

[0308] Namely, information is received from the ground, i.e. the general center 40 (or relay device 50) at predetermined times (for example every one minute) by the in-vehicle device 30 mounted on the vehicle (step 400). A determination is then made as to whether or not the received information is the latest information (step 402) and, if the received information is the latest information (if the determination in step 402 is affirmative), the area in which a charge is applied is led out while the GPS correction information is stored (step 404). If, however the received information is not the latest information (i.e. the determination in step 402 is negative), GPS signals from the GPS satellites 20, 22, and 24 are received (step 406), the current date and time (year, month, date, and time) are read, and the current position (latitude and longitude P (t)) of the in-vehicle device, namely of the host vehicle thereof, is determined (step 410). The determined latitude and longitude P (t) are then matched with a map database stored in advance (step 412), the area to which the latitude and longitude P (t) belong are then decided (step 414), and the latitude and longitude P (t), the date and time t, and the area are then stored as vehicle location history (step 416). As a result, the area in which the vehicle 32 is present at predetermined times is stored with a date and time as history.

[0309] The charge processing in the in-vehicle device 30 will next be described. This charge processing is performed at predetermined limes. The processing may be performed at predetermined times such as every hour, a predetermined day of every week, a predetermined date and time of every month, or a predetermined year, month, date, and time. Note that, in the present embodiment, the execution of the charge processing may also be performed in response to an instruction from the general center 40 (or relay device 50), instead of at a predetermined time.

[0310] As is shown in Fig. 20, in step 420, at a predetermined date and time, or, by making a determination as to whether or not there has been an instruction from the general center 40 (or relay device 50), a determination is made as to whether or not the conditions match. If the conditions do not match, the determination in step 420 is negative and the current routine is ended.

[0311] If, however, the conditions do match, the determination in step 420 is affirmative and, in step 422, the history information is acquired. This history information is the list of the vehicle location history stored in step 416 of Fig. 8 above. In the next step 424, the calculation formula (charge calculation formula) is set. The calculation formula is determined by the above calculation conditions. These calculation conditions are conditions for determining the charge amount (charge calculation conditions) and comprise the number of entries into an area, the time of length of stay in an area or the like. The charge calculation formula is determined by the calculation conditions. In formula (4) below, a charge calculation formula is shown as a general formula considering an area.

$$(\text{charge amount}) = f(N_A, N_H, N_I, N_J, t) \tag{4}$$

wherein,

N_A : the evaluation of the area (i.e. the number of entries and the time of length of stay for each area determined by the charge calculation conditions) note that the area may comprise a plurality of areas
N_H : the level of congestion
N_I : the speed (average speed)
N_J : the total distance traveled within the area
T : the date and time

[0312] In the next step 426, the charge is calculated using the calculation formula set above and the history information. When the charge calculation is ended, the routine proceeds to step 427A where a determination is made as to whether or not an IC card 232, on which toll balance information and the like is stored, is loaded in a card read / write device 234. When there is no IC card 232 loaded in the IC card read / write device 234, the charge processing cannot be accomplished, therefore, the determination in step 427A is negative. The routine then proceeds to step 427B where the charge calculated above is stored in memory. Because it is possible that previous unpaid tolls are included therein, the storing of the toll is a cumulative processing. If, however, an IC card 232 is loaded in the IC card read / write device 234, the charge processing can be accomplished. Therefore, the determination in step 427A is affirmative and the charge processing in step 428 is carried out. This charge processing is a processing to subtract the above determined charge from the balance of the IC card 232.

[0313] Next, the operation of the ground installation and the in-vehicle device while the vehicle is running is described further. Note that the description below is of when the toll varies in accordance with the number of times the vehicle enters into the area in which a charge is applied. Furthermore, the vehicle is taken as traveling along a route Rt from a start point STP to an end point EDP in the area comprising the areas A to C in Fig. 19.

[0314] Note that, in the present embodiment, a relay device 50 is installed in an area, in which a vehicle traveling in the vicinity of a midway point PS3 on the route Rt in Fig. 19 can be photographed, as a checkpoint CP. The description given below is of when the operation of the ground installation is performed by the relay device 50.

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[0315] As is shown in Fig. 21, when power is on for the in-vehicle device, the routine proceeds to step 501 where a determination is made as to the area in which the vehicle is currently located. In this step 501, the above described area determination processing is performed (see Fig. 5). In the next step 503, a determination is made as to whether or not the area determined in step 501 is a area in which a charge is applied. When it is a area in which a charge is applied, the determination in step 503 is affirmative and, in the next step 505, a determination is made as to whether or not the previous area (the area determined at the previous time this routine was executed) was a area in which a charge is applied. If the previous area was not a area in which a charge is applied, the current instance is the first time the vehicle has entered a area in which a charge is applied, therefore, the determination in step 505 is negative. In the next step 506, as is described below, charge area entry processing is executed and the routine proceeds to step 516. If, however, the previous area was a area in which a charge is applied, the determination in step 505 is affirmative and the routine proceeds, without any change, to step 516.

[0316] If the current area is not a area in which a charge is applied and the determination in step 503 is negative, the routine proceeds to step 508 where a determination is made as to whether or not the distance to the area in which a charge is applied is equal to or less than a predetermined distance which enables a determination to be made as to whether or not the vehicle is approaching the area in which a charge is applied. If the distance to the area in which a charge is applied is equal to or less than a predetermined distance, the determination in step 508 is affirmative and, in the next step 514, information indicating that the vehicle is approaching the area in which a charge is applied is provided by images and sound, and the routine returns to step 501. For example, it is possible for a fixed time to display information such as "approaching area in which a charge is applied" on the display panel 227S (see Fig. 18B), or to provide this vocally from the sound device 228, or to display it on the display of the navigation system via the display device 224.

[0317] If the determination in step 508 is negative, the routine advances to step 510 where a determination is made as to whether or not the previous area was a area in which a charge is applied. If the previous area was not a area in which a charge is applied, the routine returns to step 501. If, however, the previous area was a area in which a charge is applied, then currently, the vehicle has departed from a area in which a charge is applied and the determination in step 510 is affirmative. In the next step 512, as described below, the charge area departure processing is executed and the routine proceeds to step 516.

[0318] Accordingly, at the point PS1 partway on the route Rt in Fig 19, the information that the vehicle is approaching a area in which a charge is applied is provided. At the partway point PS2, the charge area entry processing for when a vehicle first enters a area in which a charge is applied is performed. At the partway points PS3 and PS4, because the previous area was a area in which a charge is applied, the routine proceeds to the next step without any change. At the partway point PS5, charge area departure processing for when a vehicle departs from a area in which a charge is applied is performed.

[0319] In step 516, a determination is made as to whether or not an IC card 232 is loaded into the IC card read / write device 234. If there is no IC card 232 loaded in the IC card read / write device 234, the charge processing cannot be accomplished. Therefore, the determination in step 516 is negative, and the routine proceeds to step 518 where a violation is displayed. This violation display is performed by flashing the observation lamp 227 on and off in a predetermined violation pattern (for example, at a timing where the lamp is turned on for a fixed time and then off for a fixed time repeatedly). If, however, an IC card 232 is loaded in the IC card read / write device 234, it is possible to accomplish the charge processing. Therefore, there is no violation display, the determination in step 516 is affirmative, and the routine proceeds without any change to step 520. Note that a pattern stored in advance in-vehicle device may be used for the violation pattern, or a pattern received from the ground side may be used for the violation pattern.

[0320] In step 520, a determination is made as to whether or not there has been an inquiry from the ground side about fixed data such as the ID, namely, the ID code made up of the vehicle number and the like and the vehicle model information and the like. If this determination is affirmative, then, in the next step 522, the ID inquiry processing (described below in detail) is executed and the routine then proceeds to step 524. If the determination is negative, the routine proceeds without any change to step 524. In step 524, a determination is made as to whether or not there has been an inquiry from the ground side about the position of the vehicle. If this determination is affirmative, then, in the next step 526, position inquiry processing (described below in detail) is executed and the routine proceeds to step 528. If the determination is negative, the routine proceeds without any change to step 528.

[0321] In the next step 528, a determination is made as to whether or not the power supply to the vehicle has been cut. If power is being supplied, the determination in step 528 is negative, and the routine returns to step 500. If, however, the power supply has been cut, the determination in step 528 is affirmative and, in the next step 530, the current status is stored and then the present routine is ended. In the storing of the current status in step 530, at the least, whether or not a violation was displayed in the above processing is stored.

[0322] Note that when the observation lamp 227 is flashing in a violation pattern, it continues to flash until the power supply to the in-vehicle device is cut off. In addition, even if the power supply is cut off, because that state is stored, it is possible to confirm whether or not the violation state existed previously.

[0323] Next, a detailed description will be given of the charge area entry processing of the above step 506. This

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charge area entry processing is processing performed when a vehicle has entered a area in which a charge is applied. For example, at the point PS2 partway along the route Rt (Fig. 19), a vehicle will have entered the area in which a charge is applied for the first time, therefore the charge area entry processing of Fig. 22 is executed.

[0324] Firstly, in step 532, notification is made that the vehicle has entered a area in which a charge is applied by transmitting the ID code and current position. Note that, it is also possible to add entry information indicating that the vehicle has entered a area in which a charge is applied to the transmission of the ID code and current position. Because it is possible to determine that a vehicle has entered into a area in which a charge is applied from the current position and the previous position of the vehicle, therefore, it is also possible to make the determination on the ground side using the history information.

[0325] In the next step 534, a determination as to the receipt of an authorization result is repeated until a result of the authorization of the entry is received. When an authorization result is received, then, in the next step 536, a determination is made from the received authorization result as to whether or not the host vehicle is authorized as a normal vehicle. Note that, in this step 534, the information below is received from the ground side. When the result of the authorization is that the vehicle is a normal vehicle, the latest charge table and the first normal pattern, which is a flashing pattern of the observation lamp 227 indicating that the vehicle is a normal vehicle, are received (are transmitted from the ground side). When the result of the authorization is that the vehicle is in violation, information for performing a violation notification is received.

[0326] The first normal pattern is intended to allow confirmation from outside a vehicle that the host vehicle is a normal vehicle for which a charge can be processed. Therefore, the first normal pattern is a pattern for being flashed at the observation lamp 227 at a predetermined timing (for example a timing where the lamp is turned on and off repeatedly for predetermined time lengths). For example, as is shown in Fig. 23, a pattern is set that includes two pulses of pulse width t, with 6t set as one cycle in which the lamp is turned on for one time t, off for one time t, on for one time t, and off for 3 times t. If this pattern is used, it is possible to confirm the cyclic flashing from outside the vehicle, and confirm that the vehicle is a normal vehicle.

[0327] When an authorization result that the in-vehicle device is not in a normal vehicle is received, the determination in step 536 is negative and the routine proceeds to step 542 where violation processing is performed. This violation processing is intended to allow confirmation from outside a vehicle that the vehicle is in violation, and is performed by flashing the observation lamp 227 on and off in a predetermined violation pattern that is different from the above first normal pattern (for example, by repeatedly turning on and off the lamp for a time t, namely, continuously flashing).

[0328] If, however, result of the received authorization is that the vehicle is a normal vehicle, then the determination in step 536 is affirmative and, in the next step 538, a determination is made as to whether or not the IC card 232 is loaded in the IC card read / write device 234. If the IC card 232 is not loaded, the charge processing cannot be performed. Therefore, the routine proceeds to step 542 where violation processing is performed. If, however, the IC card 232 is loaded, the charge processing can be accomplished. Therefore, the determination in step 538 is affirmative and the routine proceeds, as it is, to step 540 where normal processing is performed without performing the violation processing. This normal processing is intended to allow confirmation from outside the vehicle that the IC card 232 is loaded and the vehicle is a normal vehicle capable of undergoing charge processing, and is performed by flashing the observation lamp 227 on and off in the first normal pattern.

[0329] Next, the processing on the ground side corresponding to charge area entry processing in the in-vehicle device will be described.

[0330] As is shown in Fig. 24, in step 600, repeated attempts are made to receive from the ground a notification (ID code and vehicle position) including an ID, namely, an ID code comprising the vehicle number and the like until this notification is received. The vehicle position in this notification includes at least the current vehicle position and may also include the vehicle location history which comprises the positions of the vehicle up until the current position. When this notification is received from the in-vehicle device, the routine proceeds to step 602, where the received ID code and vehicle position are used to check the ID code and the behavior of vehicle. A determination is made as to whether or not the ID code and the behavior of the vehicle are normal. Note that the checking of the ID code can be performed by referring to the recorded ID code if a normal ID code is recorded. The checking of the vehicle behavior can be performed by matching the recieved vehicle positions with a map or the like and then determining whether or not that position is an appropriate position.

[0331] When the ID code and the like are normal, the determination in step 602 is affirmative and, in the next step 604, the vehicle is authorized as a normal vehicle. When the ID code and the like are not normal, the determination in step 602 is negative and the routine proceeds to step 606, the authorization is that the vehicle is in violation. In the next step 608, the authorization result for the vehicle which is authorized in step 604 or step 606 is transmitted to the vehicle (i.e. to the in-vehicle device).

[0332] In this way, because the observation lamp 227 is flashed in either a first normal pattern or in a violation pattern in accordance with the authorization result from the ground side indicating whether or not a vehicle is a normal vehicle, it is a simple matter to confirm from outside the vehicle whether the vehicle is a normal vehicle for which charge

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processing can be accomplished or a vehicle that is in violation for which charge processing cannot be accomplished.

[0333] Next, the ID inquiry processing of step 522 will be described in detail This ID inquiry processing is carried out when a vehicle is within a checkpoint. For example, the processing of Fig. 25 is performed at the point PS3 partway on the route Rt (see Fig. 19) which is within the checkpoint.

[0334] Firstly, in step 544, information relating to the ID code is notified by transmitting fixed data such as the ID code and the vehicle model information. Note that it is also possible to include information indicating whether the IC card is loaded or is not loaded.

[0335] Next, when an authorization result is received for the above notification (i.e. the determination in step 456 is affirmative), a determination is made from the received authorization result as to whether or not the host vehicle has been authorized as a normal vehicle (step 548). If the host vehicle has been authorized as a normal vehicle, the present routine ends at that point with no further change. If, however, the host vehicle is not authorized as a normal vehicle, violation processing is performed to cause the observation lamp 227 to flash on and off in a predetermined violation pattern (step 550).

[0336] Next the processing of the ground side, namely, of the relay device 50 in response to the ID inquiry processing of the in-vehicle device will be described.

[0337] As is shown in Fig. 26, in step 610 repeated processing is performed until notification is received from the in-vehicle device. This notification includes information made up of the ID code, the vehicle model, and the existence or otherwise of an IC card. When the notification is received from the in-vehicle device, the routine proceeds to step 612 where a determination is made as to whether or not the received notification is normal. This determination is performed using all of the ID code, the vehicle model, and the existence or otherwise of an IC card in the received notification as well as a determination as to whether or not the ID code and the vehicle behavior are normal.

[0338] When the notification (The ID code and the like) is normal, the determination in step 612 is affirmative and, in the next step 614, vehicle model measurement processing is performed. In this vehicle model measurement processing, the size and height of the vehicle as well as the existence or otherwise of traction is determined using image pickup information picked up by the image pickup device 154A of the vehicle measuring device 154. In the next step 616, a determination is made as to whether or not the vehicle model measured in step 614 matches the vehicle model in the notification received in step 610. If the models do not match, the determination is negative, and the routine proceeds to step 620. If the models do match, the determination is affirmative and the routine proceeds to step 618. Next, in step 618, the vehicle for which the notification is received is authorized to be a normal vehicle. If, however, the notification is not normal, or if the vehicle models do not match, the determination in step 612 is negative and, in the next step 620, the vehicle is authorized as being in violation. In the next step 622, the vehicle number is photographed and then the routine proceeds to step 624. In step 624, the authorization result of the vehicle authorized in step 618 or step 620 is transmitted to the vehicle (i.e. to the in-vehicle device).

[0339] In this way, because the observation lamp 227 is flashed on and off in either a first normal pattern or in a violation pattern in accordance with an authorization result from the ground indicating whether or not a vehicle is a normal vehicle, it is easy to confirm from outside the vehicle whether the vehicle is a normal vehicle or is in violation.

[0340] Next the position inquiry processing of the above step 526 will be described in detail. This position inquiry processing is processing to inquire as to the position in which a vehicle is located to the vehicle. For example, at the point PS4 partway along the route Rt in Fig. 19, a vehicle is inside a area in which a charge is applied. Therefore, in order to carry out the charge processing, it is necessary to be able to confirm that the position of the vehicle is within the area in which a charge is applied. Therefore, the position inquiry processing shown in Fig. 27 is performed.

[0341] Firstly, in step 552, a notification is made as to the ID code and current position. Next in step 554, a determination as to the receipt of the authorization result is repeated until the authorization result is received. When the authorization result has been received, then, in the next step 556, a determination is made from the received authorization result as to whether or not the host vehicle is a normal vehicle. Note that in the step 554, the information below is received from the ground side. When the result of the authorization is that the vehicle is a normal vehicle, the latest charge table as well as a second normal pattern which is a flashing pattern for the observation 227 indicating the fact that the vehicle is a normal vehicle are received (i.e. are transmitted from the ground side). Moreover, when the authorization result is that the vehicle is in violation, information for performing the violation notification is received.

[0342] When an authorization result to the effect that the vehicle is not a normal vehicle is received, the determination in step 556 is negative and the routine proceeds to step 560 where violation processing is performed. This violation processing is carried out by flashing the observation lamp on and off in a predetermined violation pattern (for example, by repeatedly turning the lamp on for a predetermined time and then off for a predetermined time) in order to allow confirmation outside the vehicle, in the same way as described above, that the host vehicle is in violation.

[0343] If, however, an authorization result is received to the effect that the vehicle is a normal vehicle, the determination in step 556 is affirmative and, in the next step 558, normal processing is carried out. This normal processing is processing to turn on the observation lamp 227 so as to switch it to a second normal pattern indicating that the vehicle is a normal vehicle, and so that it can be confirmed from outside the vehicle that the charge processing is being carried

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out.

[0344] Next, the processing on the ground in response to the position inquiry processing of the in-vehicle device will be described.

[0345] As is shown in Fig. 28, in step 626, a determination is repeatedly performed until a notification (ID code and vehicle position) including an ID code comprising an ID, i.e. the vehicle number and the like, is received from the ground side. The vehicle position in this notification is at least the current position of the vehicle and may include the vehicle location history up until the current position. Once the notification is received from the in-vehicle device, the routine proceeds to step 628 where, using the received vehicle position, the behavior of the vehicle is checked and a determination is also made as to whether or not the behavior of the vehicle is normal.

[0346] When the behavior of the vehicle is normal, the determination in step 628 is affirmative and, in the next step 630, the vehicle is authorized as a normal vehicle. If the behavior of the vehicle is not normal, the determination in step 628 is negative and, in the next step 632, the vehicle is authorized as being in violation. In the next step 634, the result of the authorization of the vehicle authorized in step 630 or step 632 is transmitted to the vehicle (i.e. to the in-vehicle device). Note that, in step 634, either the above second normal pattern or information is sent.

[0347] In this way, because the observation lamp 227 is flashed on and off in either a second normal pattern or in a violation pattern in accordance with an authorization result from the ground indicating whether or not a vehicle is a normal vehicle, it is easy to confirm from outside the vehicle whether the vehicle is a normal vehicle or is in violation.

[0348] Moreover, because the lamp changes from a first normal pattern to a second normal pattern different from the first normal pattern, it is easy to confirm the state of a normal vehicle on the ground.

[0349] Next, the charge area departure processing of step 512 will be described in detail. This charge area departure processing is processing carried out when a vehicle has left from a area in which a charge is applied. For example, because a vehicle has departed from the area in which a charge is applied at the point PS5 partway along the route Rt in Fig. 19, the charge area departure processing of Fig. 29 is performed.

[0350] Firstly, in step 562, a notification is made that the vehicle has left the area in which a charge is applied by the transmission of the ID code and current position. Note that, because the fact the vehicle has left the area in which a charge is applied can be determined from the current position of the vehicle and the previous position of the vehicle, it may also be determined on the ground side form this history information.

[0351] In the next step 564, a determination as to whether the authorization result has been received is repeatedly performed until authorization that the vehicle has departed is received. When the authorization result is received, in the next step 566, a determination is made from the authorization result as to whether or not the host vehicle has been authorized as a normal vehicle. Note that, in step 564, the information below is received from the ground. When the authorization result is that the vehicle is a normal vehicle, extinguish permission information indicating permission to extinguish the observation lamp 227 in order to end the notification to the outside of the vehicle because the vehicle is a normal vehicle is received (i.e. is transmitted from the ground side). If the authorization result is that the vehicle is in violation, information for performing the violation notification is received.

[0352] When the in-vehicle device receives an authorization result to the effect that the vehicle is not a normal vehicle, then determination in step 566 is negative and the routine proceeds to step 572 where, in the same way as described above, violation processing is performed to flash the observation light 227 on and off in a predetermined violation pattern. When, however, the in-vehicle device receives an authorization result to the effect that the vehicle is a normal vehicle, the determination in step 566 is affirmative and, in the next step 568, a determination is made as to whether or not an IC card 232 is loaded in the IC card read / write device 234. If an IC card 232 is not loaded, the charge processing cannot be performed so the routine proceeds to step 572 where violation processing is performed. If, however, an IC card 232 is loaded, the charge processing can be carried out so the determination in step 568 is affirmative. The routine then proceeds to step 570 where normal processing is performed without the violation processing being carried out. This normal processing is processing to extinguish the observation lamp 227 using the above received extinguish permission information.

[0353] Next, the processing on the ground side in response to charge area departure processing of the in-vehicle device will be described.

[0354] As is shown in Fig. 30, in step 636, a determination is repeatedly performed until a notification (ID code and vehicle position) including an ID code comprising an ID, i.e. the vehicle number or the like, is received from the ground side. Once the notification is received from the in-vehicle device, the routine proceeds to the next step 638 where, using the received ID code and vehicle position, the ID code and vehicle behavior are checked and a determination is made as to whether or not the ID code and vehicle behavior are normal.

[0355] If the ID code and the like are normal, the determination in step 638 is affirmative and, in the next step 640, the vehicle is authorized as normal. If the ID code and the like are not normal. The determination in step 638 is negative and, in the next step 642, the vehicle is authorized as being in violation. In the next step 644, the above authorized vehicle authorization result is transmitted to the vehicle (i.e. the in-vehicle device). Note that, in step 644, information that includes a charge processing start instruction indicating the start of charge processing is transmitted.

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[0356] In this way, because the observation lamp 227 is flashed on and off in either a second normal pattern or in a violation pattern in accordance with an authorization result from the ground indicating whether or not a vehicle is a normal vehicle, it is easy to confirm from outside the vehicle whether the vehicle is a normal vehicle or is in violation.

[0357] When the vehicle has departed from the area in which a charge is applied, if the vehicle is a normal vehicle, the observation lamp is extinguished allowing easy confirmation from the outside of the vehicle that the vehicle is normal. If the departed vehicle is in violation, because the observation lamp 227 is turned on or is flashed on and off in a violation pattern, it is a simple matter to confirm from outside the vehicle that charge processing has not been accomplished and the vehicle is in violation.

[0358] Note that the above violation pattern may comprise the lamp being turned on continuously or the lamp being flashed on and off continuously. If this is so, the determination is easy when confirming the state of the observation lamp from outside the vehicle.

[0359] In the above embodiment, a description was given of when one observation lamp was used, however, this embodiment is not limited to one lamp and a combination of a plurality of lamps may be used.

[0360] As is shown in Fig. 31, for example, an observation lamp 227 can be formed from a plurality of observation lamps 227A, 227B, 227C, and 227D. In this case, it is possible to make normal pattern more intricate thereby increasing the secrecy level. Moreover, it is also possible to use as vehicle type determining lamps indicating the type of the vehicle in which the observation lamps are installed, such as heavy, medium, light and two-wheeled vehicles. Furthermore, Table 6 below shows a corresponding of the driver of the vehicle on the route Rt with an observation lamp.

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Table 6

Position	Display Panel IC card		Observation Lamp IC card	
	Not loaded	Loaded	Not loaded	Loaded
STP		Balance ¥000 (Charge area)	All flashing	All on
PS1		(Approaching charge area)	All flashing	Lamp corresponding to vehicle classification flashes for predetermined time
PS2		(Entered charge area)	All flashing	Lamp corresponding to vehicle classification flashes for predetermined time
PS3 PS4		Charge amount: ¥00/entry Charge amount: ¥00/minute	All flashing	Lamp corresponding to vehicle classification turned on or flashing in pattern
PS5 EDP		Outside charge area	All flashing	·Charging begins normally (lamp corresponding to vehicle classification flashes for predetermined time) ·Charging ends normally (all off) ·Balance insufficient (all flashing until new card is loaded)

[0361] In the above embodiment a description was given of when an observation lamp 227 was installed on the dashboard of a vehicle, however, the installation of the lamp is not limited to the dashboard arid it may be installed on the outside of the vehicle.

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[0362] As is shown in Fig. 32, number plates 34 and 36 are normally attached to a vehicle. If observation lamps 38 are installed on the number plates 34 and 36 and connected to the in-vehicle device 38, display for observation is made on the number plates 34 and 36, confirmation from outside the vehicle becomes a simple matter. For example, as shown in Fig. 33, an observation lamp 38 capable of displaying numbers and symbols is installed on the number plates 34 and 36. It is possible to display the current state (for example, to indicate that the vehicle is in violation) of the vehicle in numbers or symbols on this observation lamp 38. As a result, confirmation becomes easy at a position away from the vehicle.

[0363] Next, processing to automatically determine from outside the vehicle, namely, on the ground side, a normal vehicle or vehicle in violation determined in the present embodiment. Note that, this processing is performed here in the relay device 50 and is described together with the processing routine. Further, it is possible to set the relay device 50 and the processing below as an observation device.

[0364] As is shown in Fig. 34, when the violation detection processing is executed, the above normal pattern is read in step 650. All set normal patterns are read. It is preferable if a normal pattern generated by a signal received in the relay device 50 from the general center 40 is used for this normal pattern. By using this normal pattern generated from a received signal, the latest normal pattern can be used and the secrecy of the normal pattern can be improved.

[0365] In the next step 652, the vehicle is photographed for a set time. This photography may be performed such that at least the observation lamp is photographed. In step 652, the flash pattern is extracted from the flash time of the observation lamp of the photographed vehicle. This extraction can be performed by measuring the time intervals when the lamp is on or off.

[0366] The vehicle photography of step 652 is not limited to the above set time photography. For example, if an electronic shutter is provided in an image pickup device and the electronic shutter either opened or closed in synchronization with the above normal pattern, the electronic shutter can be synchronized with the observation lamp. As a result it is also possible to pick up an image only during the time the lamp is on in synchronization with the flashing of the normal pattern.

[0367] In the next step 654, a determination is made as to whether or not the normal pattern read in step 650 matches the pattern extracted in step 652. If they do match, the determination in step 652 is affirmative and, in the next step 656, the photographed vehicle the vehicle is authorized as a normal vehicle and the routine is ended.

[0368] In the determination in step 654, when an electronic shutter is provided in the image pickup device and the electronic shutter is made either opened or closed in synchronization with the normal pattern, the electronic shutter can be synchronized with the flashing of the observation lamp. As a result, it is possible to determine that the patterns match by picking up an image only during the time the lamp is on in synchronization with the flashing of the normal pattern.

[0369] For example, when the observation lamp 227 is flashed on and off in the pattern shown in Fig. 23, if the detection times are set as the times T1 and T2, the time when the pattern is normal is when the lamp is on at the time T1 and the lamp is off at the time T2. If, however, at least one of the lamp being off at the time T1 or the lamp being on at the time T2 occurs, the lamp is not turned on in a normal pattern and it can be determined that the patterns do not match.

[0370] If the patterns do not match, then determination in step 654 is negative and the routine proceeds to the next step 658 where it is authorized that the photographed vehicle is in violation. In the next step 660, processing for a vehicle in violation is carried out. Examples of processing for a vehicle in violation include photographing the vehicle number (number plate), photographing the driver, notifying the observer and the like.

[0371] By photographing the flashing of an observation lamp in a normal pattern in this way, it is possible to easily an automatically determine whether a vehicle is a normal vehicle or is in violation.

[0372] Note that the above description was for the detection of a normal pattern, however, it is also possible to detect a violation pattern. In this case, it is possible to detect a specific violation pattern and perform an observation corresponding to the type of violation. Further, in the above, a description was given for that the flashing of an observation lamp was observed, however, the observation is not limited to the flashing of light and it is also possible to perform an observation of notification by radio waves. In this case, the cycle and frequency of the waves as well as the waveform, the amplitude and the like can be set for a normal pattern.

[0373] In the above embodiment, a description was given for when the charge was made by deducting the toll from an IC card on which toll balance information and the like was stored, however, the charge processing is not limited to charge processing using an IC card, and it is also possible to approve the toll from an settled account such as a credit card or bank account associated with the user of the vehicle determined by an ID code. In this case, when a card or account that allows charge processing to be processed automatically is determined, by notifying the in-vehicle device as to the toll deduction from the deductible card or bank account before the deducation, the user can confirm beforehand the payment of a toll that has been created because of a charge.

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exponentiating a signal comprising the difference signal, thereby generating an exponentiated signal;

low-pass filtering a signal comprising the difference signal, thereby generating a filtered signal; and

generating an output signal comprising the exponentiated signal and the filtered signal, wherein the second input signal comprises the output signal.

76. A method as recited in claim 75, wherein the steps of exponentiating and low-pass filtering are combined to form an exponentiating-filtering step, comprising:

receiving the signal comprising the difference signal into an input terminal of a transistor having first and second current-carrying terminals, the first current-carrying terminal being adapted to be connected to at least one voltage source, and the second current-carrying terminal being connected to an output terminal; and

suppressing high-frequency components of the signal comprising the difference signal, using a high-frequency shunt adapted to be connected between the input terminal and the at least one voltage source, the high-frequency shunt comprising a capacitor.

77. A method of detecting signal-size, comprising:

receiving an input signal into a first node;

driving a first bias current through a first transistor, the first transistor comprising:

a first signal-receiving terminal connected to a second node,

a first current-carrying terminal connected to a third node, and

a second current-carrying terminal through which the first bias current is

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driven;

driving a second bias current through a second transistor, the second transistor comprising:

a second signal-receiving terminal connected to a fourth node,

a third current-carrying terminal connected to the third node, and

a fourth current-carrying terminal through which the second bias current is driven, the fourth current-carrying terminal being connected to the fourth node;

using a high-frequency shunt to suppress high frequency components of the input signal, the high-frequency shunt being adapted to be connected between the fourth node and a first voltage source;

driving a third bias current through a third transistor, the third transistor comprising:

a third signal-receiving terminal connected to the fourth node,

a fifth current-carrying terminal connected to a fifth node, and

a sixth current-carrying terminal through which the third bias current is driven; and

receiving an error signal from a fourth transistor, the fourth transistor comprising:

a first signal-receiving terminal adapted to be connected to a second voltage source,

a seventh current-carrying terminal connected to the fifth node, and

an eighth current-carrying terminal connected to the first node.

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78. A method as recited in claim 77, further comprising:

limiting a voltage between the first node and the second voltage source;

driving a fourth bias current through a fifth transistor, the fifth transistor comprising:

a fifth signal-receiving terminal connected to the fourth node,

a ninth current-carrying terminal connected to a sixth node, and

a tenth current-carrying terminal through which the fourth bias current is driven;

using a sixth transistor to drive a controlling current through a controlling branch of a current mirror, the sixth transistor comprising:

a sixth signal-receiving terminal adapted to be connected to the second voltage source,

an eleventh current-carrying terminal connected to the sixth node, and

a twelfth current-carrying terminal in communication with the controlling branch; and

using the current mirror to control an output current in accordance with the controlling current, the output current flowing through a controlled branch of the current mirror.

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AMENDED CLAIMS
[received by the International Bureau on 05 June 2002 (05.06.02);
original claims 1, 8, 9, 11, 13, 16, 17-19 and 20 amended;
remaining claims unchanged (4 pages)]

1. An apparatus for processing a signal, comprising:

a selected one of a class-AB circuit and a class-B circuit, the selected one having at least one input and at least one bias, the at least one input being adapted to receive at least one input signal, and the selected one being coupled to process the at least one input signal to thereby generate at least one output signal related to the at least one input signal by an input-output characteristic having a crossover region which introduces distortion; and

an amplitude detector coupled to perform the operations of:

receiving the at least one input signal,

detecting at least one amplitude of the at least one input signal, and

dynamically adjusting the at least one bias in accordance with the at least one amplitude, wherein the at least one bias controls a level of the at least one output signal such that the at least one output signal avoids the crossover region.

2. An apparatus as recited in claim 1, wherein the selected one comprises an amplifier.

3. An apparatus as recited in claim 1, wherein the selected one comprises a filter.

4. An apparatus as recited in claim 3, wherein the filter is internally non-linear.

5. An apparatus as recited in claim 3, wherein the filter comprises a companding filter.

6. An apparatus as recited in claim 3, wherein the filter comprises a log-domain filter.

7. An apparatus as recited in claim 1, wherein the amplitude detector comprises a filtered rectifier.

8. An apparatus as recited in claim 1, wherein the amplitude detector comprises a filter-exponentiator coupled to low-pass-filter and exponentiate a detected signal comprising the at least one input signal, thereby generating a filtered-exponentiated signal, wherein an output signal of the amplitude detector

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comprises the filtered-exponentiated signal, and wherein the detected signal comprises the output signal of the amplitude detector.

9. An apparatus for processing a signal, comprising a filter having at least one input and at least one bias, wherein the at least one input comprises:

a first input for receiving a first input signal; and

a second input for receiving a second input signal, wherein the filter is coupled to perform the steps of:

applying a first filtering operation to the first input signal, thereby generating a first output signal which is communicated to at least one output of the filter, the first filtering operation having a first frequency characteristic in which low frequencies are suppressed, and

applying a second filtering operation to the second input signal, the second input signal controlling the at least one bias, the second filtering operating having a second frequency characteristic in which low frequencies are passed, and the second input signal being adjusted in accordance with an amplitude of the first input signal.

10. An apparatus as recited in claim 9, wherein the first frequency characteristic comprises at least one of a band-pass characteristic and a high-pass characteristic, the at least one bias being isolated from low-frequency components of the first input signal.

11. An apparatus for processing a signal, comprising a filter having:

at least one signal input; and

first and second bias inputs, wherein the at least one signal input comprises first and second signal inputs, the first signal input being adapted to receive a first input signal and a first bias signal related to an amplitude of at least one of the first input signal and a second input signal, the first bias signal being for controlling a first bias, the second signal input being adapted to receive the second input signal and a second bias signal, the second bias signal being for controlling a second bias, the second bias signal being approximately equal to the first bias signal, and the filter being coupled to filter a difference of the first and second input signals to generate a filter output signal.

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12. An apparatus as recited in claim 11, wherein the filter is internally non-linear.

13. An apparatus as recited in claim 11, further comprising an amplitude detector coupled to perform the operations of:

receiving the at least one of the first and second input signals;

detecting the amplitude; and

adjusting at least one of the first and second biases dependent on at least the amplitude.

14. An apparatus as recited in claim 11, wherein the filter comprises a companding filter.

15. An apparatus as recited in claim 11, wherein the filter comprises a log-domain filter.

16. An apparatus as recited in claim 11, wherein the filter is coupled to apply, to a third input signal comprising at least one of the first and second input signals, a compression operation, a filtering operation, and an expansion operation.

17. An apparatus as recited in claim 16, wherein the filter comprises a compression section, comprising:

a first transistor having a first current control terminal and first and second current-carrying terminals, the first current-carrying terminal being for receiving the third input signal, and the second current-carrying terminal being adapted to be connected to a first voltage source; and

a second transistor having a second current control terminal and third and fourth current-carrying terminals, the second current control terminal being connected to the first current-carrying terminal, the third current-carrying terminal being connected to the first current control terminal, and the fourth current-carrying terminal being adapted to be connected to a second voltage source, wherein an output signal of the compression operation comprises a voltage at the second current control terminal.

18. An apparatus as recited in claim 17, wherein the filter further comprises an expansion section, comprising:

a third transistor having a third current control terminal and fifth and sixth

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current-carrying terminals, the third current control terminal being for receiving the output signal of the compression operation; and

a high-frequency shunt connected between the third current control terminal and the fifth current-carrying terminal, wherein an output signal of the filter comprises a signal generated at the sixth current-carrying terminal.

19. An apparatus as recited in claim 16, wherein the filter comprises an expansion section, comprising:

a transistor having a current control terminal and first and second current-carrying terminals, the current control terminal being for receiving an output signal of the compression operation; and

a high-frequency shunt connected between the current control terminal and the first current-carrying terminal, wherein an output signal of the filter comprises a signal generated at the second current-carrying terminal.

20. An apparatus as recited in claim 16, wherein the filter comprises a compression section, comprising a first transistor having a first current control terminal and first and second current-carrying terminals, the first current control terminal being adapted to be connected to a first voltage source, the first current-carrying terminal being coupled to receive the third input signal, and the second current-carrying terminal being adapted to be connected to a current source, wherein an output signal of the compression operation comprises a voltage at the second current-carrying terminal.

21. An apparatus as recited in claim 20, further comprising:

a first node for receiving the output signal of the compression operation;

a high-frequency shunt adapted to be connected between the first node and at least one of the first voltage source and a second voltage source; and

an expansion section, comprising a second transistor having a second current control terminal and third and fourth current-carrying terminals, the second current control terminal being adapted to be connected to at least one of the first voltage source, the second voltage source, and a third voltage source, and the fourth current-carrying terminal being for receiving a signal from the first node, wherein an output signal of the filter comprises a signal generated at the third current-carrying terminal.

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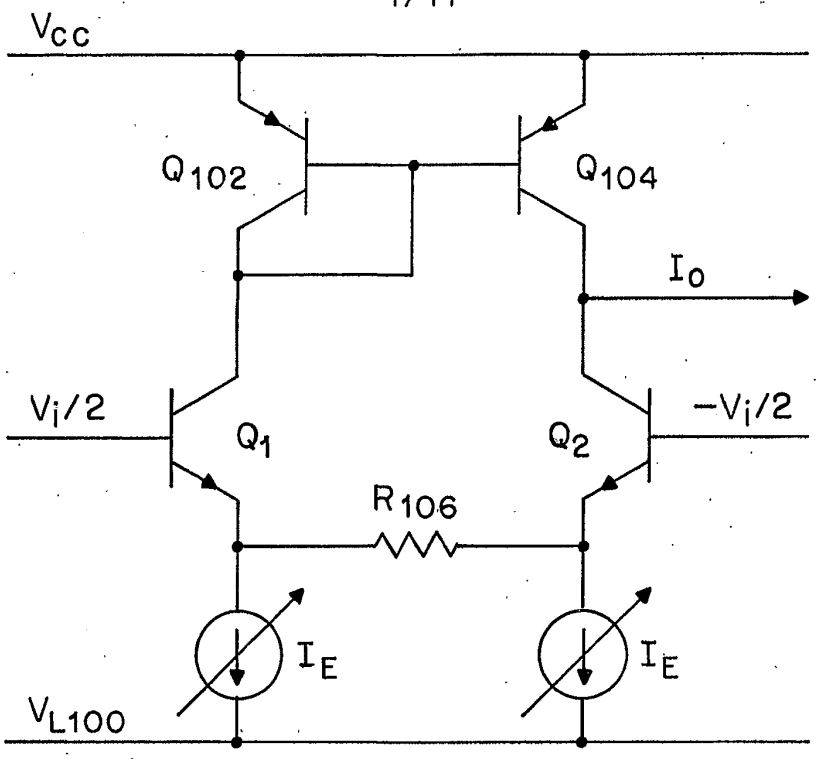

FIG. 1

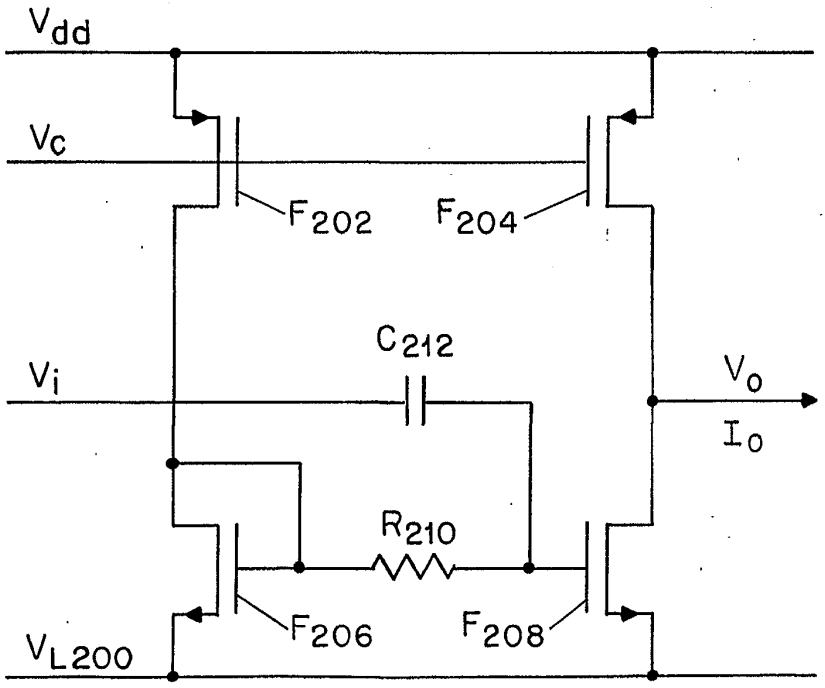

FIG. 2

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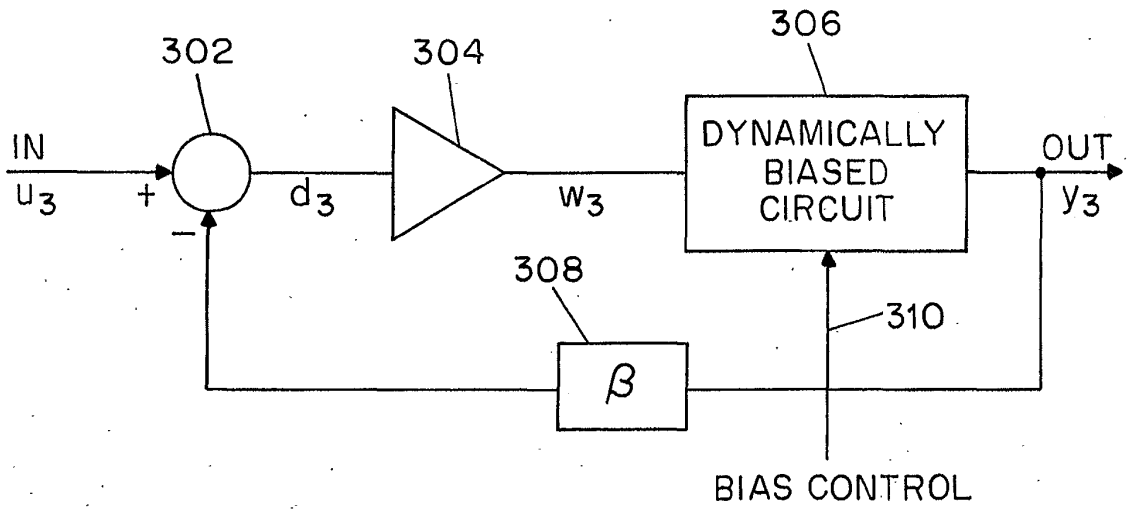

FIG. 3

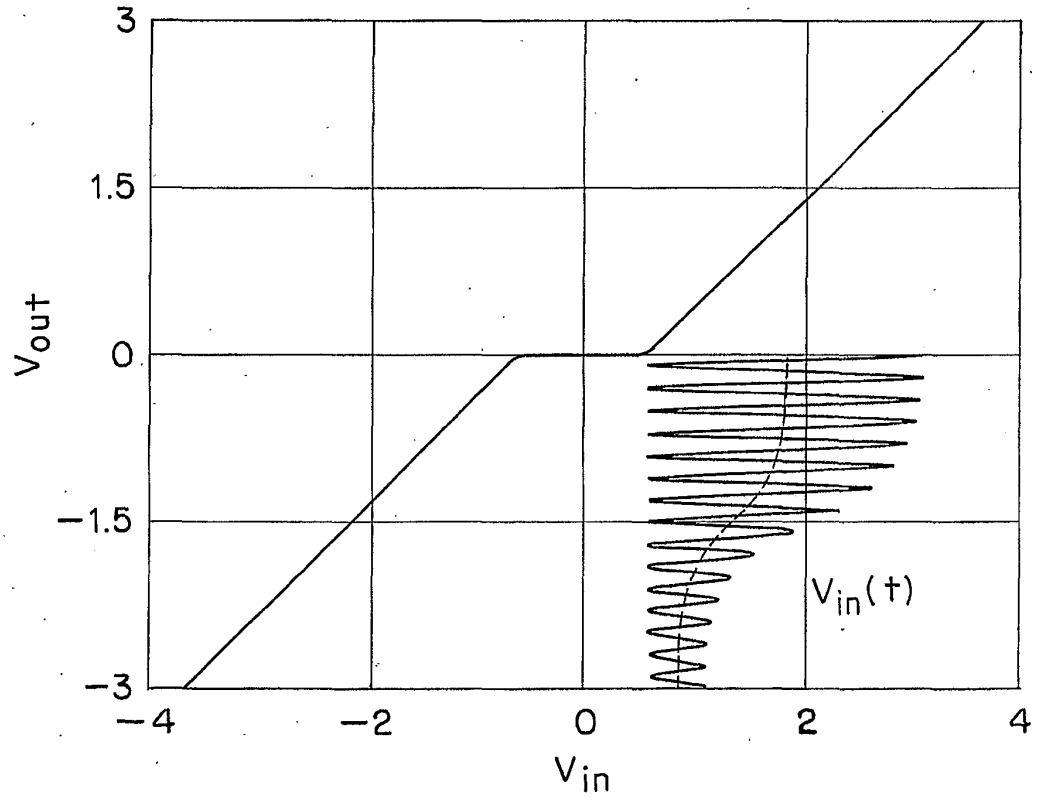

FIG. 4

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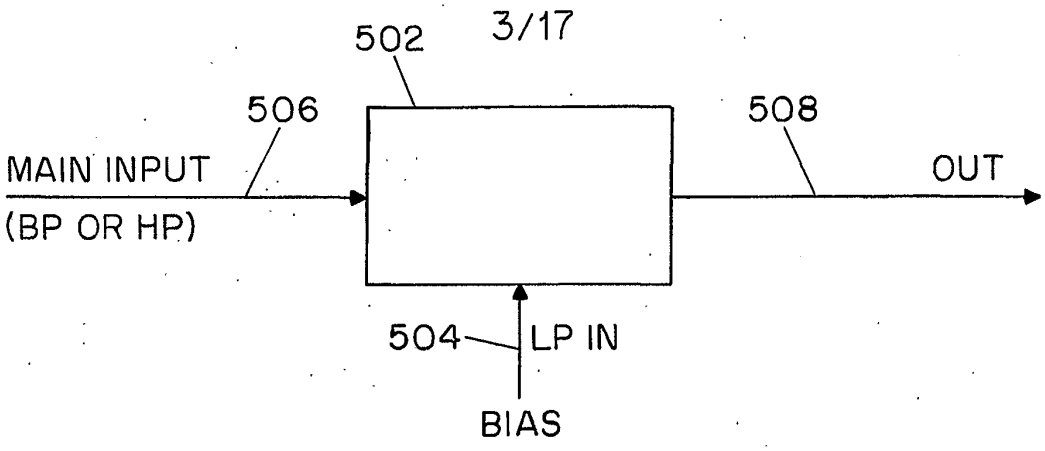

FIG. 5

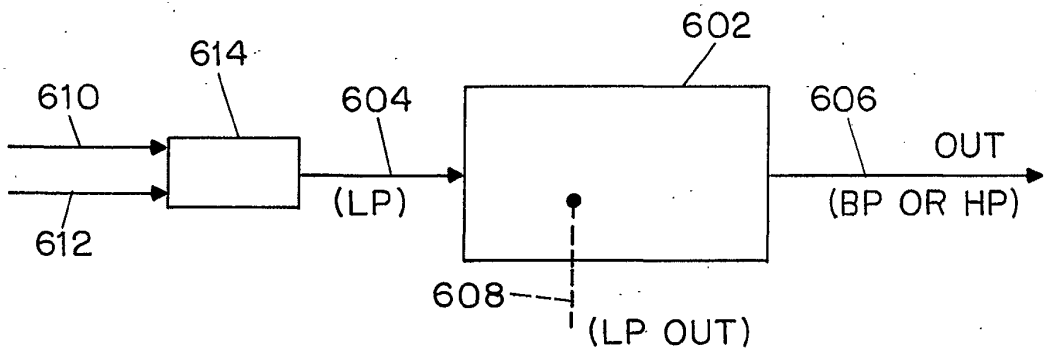

FIG. 6

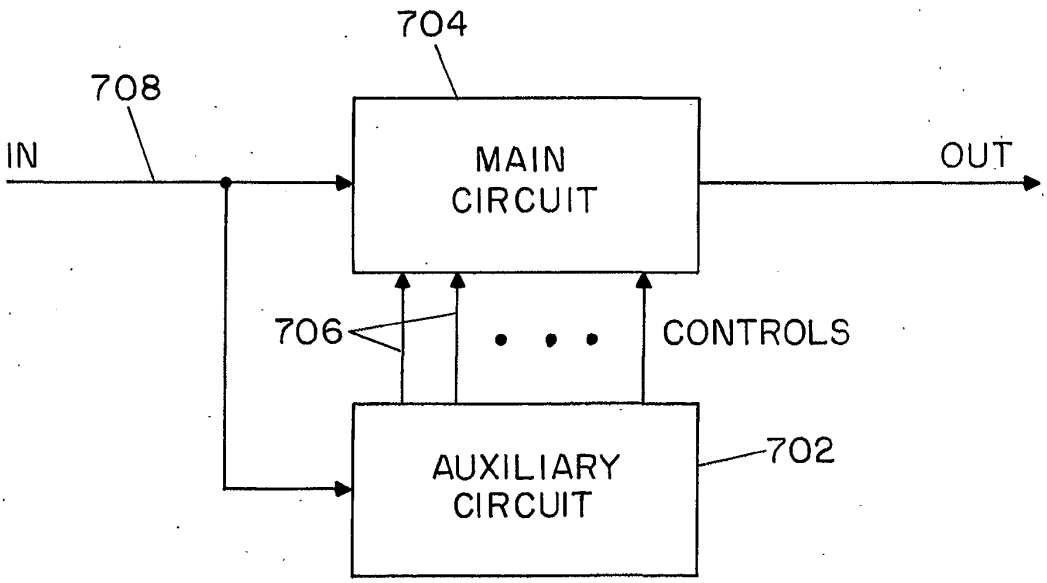

FIG. 7

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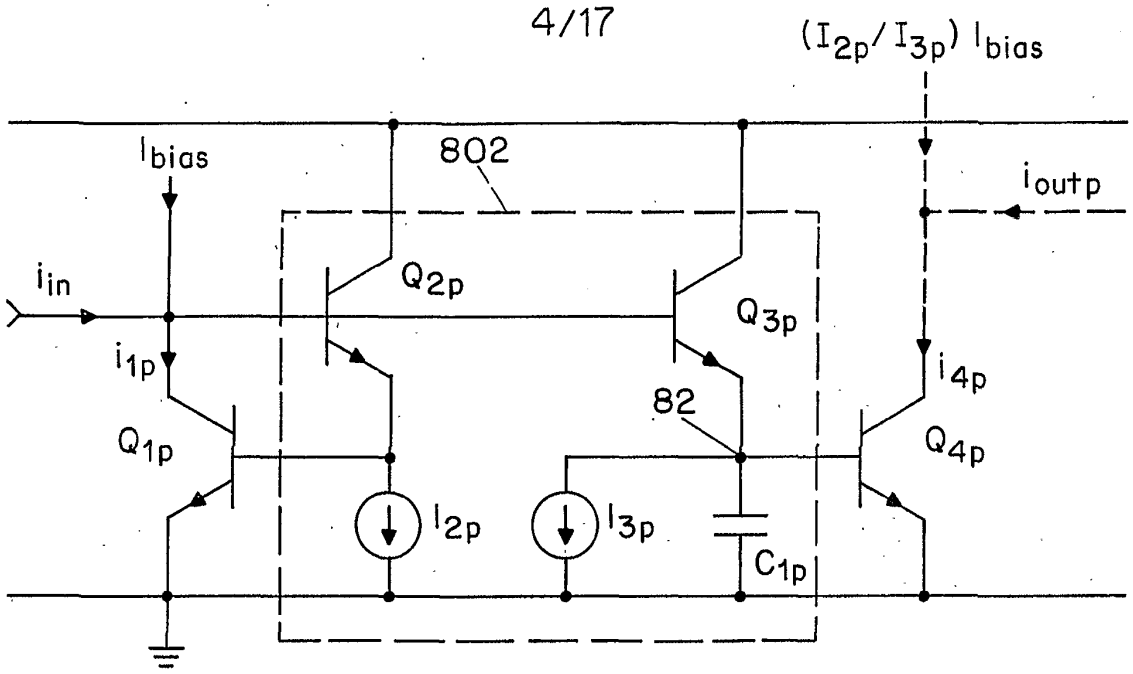

FIG. 8a

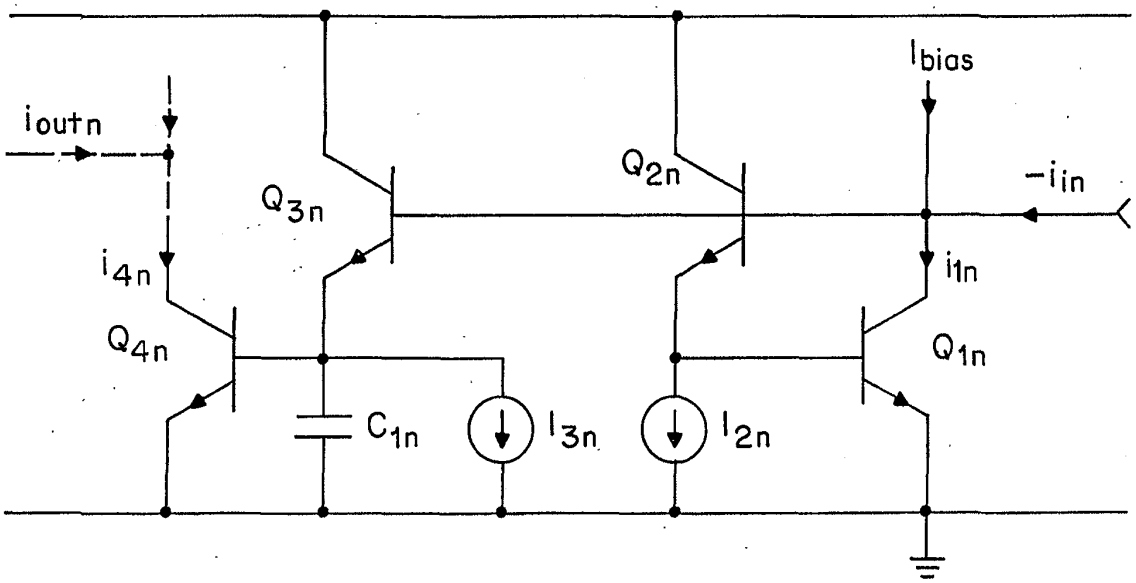

FIG. 8b

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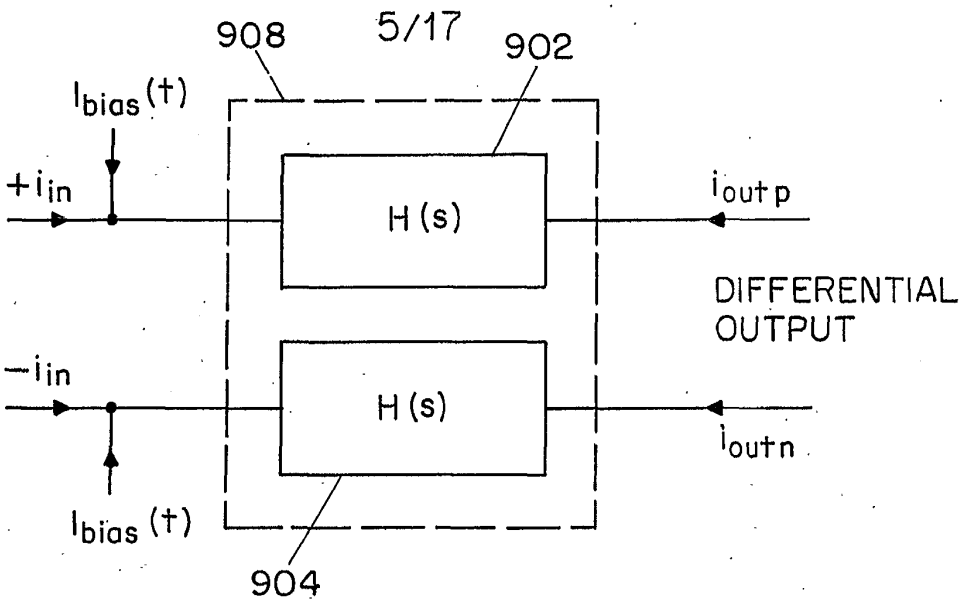

FIG. 9a

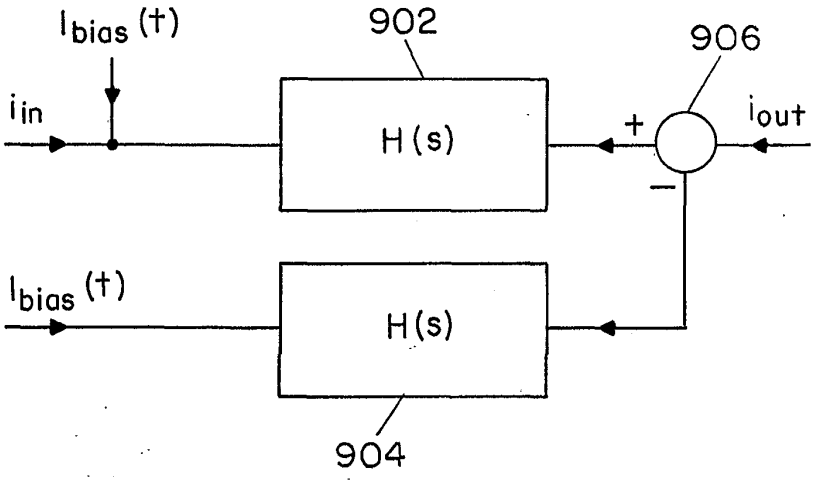

FIG. 9b

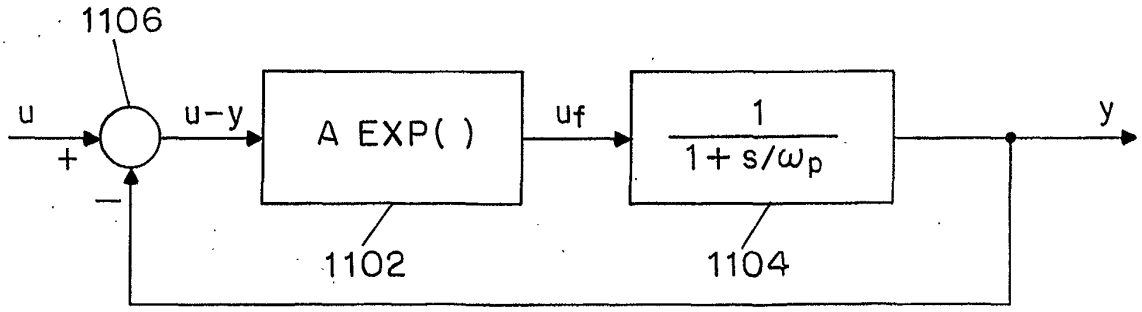

FIG. 11

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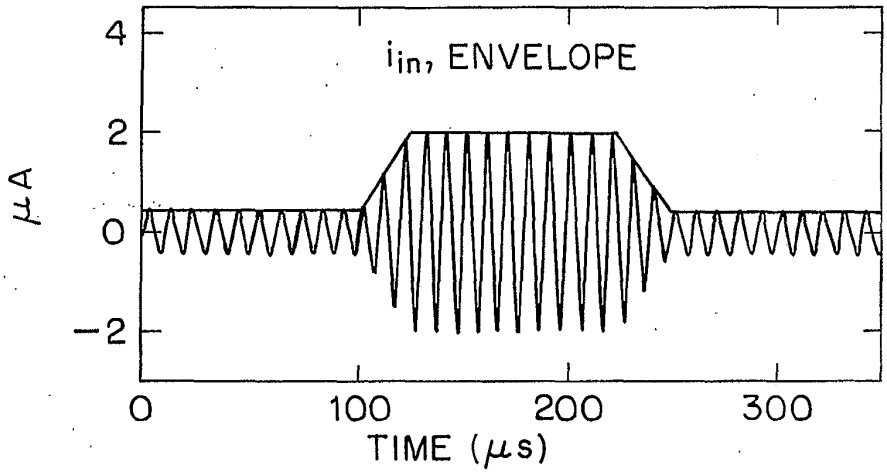

FIG. 10a

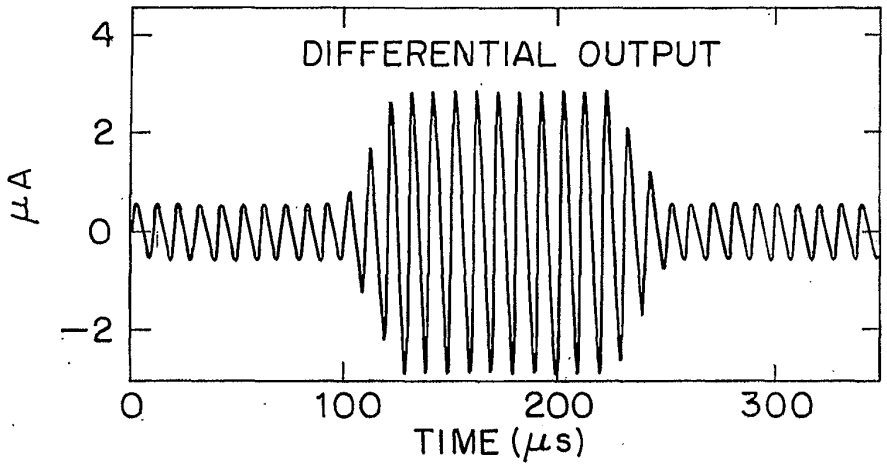

FIG. 10b

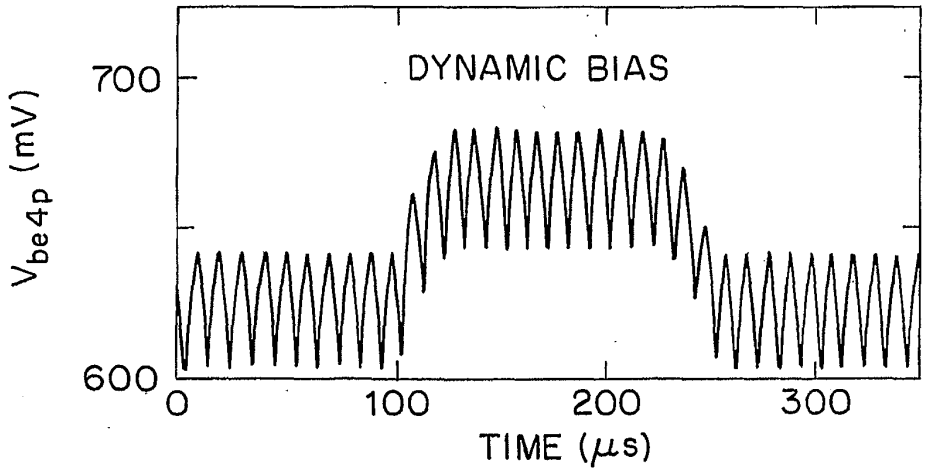

FIG. 10c

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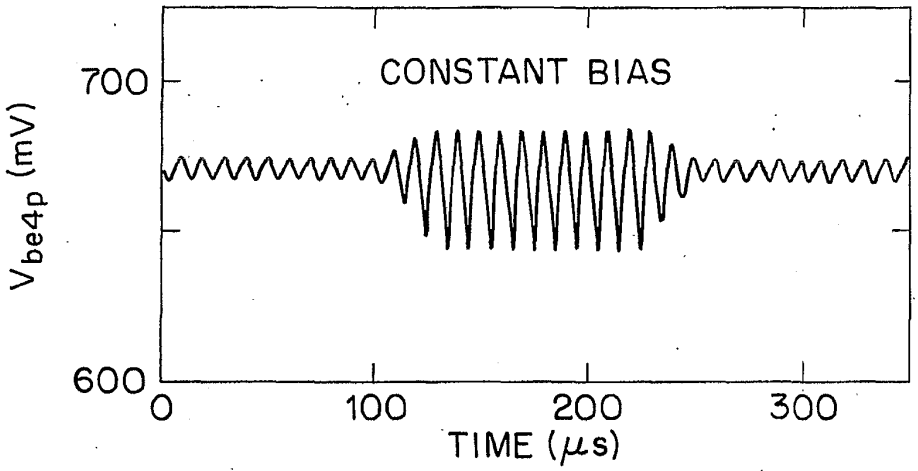

FIG. 10d

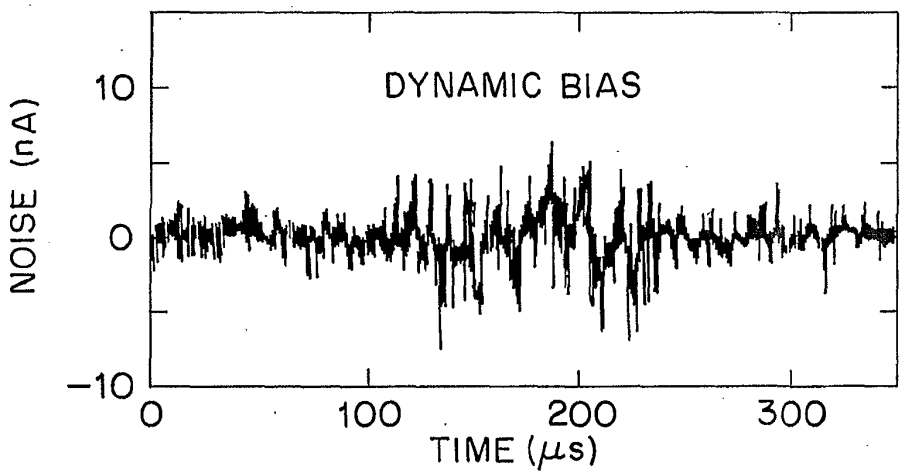

FIG. 10e

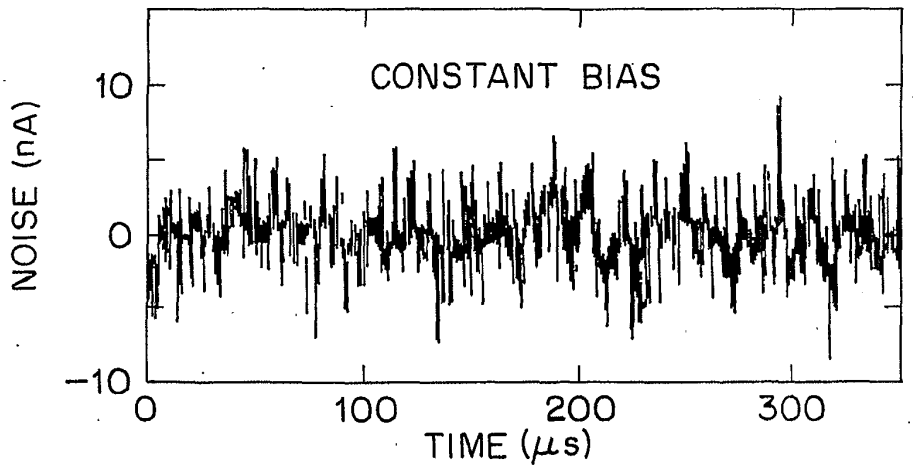

FIG. 10f

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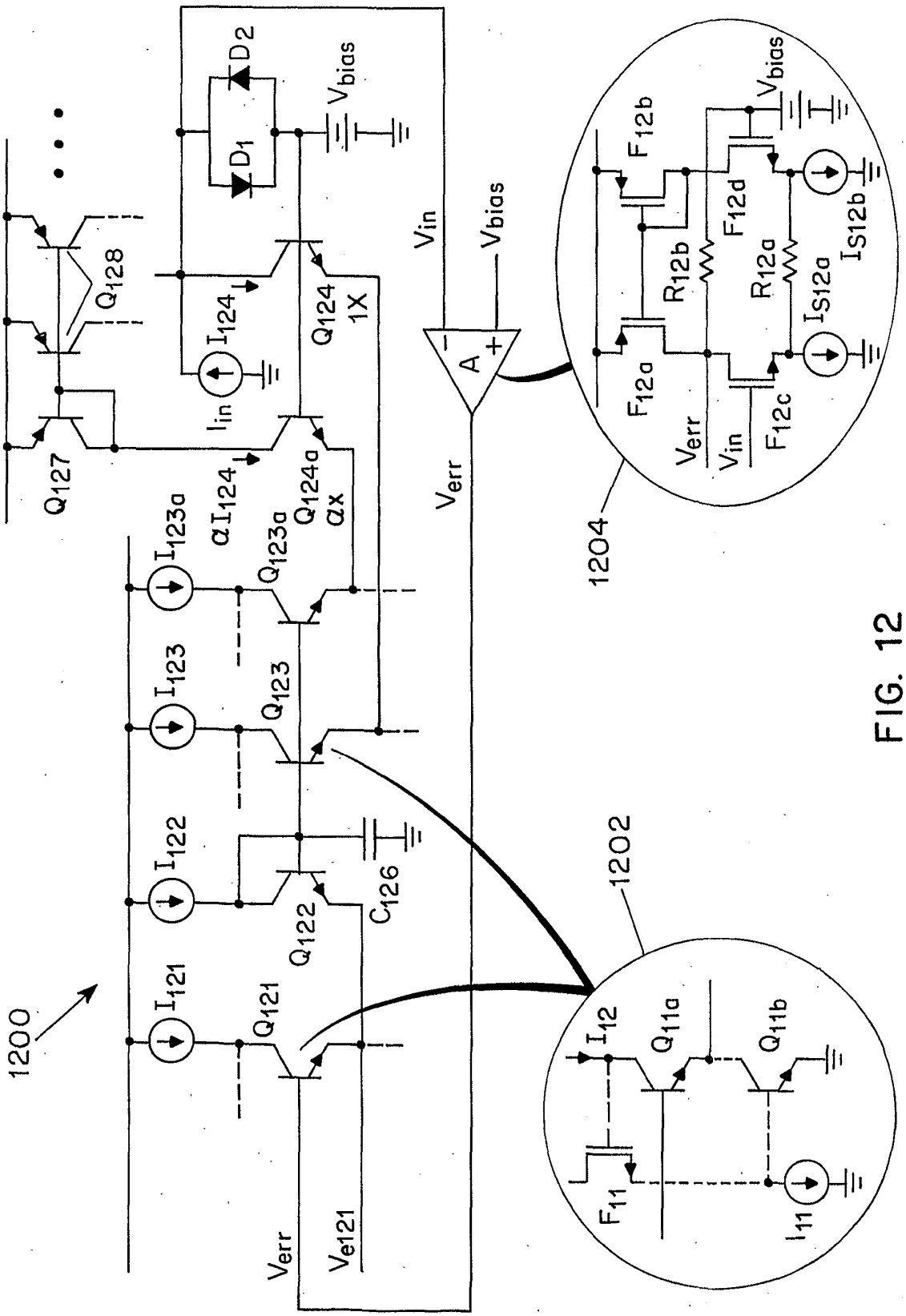

FIG. 12

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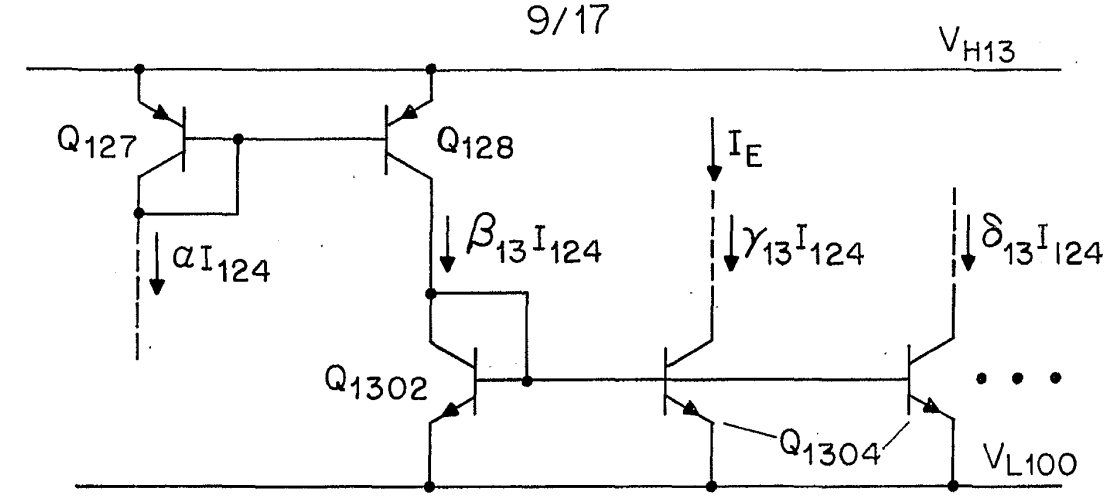

FIG. 13

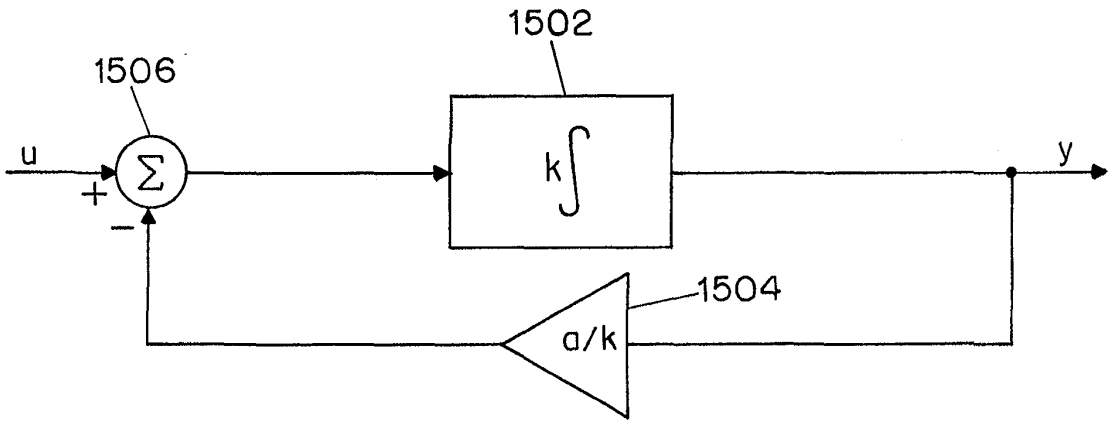

FIG. 15a

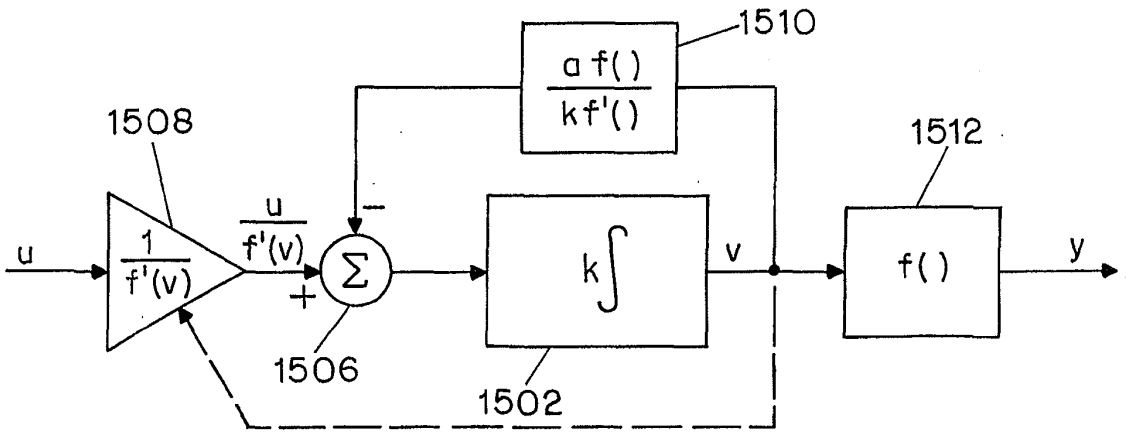

FIG. 15b

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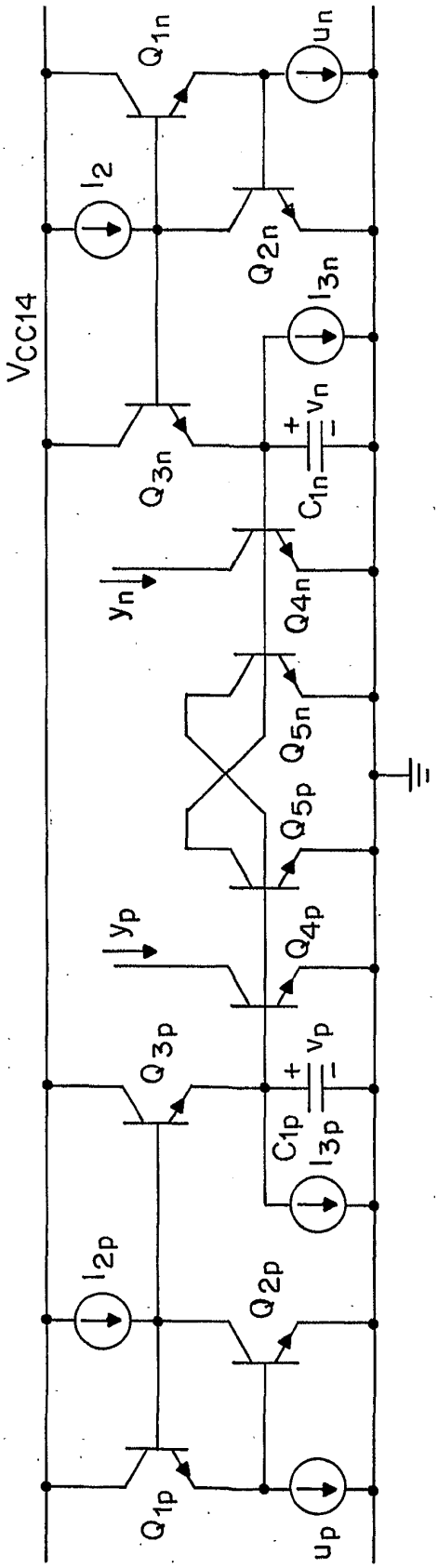

FIG. 14

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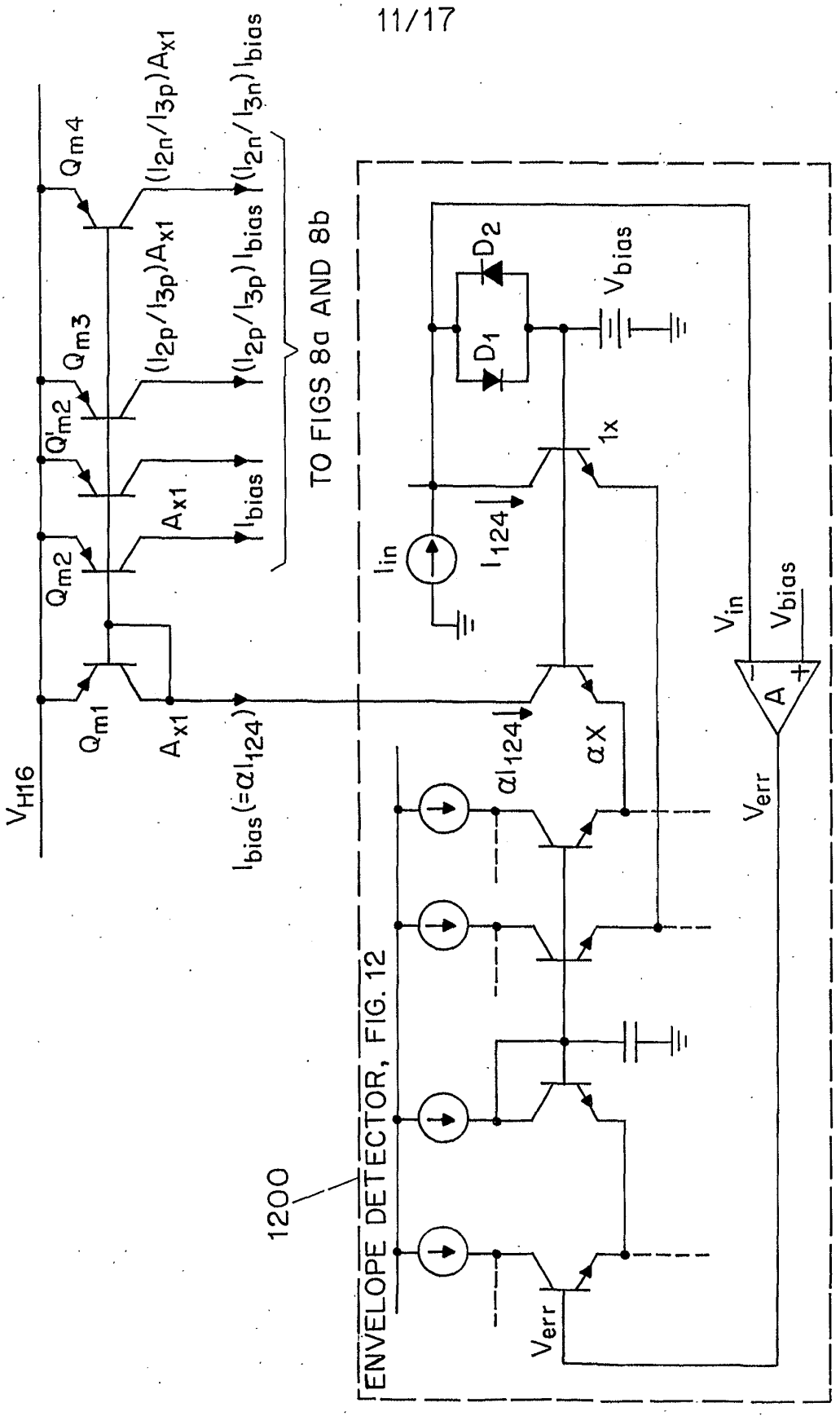

FIG. 16

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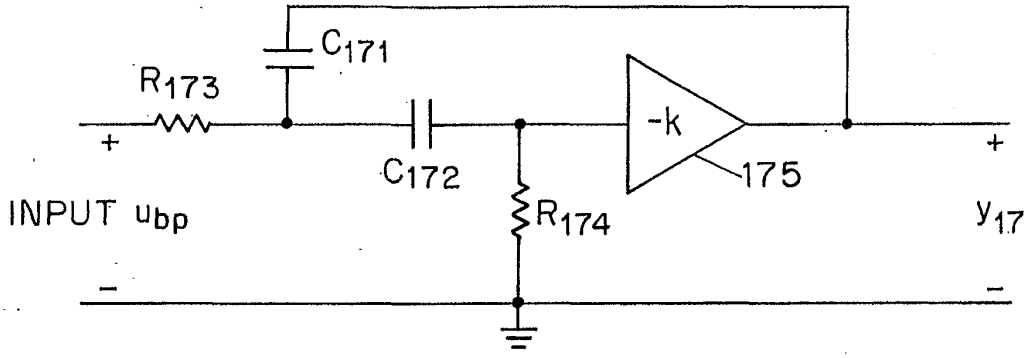

FIG. 17a

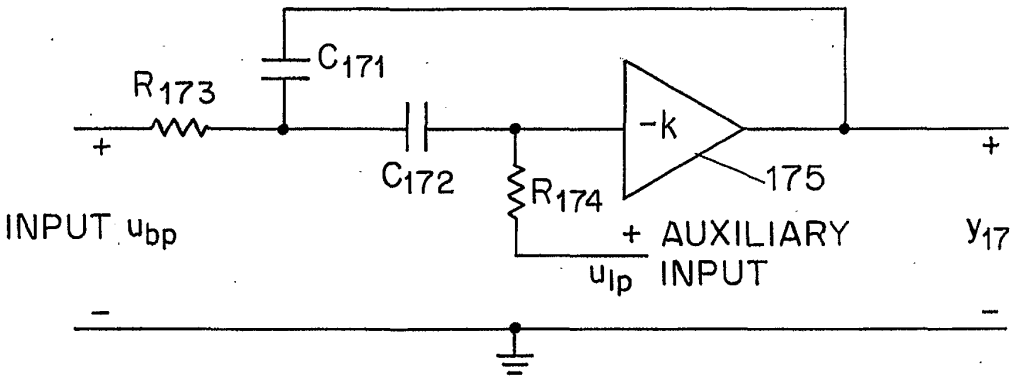

FIG. 17b

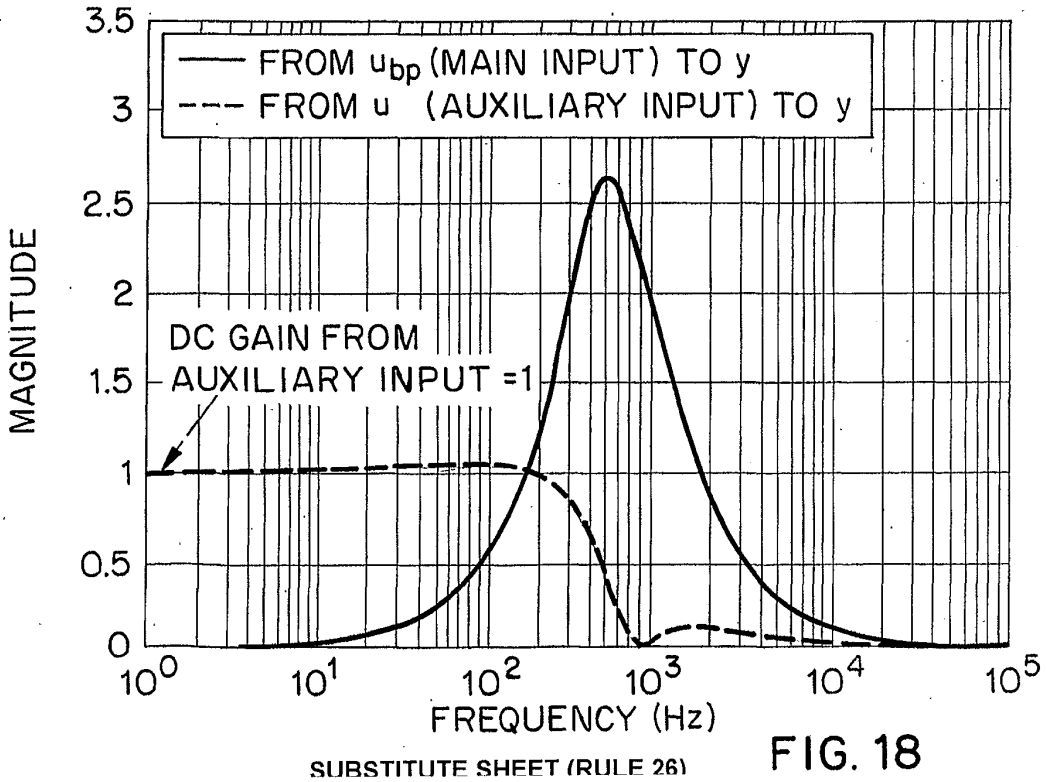

FIG. 18

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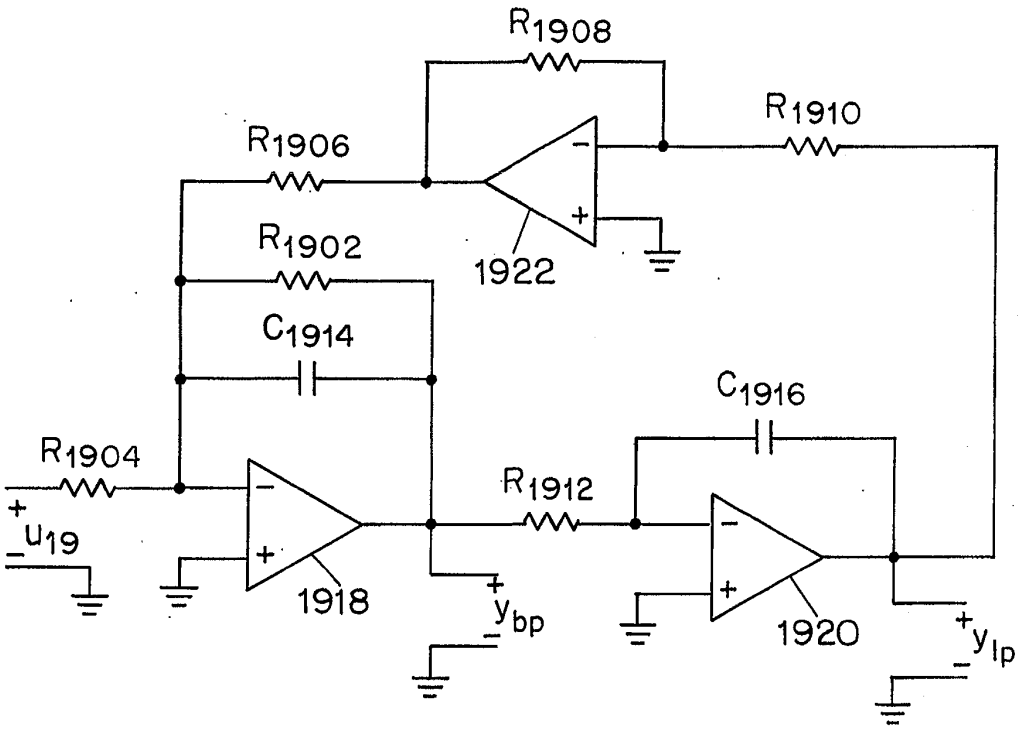

FIG. 19

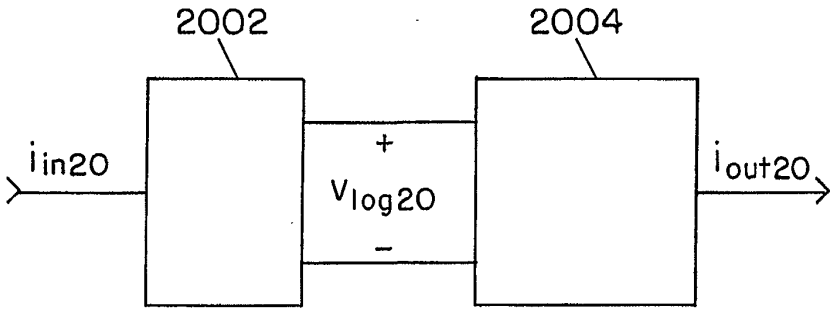

FIG. 20a

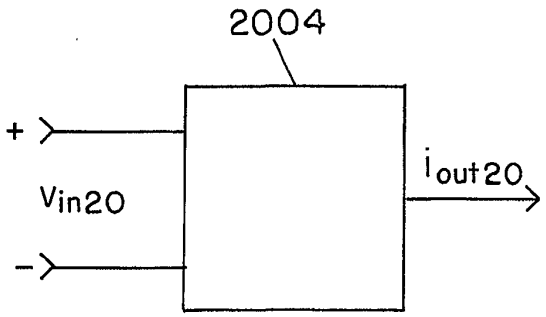

FIG. 20b

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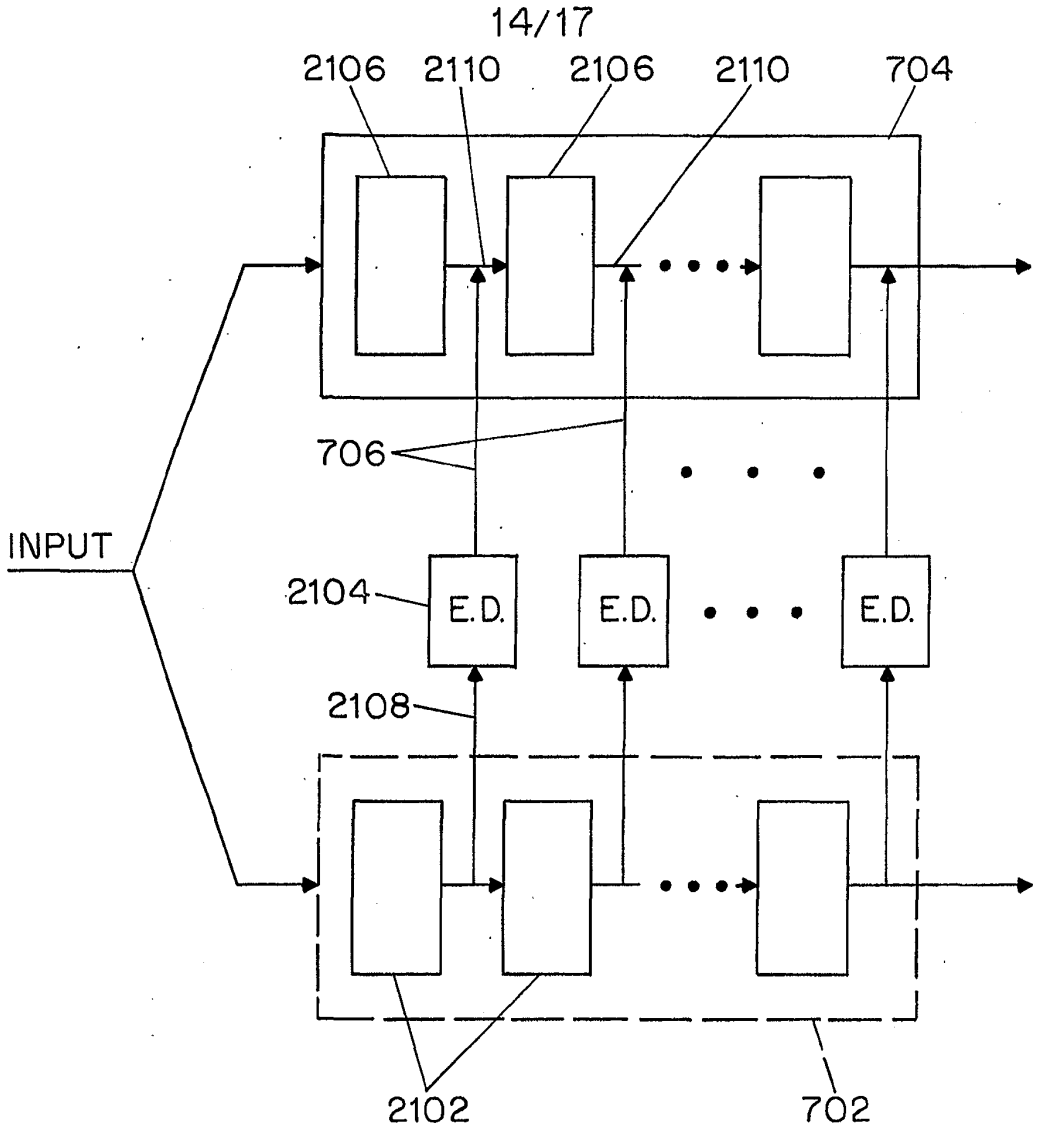

FIG. 21

Google Exhibit 1004, Page 752 of 1125

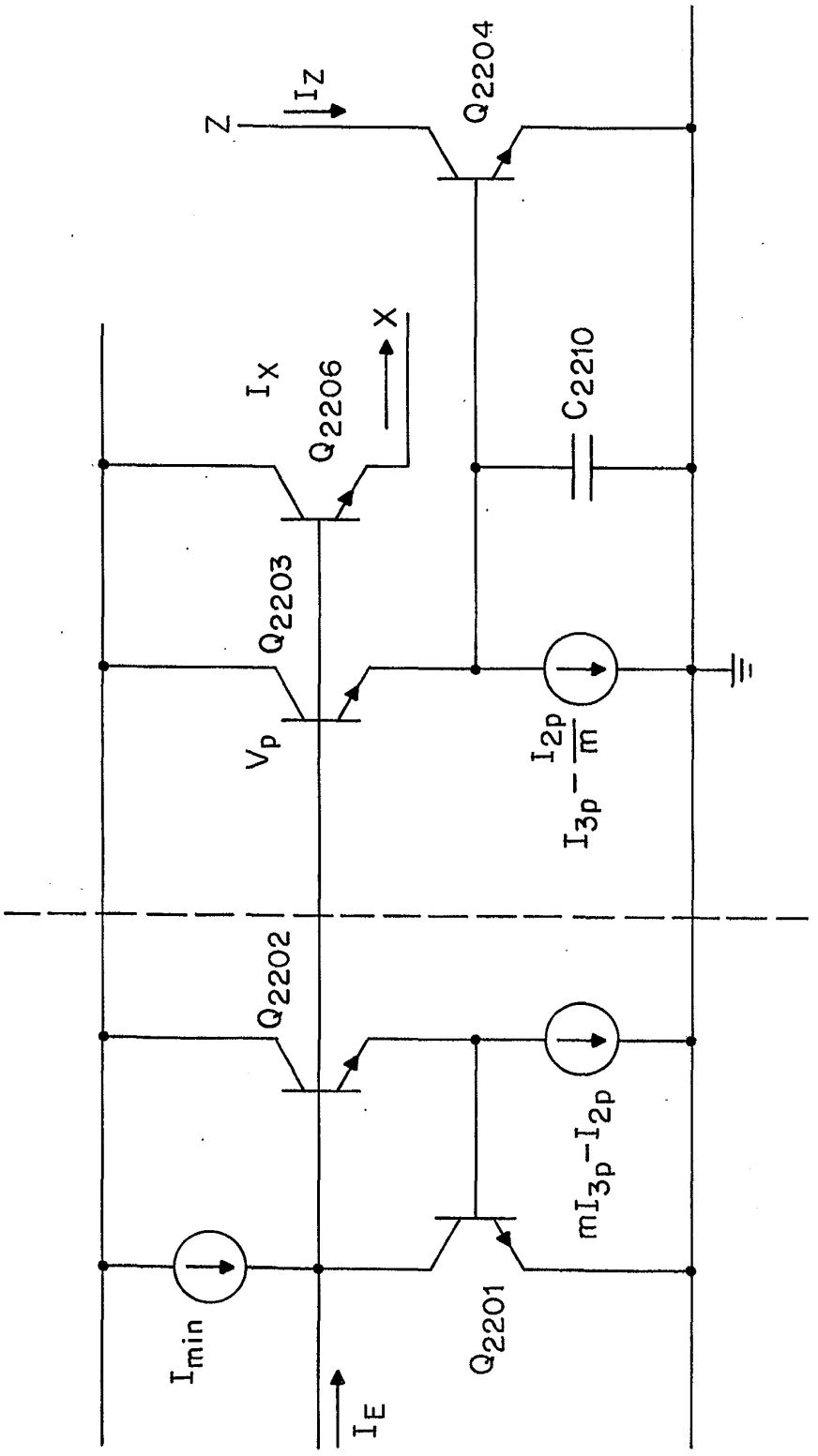

FIG. 22

Google Exhibit 1004, Page 753 of 1125

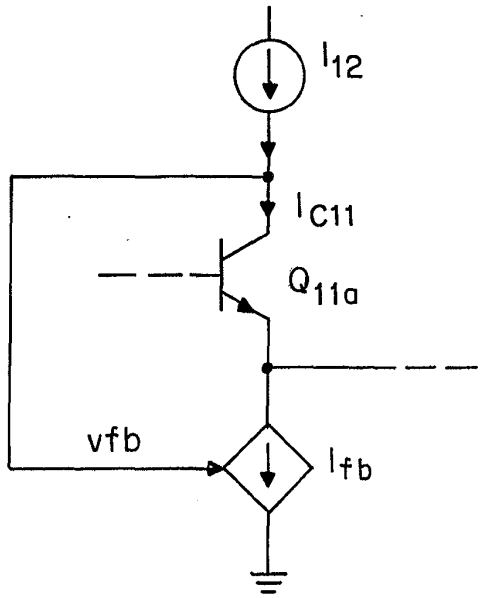

FIG. 23

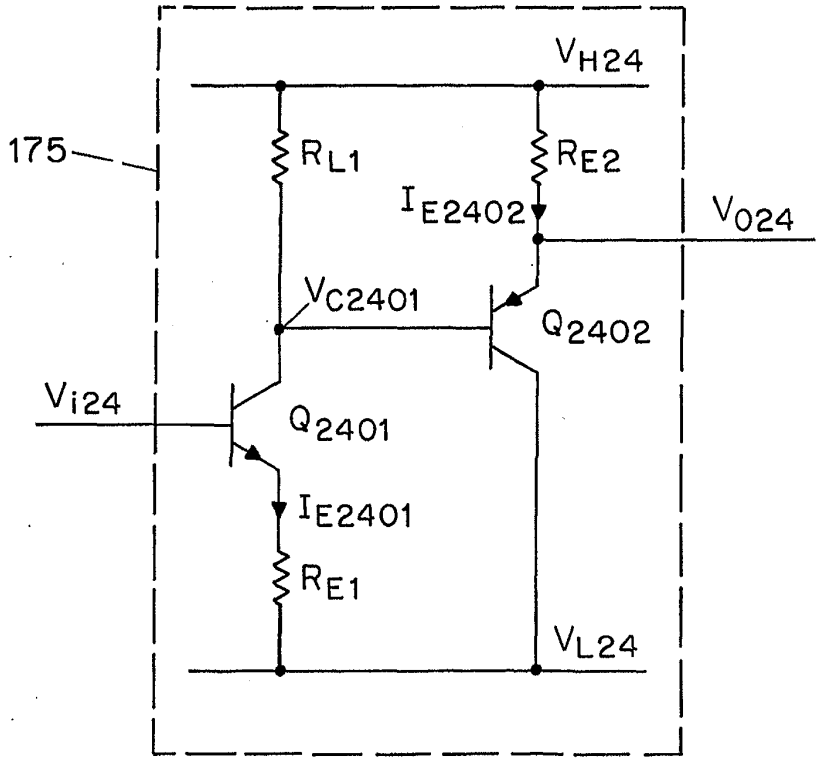

FIG. 24

Google Exhibit 1004, Page 754 of 1125

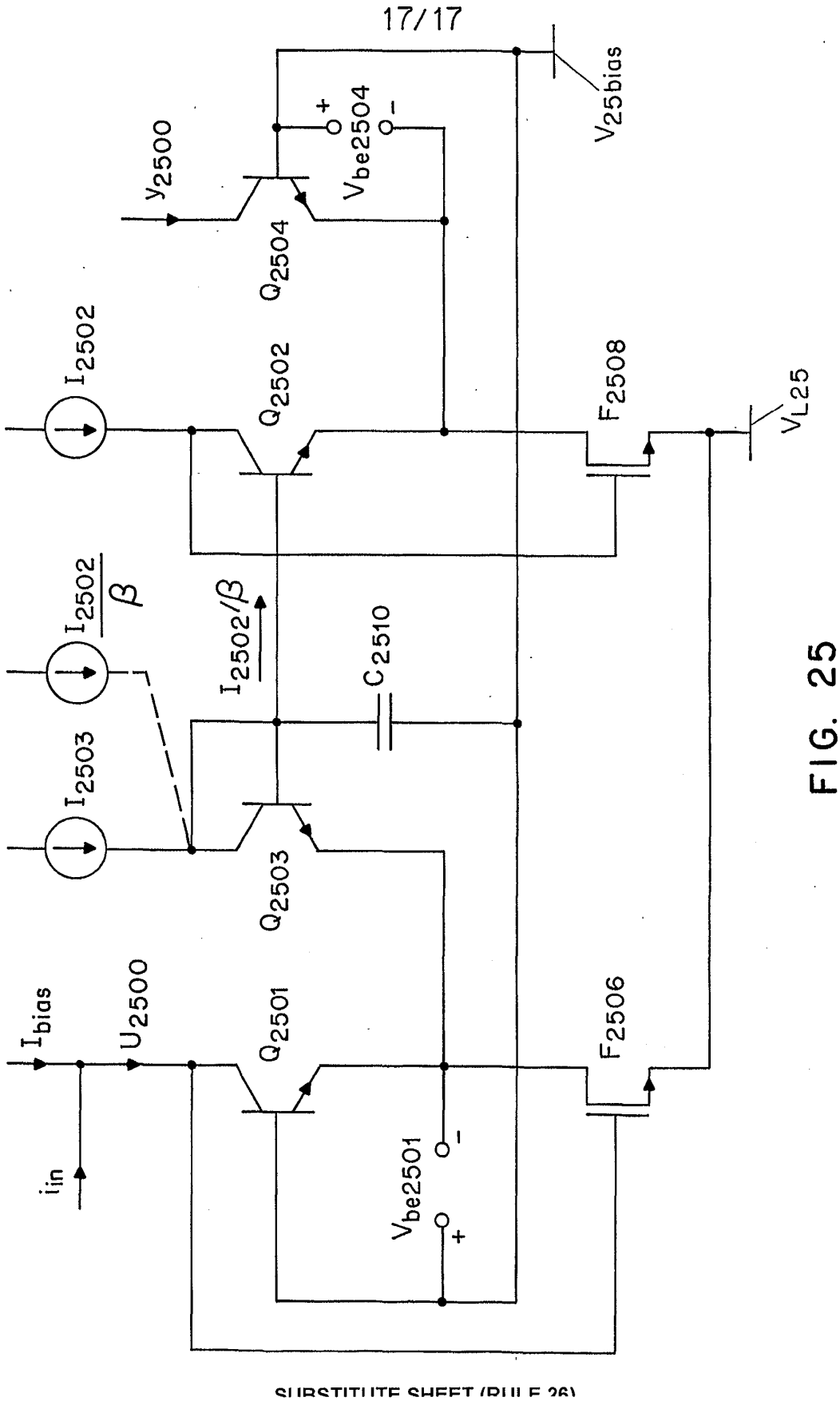

FIG. 25

Google Exhibit 1004, Page 755 of 1125

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US01/03852

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :H03K 5/00, H03F 3/45
US CL :327/50, 103, 552, 553, 554, 555, 556, 557, 558, 559, 530, 306
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 327/50, 103, 552, 553, 554, 555, 556, 557, 558, 559, 530, 306

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

USPTO APS EAST

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 6,011,418 A (SINISCALCHI) 04 January 2000 (04.01.2000), fig. 1.	8 --- 1-7, 9-78
Y	US 5,572,163 A (KIMURA et al) 05 November 1996 (05.11.1996), fig. 1.	11-23
Y	US 5,930,374 A (WERRBACH et al) 27 July 1999 (27.07.1999), figs. 1-4.	24-28, 63-67
Y	US 5,229,721 A (STADE) 20 July 1993 (20.07.1993), fig. 1.	32-35, 71-74
Y	US 5,414,776 A (SIMS, JR.) 09 May 1995 (09.05.1995), fig. 2.	38-39, 47, 77-78
Y	US 5,757,229 A (MITZLAFF) 26 May 1998 (26.05.1998), fig. 1.	1-7, 40-46, 50-62

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search	Date of mailing of the international search report
30 APRIL 2001	12 JUN 2001

Name and mailing address of the ISA/US	Authorized officer
Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231	DINH LE
Facsimile No. (703) 305-3230	Telephone No. (703) 305-3790

Form PCT/ISA/210 (second sheet) (July 1998)★

Google Exhibit 1004, Page 756 of 1125

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US01/03852

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,467,045 A (TANIGAWA) 14 November 1995 (14.11.1995), fig. 4.	29-31, 68-70
Y	US 5,155,353 A (PAHR) 13 October 1992 (13.10.1992), fig. 1.	36-37, 75-78
Y	US 5,942,035 A (OKANOBU) 24 August 1999 (24.08.1999), fig. 6.	48-49

Google Exhibit 1004, Page 757 of 1125

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 7

Complete if Known	
Application Number	12/350,817
Filing Date	January 8, 2009
First Named Inventor	James Ashley Jr.
Art Unit	2473
Examiner Name	Kwang Bin Yao
Attorney Docket Number	081221-011500/US

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Grant/Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US- 2007-0244633A1	10-18-2007	Phillips et al.	
		US- 7,848,765B2	12-07-2010	Phillips et al.	
		US- 7,539,742B2	05-26-2009	Spector	
		US- 6,970,922B1	11-29-2005	Spector	
		US- 7,870,229B2	01-11-2011	Spector	
		US- 2002-0072356A1	06-13-2002	Yamashita et al.	
		US- 2002-0059434A1	05-16-2002	Karaoguz et al.	
		US- 6,014,089	01-11-2000	Tracy et al.	
		US- 6,496,575B1	12-17-2002	Vasell et al.	
		US- 6,717,513B1	04-06-2004	Sandelman	
		US- 2001-048755A1	12-06-2001	Weins et al.	
		US- 7,323,982	01-29-2003	Staton	
		US- 7,286,929	07-23-2007	Staton	
		US- 7,138,916	11-21-2006	Schwartz	
		US- 5,986,508A	11-1999	Nevin et al.	
		US- 6,531,924	03-2003	Aparin	
		US- 7,064,614	08-2007	Beffa	
		US- 3,518,674	06-1970	Moorhead et al.	
		US- 3,772,668	11-1973	Smith	
		US- 4,217,668	08-1980	Freeny, Jr.	
		US- 4,224,596	09-1980	Knickel	
		US- 4,688,026	08-1987	Scribner et al.	
		US- 4,884,208	11-1989	Marinelli et al.	
		US- 5,142,281	08-1992	Park	
		US- 5,365,516	11-1994	Jandrell	
		US- 5,627,517	05-1997	Theimer et al.	
		US- 5,917,405	06-1999	Joao	

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Sheet 2 of 7

Complete if Known	
Application Number	12/350,817
Filing Date	January 8, 2009
First Named Inventor	James Ashley Jr.
Art Unit	2473
Examiner Name	Kwang Bin Yao
Attorney Docket Number	081221-011500/US

U.S. PATENT DOCUMENTS

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		US- 6,043,748	03-2000	Touchton et al.	
		US- 6,236,358	05-2001	Durst et al.	
		US- 6,421,001	07-2002	Durst et al.	
		US- 6,509,830	01-2003	Elliot et al.	
		US- 2005-0159883A1	07-2005	Humphries et al.	
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		US- 2004-0208344	10-2004	Liu et al.	
		US- 6,597,365	07-2003	Baecke et al.	
		US- 7,174,301	02-2007	Florence et al.	
		US- 4,847,773	07-1989	van Helsdingen et al.	
		US- 6,617,969	09-2003	Tu et al.	
		US- 6,665,613	12-2003	Duvall	
		US- 6,674,368	01-2004	Hawkins et al.	
		US- 6,812,824	11-2004	Goldinger et al.	
		US- 2001-0040513	11-2001	McDonald	
		US- 2002-0147006	10-2002	Coon et al.	
		US- 2002-0196151	12-2002	Troxler et al.	
		US- 2003-0149526	08-2003	Zhou et al.	
		US- 2003-0163287	08-2003	Vock et al.	
		US- 2004-0201454	10-2004	Waterhouse et al.	
		US- 6,009,330	12-1999	Kennedy, III et al.	
		US- 6,055,426	04-2000	Beasley	
		US- 6,617,969	09-2003	Mi et al.	
		US- 6,717,513	04-2004	Shprecher et al.	
		US- 2004-0196182	10-2004	Unnold	
		US- 2006-0109107	05-2006	Staton et al.	
		US- 4,819,860	04-1989	Hargrove et al.	

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Sheet 3 of 7

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Application Number	12/350,817
Filing Date	January 8, 2009
First Named Inventor	James Ashley Jr.
Art Unit	2473
Examiner Name	Kwang Bin Yao
Attorney Docket Number	081221-011500/US

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Grant/Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US- 4,958,645	09-1990	Cadell et al.	
		US- 6,243,039	06-2001	Elliot	
		US- 5,389,934	02-1995	Kass	
		US- 5,528,248	06-1996	Steiner et al.	
		US- 5,642,303	06-1997	Small et al.	
		US- 5,670,944	09-1997	Myllymaki	
		US- 5,699,244	12-1997	Clark, Jr. et al.	
		US- 5,796,634	08-1998	Craport et al.	
		US- 5,917,414	06-1999	Oppelt et al.	
		US- 5,917,415	06-1999	Atlas	
		US- 5,938,721	08-1999	Dussell et al.	
		US- 6,002,994	12-1999	Lane et al.	
		US- 6,102,856	08-2000	Groff et al.	
		US- 6,177,905	01-2001	Welch	
		US- 6,198,394	03-2001	Jacobsen et al.	
		US- 6,317,605	11-2001	Sakuma	
		US- 6,446,004	09-2002	Cao et al.	
		US- 6,469,116	12-2002	Farringdon et al.	
		US- 6,579,231	06-2003	Phipps	
		US- 6,611,206	08-2003	Eshelman et al.	
		US- 6,625,457	09-2003	Raith	
		US- 6,646,873	11-2003	Chu-Chia et al.	
		US- 6,826,473	11-2004	Burch et al.	
		US- 6,853,911	02-2005	Sakarya	
		US- 6,856,898	02-2005	Tompkins et al.	
		US- 6,867,733	03-2005	Sandhu et al.	
		US- 6,868,074	03-2005	Hanson	

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Sheet 4 of 7

Complete if Known	
Application Number	12/350,817
Filing Date	January 8, 2009
First Named Inventor	James Ashley Jr.
Art Unit	2473
Examiner Name	Kwang Bin Yao
Attorney Docket Number	081221-011500/US

U.S. PATENT DOCUMENTS

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		US- 6,868,410	03-2005	Fortin et al.	
		US- 6,909,891	06-2005	Yamashita et al.	
		US- 2001-0027378	10-2001	Tennison et al.	
		US- 2001-0032236	10-2001	Lin	
		US- 2002-0059434	05-2002	Karaoguz et al.	
		US- 2003-0013462	01-2003	Adachi	
		US- 2002-0068544	06-2002	Barzilay et al.	
		US- 2004-0075553	04-2004	Ono	
		US- 2004-0152460	08-2004	La et al.	
		US- 2004-0220731	11-2004	Tucker et al.	
		US- 2005-0275549	12-2005	Barclay et al.	
		US- 6,904,363	06-2005	Inbar et al.	
		US- 2001-0046884	11-2001	Yoshioka	
		US- 2004-0248586	03-2005	Patel et al.	
		US- 2005-0068227	03-2005	Caspi et al.	
		US- 5,235,633	08-1993	Dennison et al.	
		US- 5,388,147	02-1995	Grimes	
		US- 5,546,445	08-1996	Dennison et al.	
		US- 5,617,944	04-1997	McTaggart	
		US- 5,621,785	04-1997	Norimatsu	
		US- 5,835,907	11-1998	Newman	
		US- 5,918,180	06-1999	Dimino	
		US- 5,938,721	08-1999	Dussell et al.	
		US- 5,946,611	08-1999	Dennison et al.	
		US- 6,073,013	06-2000	Agre et al.	
		US- 6,198.914	03-2001	Saegusa	
		US- 6,265,978	07-2001	Atlas	

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Sheet 5 of 7

Complete if Known	
Application Number	12/350,817
Filing Date	January 8, 2009
First Named Inventor	James Ashley Jr.
Art Unit	2473
Examiner Name	Kwang Bin Yao
Attorney Docket Number	081221-011500/US

U.S. PATENT DOCUMENTS

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		US- 6,300,875	10-2001	Schafer	
		US- 6,317,605	11-2001	Sakuma	
		US- 6,324,404	11-2001	Dennison et al.	
		US- 6,330,446	12-2001	Mori	
		US- 6,360,164	03-2002	Murayama	
		US- 6,438,382	08-2002	Boesch et al.	
		US- 6,477,363	11-2002	Ayoub et al.	
		US- 6,516,198	02-2003	Tendler	
		US- 6,577,897	06-2003	Shurubura et al.	
		US- 6,599,243	07-2003	Wolterman et al.	
		US- 6,714,133	03-2004	Hum et al.	
		US- 6,774,795	08-2004	Eshelman et al.	
		US- 6,847,822	01-2005	Dennison et al.	
		US- 6,859,653	02-2005	Ayoub et al.	
		US- 6,922,565	07-2005	Rhodes et al.	
		US- 6,944,464	09-2005	Muranaga	
		US- 6,983,154	01-2006	Niwa	
		US- 7,013,151	03-2006	Hirokawa	
		US- 2002-0028702	03-2002	Kim	
		US- 2002-0039903	04-2002	Niwa	
		US- 2002-0111171	08-2002	Boesch et al.	
		US- 2004-0024522	02-2004	Walker et al.	
		US- 2004-0036599	02-2004	Martin et al.	
		US- 2004-0043774	03-2004	Lee	
		US- 2004-0082840	04-2004	Chen	
		US- 2004-0176106	09-2004	Tendler	
		US- 2004-0180668	09-2004	Owens et al.	

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Sheet 6 of 7

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Filing Date	January 8, 2009
First Named Inventor	James Ashley Jr.
Art Unit	2473
Examiner Name	Kwang Bin Yao
Attorney Docket Number	081221-011500/US

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Grant/Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US- 2004-0249560	12-2004	Kim et al.	
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Examiner Initials*	Cite No.[1]	Foreign Patent Office Action Country Code[3] Number[4] Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	1	WO2003-049060A	06-12-2003	Lahaye et al.		
	2	WO2001-46926A	01-28-2001	Osterhuber et al.		
	3	WO2001-35190A	05-17-2001	StatSignal Systems		
	4	DE19960219	06-05-2001	Eisenlohr et al.		
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	8	EP1345148A	08-17-2003	Nokia Corp.		

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.
[1] Applicant's unique citation designation number (optional). [2] Applicant is to place a check mark here if English language Translation is attached.
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Sheet 7 of 7

Complete if Known	
Application Number	12/350,817
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First Named Inventor	James Ashley Jr.
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Examiner Name	Kwang Bin Yao
Attorney Docket Number	081221-011500/US

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	17	EP1345148	09-2003	Nokia Corp.		
	18	GB2369966	06-2002	Roke Manor		
	19	WO0041428	07-13-2000	Ericsson, Inc.		

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include the name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published	T[2]
	1	Wirelesswerx TrakWERK II SMS/Satellite Dual Mode Tracking Unit, Manual, November 17, 2003, pages 1-20.	
	2	Wirelesswerx Training Outline, Manual, October 29, 2004, pages 1-44.	
	3	Wirelesswerx System Description Tucson01, Manual, February 8, 2006, pages 1-10.	
	4	Wirelesswerx Requirements Specification Tucson01, Manual, February 27, 2006, pages 1-35.	
	5	Wirelesswerx Technical Overview, Manual, September 10, 2003, pages 1-19.	

Examiner Signature		Date Considered	

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FR Cite 16

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 915 398 A1

(12) DEMANDE DE BREVET EUROPEEN

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(54) Montre - bracelet de sécrité perfectionnée

(57) Montre-bracelet de sécurité perfectionnée: du type qui comprend un corps de montre dont les fonctions signalées par les aiguilles principales et secondaires du cadran de la montre sont gouvernées par des boutons, corps de montre qui est uni à un bracelet divisé en parts reliées entres elles. Les parts du bracelets sont des modules (circuits) micro-électronique reliées entres elles par une connectique filaire à double fil, formant un circuit électronique, et à la montre par un système de fermeture à fiche qui s'intègre dans une alvéole du système de fermeture que présente le boîtier de la montre; dans une des parts du bracelet se trouve une pastille stéthoscopique- capteur de tension artérielle qui se reflète dans un petit compteur avec aiguille se trouvant sur le cadran de la montre, muni d'un avertisseur sonore pour signaler lorsque la tension artérielle dépasse la limite programmée.

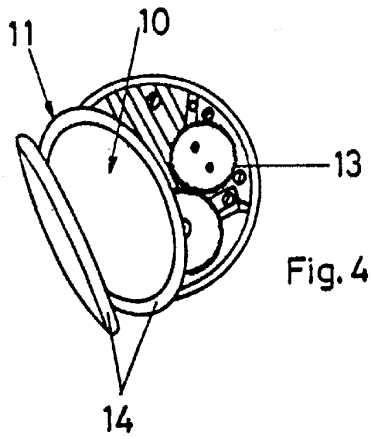

Fig. 4

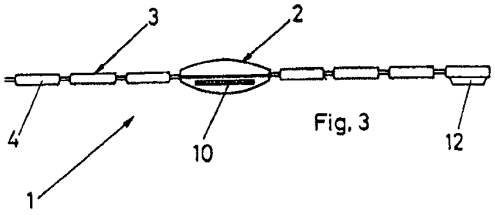

Fig. 3

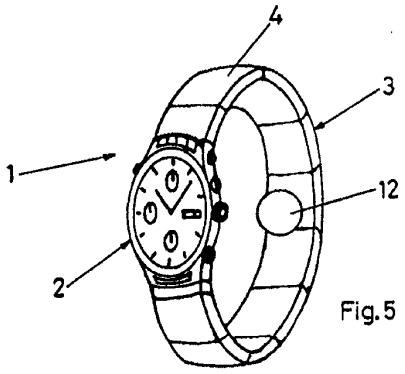

Fig. 5

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Description

[0001] La présente invention a pour objet une montre-bracelet de sécurité perfectionnée avec des prestations micro-électroniques.

[0002] La montre-bracelet de l'invention présente des prestations variées grâce à un micro-chip (puce) et quelques modules micro-électroniques placés dans le double fond dont dispose la montre et/ou dans un bracelet modulable en chaîne.

[0003] A présent, on n'a pas connaissance de montres qui présentent ces caractéristiques et qui permettent une série de fonctions de base et en plus fondamentales pour la personne qui porte ladite montre.

[0004] La montre de l'invention fonctionne par un mouvement mécanique ou automatique et le circuit micro-électronique de base est formé par un micro-chip (puce) qui est installé dans le double fond dont dispose le boîtier de la montre.

[0005] Ce micro-chip (puce) est chargé par un software (logiciel) et peut mettre en mémoire l'essentiel des renseignements que le propriétaire de la montre désire enregistrer, par exemple: son dossier médical et autres informations utiles ou personnelles.

[0006] Cet enregistrement ou chargement d' informations à loger dans la montre peut être effectué par le vendeur-dépositaire de la société commerciale horlogère au moment de la vente et modifié dans n'importe quel point de vente au moyen d'un système logiciel (de software) et sera d'un accès facile pour l'hôpital, la police etc., en cas d'urgence.

[0007] Le micro-chip (puce) constitue le circuit de base pour une série de micro-circuits électroniques intégrés, qui

- soit noyé dans une matière isolante et flexible dans le(s) module(s) du bracelet et/ou de la chaîne de la montre
- soit dans le(s) module(s) métalliques(s) (*Cage Faraday*) comme protection contre les champs magnétiques.

seront connectés par un "bus de communication", c'est-à-dire par une connectique filaire, et permettront d'atteindre une ample gamme de fonctions additionnelles, étant donné leur répartition parmi les modules composant le bracelet et/ou la chaîne de la montre.

[0008] Chaque module "circuit électronique" du bracelet et/ou de la chaîne de la montre est connecté l'un à l'autre par une connectique filaire à double fil et à la montre par un système de fermeture à fiche. Cette fiche sera engagée dans une alvéole d'un système de verrouillage du boîtier de la montre pour établir le contact.

[0009] Ainsi, selon les désirs du propriétaire de la montre, le bracelet et/ou la chaîne de la montre peuvent être composés de différents types de modules déjà chargés par software (logiciel) ou à charger ultérieurement, pour les fonctions suivantes, à titre d'exemple:

- Un module - indicateur
- Un module - radio (récepteur/émetteur) voir bouton d'alarme (détresse)
- Un module - capteur stéthoscopique de tension artérielle
- Un module vide à charger
- et toute autre sorte de modules, selon les services que cette montre-bracelet et/ou de poche doit offrir.

[0010] La montre est munie d'un bouton d'alarme (de détresse) pour signaler la détresse ou un danger imminent, bouton qui se trouve sur le côté gauche du boîtier de la montre.

Applications:

[0011]

a) Lorsque la personne en détresse appuie sur ce bouton, qui est connecté avec le module radio (émetteur / récepteur) ce module micro-électronique émet un signal qui est capté soit:

- par un système accessoire du téléphone de la personne, servant de relais pour retransmettre l'appel de détresse ou de danger au central de secours, (soit une société de protection avec qui la personne a souscrit un contrat à ce sujet, soit le central téléphonique d'assistance lorsque la personne se trouve dans une chambre d'hôpital ou dans une maison de retraite, etc.), soit

- par un système de radio capté par un système de satellite GPS (Global Positioning System = système de positionnement mondial) ou n'importe quel autre système) ou un centre de transmission régional qui retransmet l'appel de détresse au centre de secours d'une société de protection avec qui la personne a souscrit un contrat, afin que cette société de protection et/ou le central GPS local, disposant d'un équipement/tableau de détection GPS qui lui permet de localiser un appel de détresse envoyé dans un certain périmètre, puisse intervenir rapidement.

b) Pour faciliter la recherche de personnes

- ayant un problème de santé (danger de syncope, perte de mémoire et/ou autres raisons) ou

- qui pratiquent un sport dangereux, (ski alpin, par exemple)

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cet émetteur/ récepteur répondra automatiquement à un signal de recherche (dont le code est connu par la société de protection, avec qui la personne qui utilise la montre a souscrit un contrat et/ou le service de tourisme dans une station de ski) permettant ainsi la localisation de la personne recherchée.

[0012] GPS. - les 24 satellites GPS qui tournent sur six orbites à 18.000 km d'altitude, équipés d'horloges atomiques, d'ordinateurs et d'émetteurs/récepteurs, transmettent la position d'un objet mille fois par seconde. En mesurant le temps qu'il faut pour recevoir chaque signal, un récepteur basé à terre peut déterminer la distance qui le sépare du satellite. En combinant les données fournies par plusieurs satellites on peut calculer très exactement sa latitude, sa longitude et éventuellement son altitude.

[0013] L'armée américaine précise à l'attention des utilisateurs civils que les signaux du GPS ont une marge d'erreur de 100 mètres. En réalité, cette marge est corrigée par un réseau de stations terrestres, qui permettent finalement une précision de l'ordre d'un mètre. N'importe qui peut avoir accès à ce système, totalement gratuit.

[0014] D'après Peter Huber, un spécialiste américain de la technologie en question, si la demande augmente pour ce genre d'équipement, les prix vont automatiquement chuter. Assurément, le GPS deviendra alors une option aussi banale qu'un simple autoradio.

[0015] La montre est dotée d'une pastille stéthoscopique - capteur de tension artérielle permettant de mesurer automatiquement la tension artérielle.

[0016] Ce capteur, incorporé dans le bracelet, étant en constant contact avec l'artère de l'avant-bras et programmé par un module "circuit électronique" vérifiable sur un petit compteur (no 2) de la montre, grâce au module afficheur, est muni d'un mécanisme de sonnerie qui signale une anomalie dès que la tension dépasse la limite fixée (comme le mécanisme de réveil d'une montre).

[0017] Ce système permettrait une intervention rapide en cas d'une soudaine haute pression dont souffre plus d'un tiers de la population du monde industrialisé et qui représente un danger constant d'attaque cérébrale ou autres suites. Ou en cas d'une irrégularité de tension pendant une durée dépassant le temps programmé.

[0018] La montre dispose d'un module afficheur.

[0019] Tout mode d'affichage, soit par aiguille sur le cadran ou sur un des compteurs de la montre peut être activé. En plus, un système de "cadran ou de fenêtre électroliquide peut être programmé pour la réception de messages ou autres prestations.

[0020] La montre dispose d'un système de verrouillage.

Afin d'éviter toute possibilité d'interférences avec des appareils de navigation et autres appareils, le module radio (émetteur / récepteur) et/ou tout autre module peut être bloqué par un système de verrouillage par code manuel réglable par le bouton ou électroniquement par téléchargement.

[0021] En cas de besoin de protection d'un malade, un deuxième code peut être introduit pour bloquer également l'ouverture du bracelet, permettant ainsi de localiser rapidement une personne ayant des pertes de mémoire ou avant que ne lui arrive un incident grave. Si cette personne arrivait à ouvrir le bracelet de force, ou si en cas d'accident, une irrégularité de la tension artérielle se prolongeait au-delà du temps programmé, le système d'alarme se mettrait immédiatement en fonction et les personnes chargées de la protection du malade pourraient intervenir rapidement.

[0022] Afin de pouvoir comprendre plus facilement non seulement la constitution, mais également l'usage proprement dit de la montre d'invention, la suite se réfère à l'emploi pratique de réalisation, c'est-à-dire à l'exécution uniquement énumérative mais nullement limitative de cette dernière, telle et comment elle est démontrée dans les dessins ci-joints:

Figure 1: montre une vue d'ensemble de la montre d'invention

Figure 2: montre une vue perspective d'un maillon du bracelet de la montre d'invention

Figure 3: montre une vue latérale de la montre

Figure 4: montre une vue perspective du boîtier ouvert de la montre

Figure 5: montre une vue perspective de la montre.

[0023] Les dessins se réfèrent aux parts comme suit: la montre [1], constituée par un cadran [2] et un bracelet [3]

[0024] Le bracelet [3] étant composé par des parts ou pièces [4], dont chacune d'elles constitue un module de circuit électronique.

[0025] Les parts ou modules [4] sont connectés entre eux par une connectique filaire à double fil [5] et à la montre par un système de fermeture réglé par un bouton [6] qui définit un verrouillage.

[0026] La montre au niveau du cadran présente des boutons latéraux [7], destinés au réglage normal de la montre et un bouton d'alarme [8], connectés aux compteurs [9] qui apparaissent sur le cadran.

[0027] La montre contient un micro-chip [10] installé dans le double fond [11] du boîtier de la montre, sur lequel sont emmagasinées les informations que le propriétaire de la montre désire enregistrer.

[0028] Dans le bracelet [3] de la montre [1] se trouve une pastille stéthoscopique[12] - capteur de tension artérielle, dont les détails sont représentés sous figure 5.

[0029] Dans le boîtier de la montre apparaît un mouvement [13] de montre, en outre, le boîtier se ferme par un double couvercle [14].

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[0030] La nature de l'invention étant suffisamment décrite, ainsi que la manière de la réaliser en pratique, il faut faire remarquer que les dispositions indiquées antérieurement et représentées dans les dessins ci-joints sont susceptibles à des modifications de détails à condition qu'elles n'altèrent pas le principe fondamental.

Revendications

1. La montre-bracelet de sécurité perfectionnée; du type qui comprend un corps de montre dont les fonctions sont signalées par les aiguilles principales et secondaires du cadran de la montre, qui se trouve unie par un bracelet, composé de parts reliées entre elles; caractérisées parce que les parts du bracelet sont des modules micro-électroniques reliés entre eux par une connectique filaire à double fil, formant un circuit électronique, et à la montre par un système de fermeture à fiche qui s'intègre dans l'alvéole d'un système de fermeture incorporé dans le boîtier de la montre; contentant dans une des parts du bracelet une pastille stéthoscopique - capteur de tension artérielle - qui est reflétée dans un petit compteur avec aiguille, figurant sur le cadran, avec un mécanisme de sonnerie d'avertissement lorsque la tension artérielle dépasse les limites programmées.

2. Montre-bracelet de sécurité perfectionnée selon la revendication [1], caractérisée parce que la pastille-capteur de tension artérielle est disposée dans la face intérieure du bracelet à un point où la pastille est en contact permanent avec l'artère de l'avant-bras.

3. Montre-bracelet de sécurité perfectionnée selon la revendication [1], caractérisée parce que le corps de la montre est doté d'un module indicateur, programmable pour la réception, tels que messages.

4. Montre-bracelet de sécurité perfectionnée selon la revendication [1], caractérisée parce qu'elle est dotée d'un module radio, émetteur / récepteur qui peut être bloqué par un système de fermeture avec code manuel réglable par un bouton ou poussoir disposé dans le corps de la montre ou électroniquement par téléchargeur.

5. Montre-bracelet de sécurité perfectionnée selon la revendication [1], caractérisée parce qu'elle contient un micro-chip installé dans le double fond du boîtier de la montre sur lequel les informations que le propriétaire de la montre désire enregistrer peuvent être emmagasinées.

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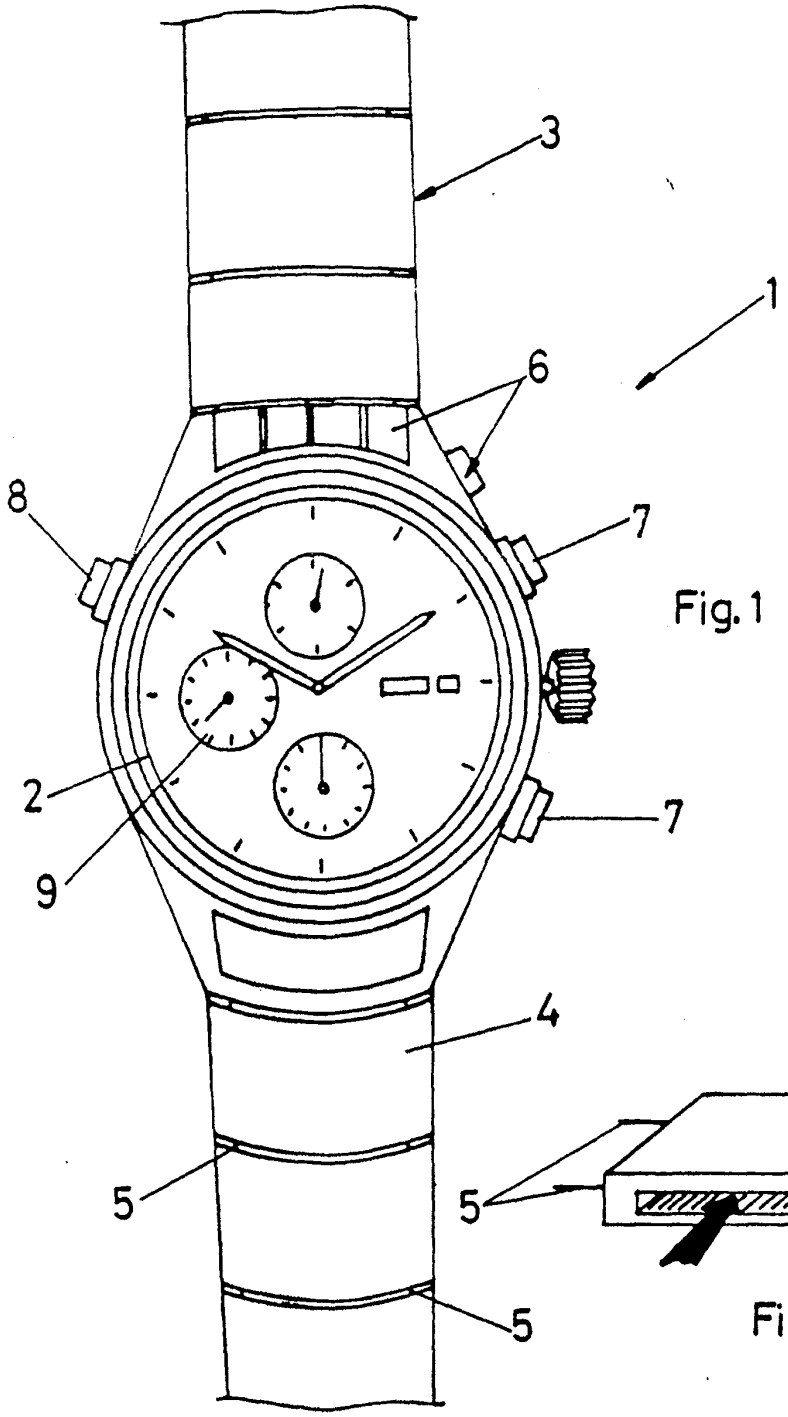

Fig. 1

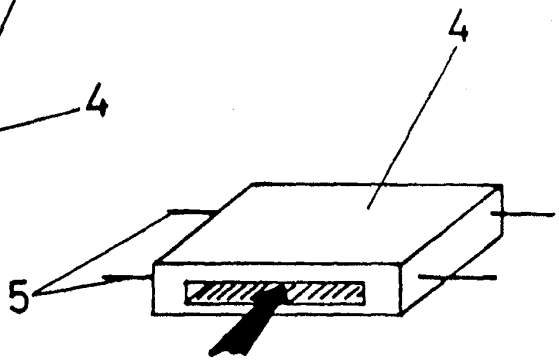

Fig. 2

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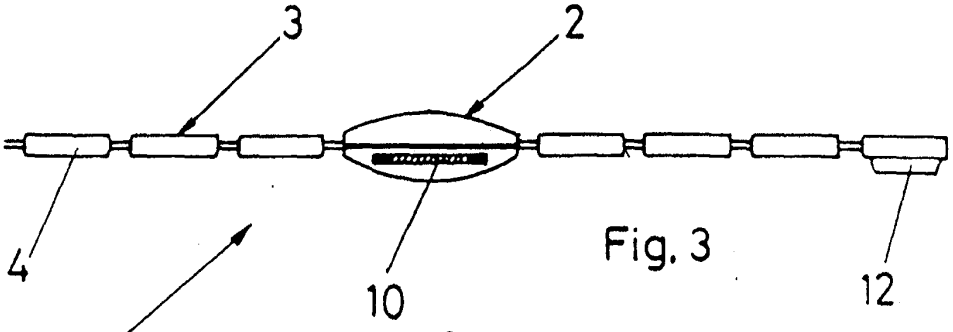

Fig. 3

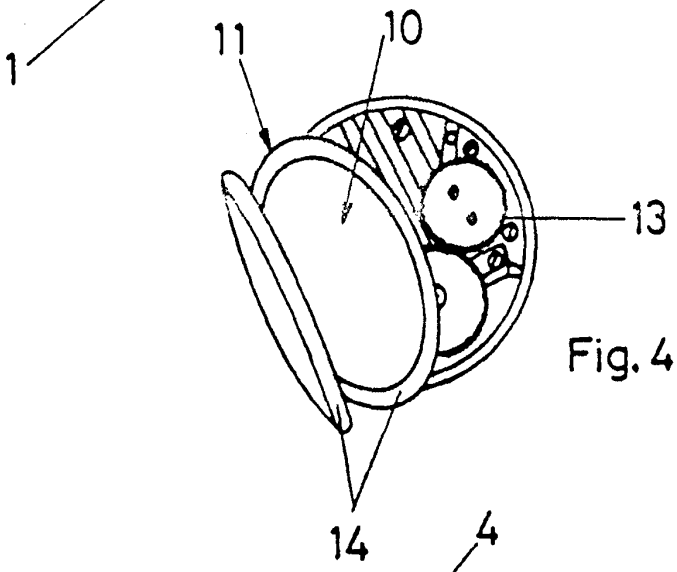

Fig. 4

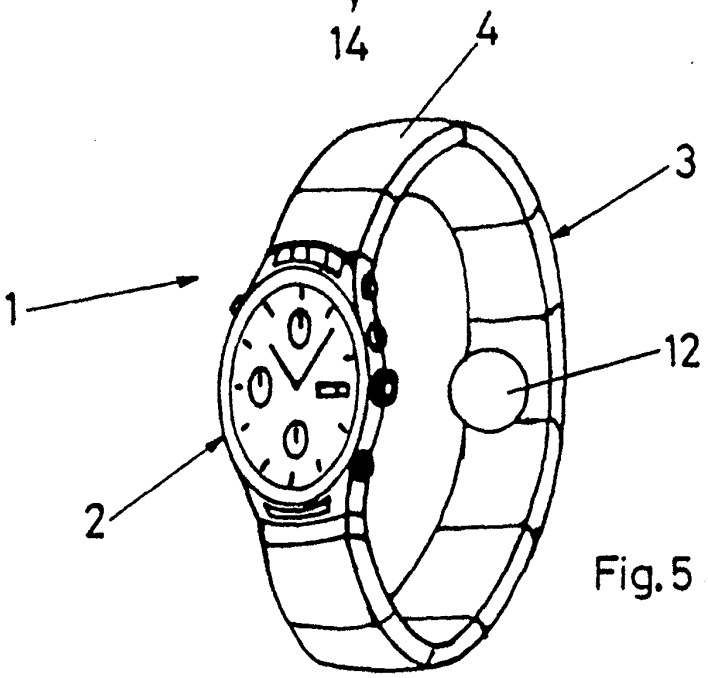

Fig. 5

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Office européen des brevets

RAPPORT DE RECHERCHE EUROPEENNE

Numéro de la demande
EP 97 12 1022

DOCUMENTS CONSIDERES COMME PERTINENTS

Catégorie	Citation du document avec indication, en cas de besoin, des parties pertinentes	Revendication concernée	CLASSEMENT DE LA DEMANDE (Int.Cl.6)
Y	GB 2 148 617 A (HIRSCH HERMANN) * page 1, ligne 119 - page 2, ligne 87 * ---	1-5	G04G1/00
Y	FR 2 284 149 A (DELTA TRANSNATIONAL INC) * page 2, ligne 24 - page 6, ligne 2; figures 1-9 * ---	1	
Y	CH 616 801 A (HEUER-LEONIDAS S.A.) * figure 5 * ---	1,2	
Y	PATENT ABSTRACTS OF JAPAN vol. 017, no. 357 (P-1568), 6 juillet 1993 & JP 05 052975 A (FUJITSU GENERAL LTD), 2 mars 1993, * abrégé * ---	1,3,4	
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Y	US 5 337 290 A (VENTIMIGLIA PHILLIP ET AL) * figure 5 * ---	5	DOMAINES TECHNIQUES RECHERCHES (Int.Cl.6) G04G
Y	DE 36 08 239 A (DS ELEKTRONIK GMBH) * figures 1-5 * -----	4	

Le présent rapport a été établi pour toutes les revendications

Lieu de la recherche	Date d'achèvement de la recherche	Examinateur
LA HAYE	6 mars 1998	Exelmans, U

CATEGORIE DES DOCUMENTS CITES

X : particulièrement pertinent à lui seul
Y : particulièrement pertinent en combinaison avec un autre document de la même catégorie
A : arrière-plan technologique
O : divulgation non-écrite
P : document intercalaire

T : théorie ou principe à la base de l'invention
E : document de brevet antérieur, mais publié à la date de dépôt ou après cette date
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(54) A method and a system for presenting reminders in a portable device

(57) The present invention relates to a method for activating actions. The method comprises the steps of defining an action, a portable device (9) related to it and, as a condition for activating the action, at least one item of position data, and determining the position of the portable device (9). When the position of the portable device (9) corresponds to the position data defined in an action, said action is activated. In the method, the information about actions is processed in a server (2), from which a data transmission connection can be set up to the device, in which the action data is transmitted from the server (2), to be activated.

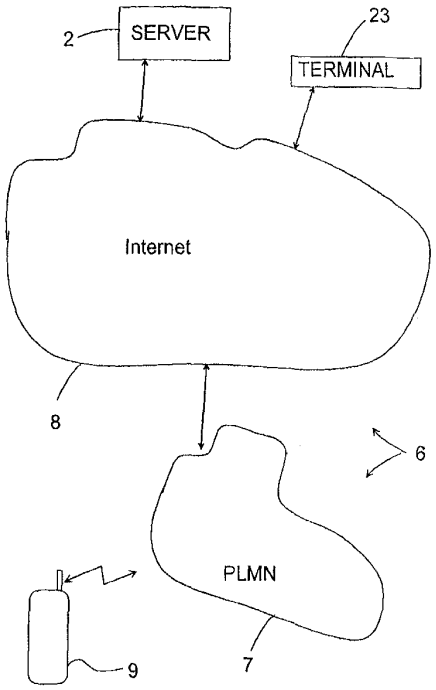

Fig. 1

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Description

[0001] The present invention relates to a method for activating actions, for example, presenting reminders, by defining an action, a portable device related to it, and at least one item of position data as a condition for activating the action, and by determining the position of the portable device, wherein when the position of the portable device corresponds to the position data defined for an action, said action is activated. Further, the invention relates to a system comprising means for activating actions, a related portable device and at least one item of position data being defined for the action as a condition for activating the action, and which system further comprises positioning means for determining the position of the portable device, and means for comparing the position of the portable device and the position data defined for an action, wherein said action is arranged to be activated when the position of the portable device corresponds to the position data defined for an action. Further, the invention relates to a server to be used in a system comprising means for activating actions, a related portable device and at least one item of position data being defined for the action as a condition for activating the action, and which system further comprises positioning means for determining the position of the portable device, and means for comparing the position of the portable device and the position data defined for an action, wherein said action is arranged to be activated when the position of the portable device corresponds to the position data defined for an action. Further, the invention relates to a portable device comprising means for activating actions, a related portable device and at least one item of position data being defined for the action as a condition for activating the action, and which portable device is arranged to be used in a system comprising positioning means for determining the position of the portable device, and means for comparing the position of the portable device and the position data defined for an action, wherein said action is arranged to be activated when the position of the portable device corresponds to the position data defined for an action.

[0002] Portable electronic devices are known to comprise various calendar functions and reminder functions. Examples of such devices to be mentioned in this context include portable communication devices, such as Nokia Communicator 9210, personal digital assistants (PDA), laptop PCs, and palmtop PCs. Also several mobile phones today have calendar functions and reminder functions.

[0003] The user can use the calendar functions for recording various events, such as meetings, appointments, trips, visits, *etc.* for the respective point of time in a memory of the device. Normally, it is possible to provide such calendar notes with a reminder, wherein the device will remind the user of an event, for example the beginning of a meeting.

[0004] One drawback in the devices equipped with such calendar functions is, for example, the fact that it is not possible to define such events which are not dependent on a particular point of time but which are rather related to a particular location, to at least some extent. For example, a person would like to be reminded of doing the shopping. In the calendar functions, the person could make an entry of this, for example, for the current date, and a reminder for a time estimated in advance to be suitable, for example for the time when he/she will probably be on his/her way home from work. However, the person is not necessarily close to a shop when the reminder comes; for example, he/she may have been delayed when leaving the place of work. Thus, the reminder may come too early and the person may forget it. On the other hand, the reminder may come so late that the person has already passed the shop and may already be at home when the reminder comes. On the other hand, an event may be such that it is not easy to define a suitable time for reminding of it. Such a situation is, for example, the purchase of an item in such a place which is not close to a location where the person has daily errands. In this case the person would like to be reminded when he/she is close to such a place. With conventional calendar functions and reminder functions, it is not possible to record such an event so that the reminder would, for sure, come at a suitable moment.

[0005] Sometimes, in families and between friends, there may be situations in which there is an errand to run, for example to buy travel tickets or to do the shopping. In such a case, it would be advantageous that the errand would be run by the person best suited for doing it. Such a person is, for example, a person who is moving in a region where the errand can be run. However, it is not always known if there is anybody close to such a location, wherein the person commissioning the errand should inquire several persons, for example by phone, who could run the errand. Such a round of inquiries may require several telephone calls, most of which are unnecessary for running the errand. This will cause unnecessary costs and take time of the person commissioning the errand as well as the persons contacted.

[0006] US patent 6,177,905 presents a system, in which the user of a wireless device, such as a wireless phone, a car phone, or another programmable portable device, may set reminders based on location. Thus, the user enters a desired reminder and sets coordinate data for it, on the basis of which the user wants the reminder to be presented in the device. The device is provided with a positioning receiver for receiving signals from satellites of the GPS system and for performing positioning of the device. This positioning data is transmitted to the device in which the data is compared with the coordinate data related to the reminders. If the coordinate data of a reminder corresponds to the current position data of the device, the message related to the reminder is presented to the user. In this way, the user can receive reminders, for example, when approaching a post office

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or a shop. In the coordinate data, it is also possible to define a range (distance from the location of the coordinates), wherein the reminder is given when the user comes within this range. However, this system has the disadvantage that, for example, location-specific reminders can be entered in the device by the user only. Furthermore, the reminders take no notice of the moment of time when the user is in the location complying with the coordinate data defined in the reminder. Thus, the reminder may be useless, if the errand related to the reminder cannot be run at the time in question, for example when the shop is closed.

[0007] It is an aim of the present invention to provide a method and a system for performing an action handling application in a server. In an advantageous embodiment of the invention, the user can enter data about location-specific actions such as reminders which can be supplemented with time data. The action can thus be restricted to apply to a given time (time range) only. Furthermore, information about actions can also be entered by other persons than the user of the device. The invention is based on the idea that the action handling application is run in a server, from which a data transmission connection can be set up to a portable device, wherein information about actions defined in the action handling application is transmitted to the portable device. To put it more precisely, the method according to the present invention is primarily characterized in that the information about actions is processed in a server, from which a data transmission connection can be set up to the device, to which the information about the action is transmitted from the server, to be activate the action. The system according to the present invention is primarily characterized in that the system comprises a server with means for processing information about actions, and means for transmitting information related to actions from the server to the device in which the action is arranged to be activated. The server according to the present invention is primarily characterized in that the server comprises means for processing information about actions, and means for transmitting information related to actions from the server to the device in which the action is arranged to be activated. Furthermore, the portable device according to the present invention is primarily characterized in that the portable device comprises means for receiving data related to actions, which data are transmitted from the server of the system which comprises means for processing information about actions, and means for transmitting data related to actions from the server to the device in which the action is arranged to be activated.

[0008] The present invention shows remarkable advantages over solutions of prior art. In the system according to the invention, also other persons than the user of the portable device can enter information in the user's application for handling actions, such as a reminder application. Thus, definition data for a location-specific action can be transmitted to the user without the user needing to set such an action him/herself. Moreover, the person entering the action data does not need to try to reach the user to notify about such an action. In the system according to the invention, an action can also be entered in such a situation in which the user's portable device is not turned on or it is not logged in a communication network, such as a mobile communication network. Thus, the person entering the action data does not need to wait until the portable device is turned on again and the data transmission connection between it and the communication network is in operation. The action or the information related to it is transmitted to the portable device by the system.

[0009] In the method and system according to an advantageous embodiment of the invention, it is also possible to define a time in connection with the action, to be used in addition to position data as a condition for activating the action. Thus, even if the user were in a location complying with the position definition related to an action, the reminder is not presented in the portable device, if the time data does not match. Thus, the unnecessary activation of actions is avoided, for example, in a situation in which the user is close to a shop when the shop is closed. Also, in a situation in which the user is, for example, on his/her way to work at a given time and does not want actions to be activated, this time data can be utilized to prevent the activation of actions at said time. In the method according to an advantageous embodiment of the invention, it is also possible to define a validity period for the action, wherein if the conditions for activating the action are not met during the validity period defined for the action, the data related to the action is deleted. Thus, the system will not be subjected to unnecessary loading with actions which are no longer valid. In the method according to an advantageous embodiment of the invention, an action can also be deleted as a response to other events, such as the fact that the errand related to the actions has been run by another user of the system.

[0010] In the following, the invention will be described in more detail with reference to the appended drawings, in which

Fig. 1 shows a system according to an advantageous embodiment of the invention in a reduced chart,

Fig. 2 shows a server according to an advantageous embodiment of the invention in a reduced block chart,

Fig. 3 shows a portable device according to an advantageous embodiment of the invention in a reduced block chart,

Fig. 4 shows a situation, in which the invention can be applied, and

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Fig. 5 illustrates another situation, in which the invention can be applied.

[0011] Figure 1 shows a system 1 according to an advantageous embodiment of the invention. It preferably comprises at least one server 2 with means, 3, 4 for performing actions, such as reminder functions. Furthermore, the server 2 comprises communication means 5 for data transmission between the server 2 and a communication network 6. The communication network 6 can be any communication network in which data can be transferred electronically. In practical applications, the communication network 6 may comprise more than one communication network, such as a mobile communication network 7 (public land mobile network, PLMN) and the Internet data network 8. Furthermore, the structure of such communication networks 6 is prior art known by anyone skilled in the art, wherein it is not necessary to describe them in more detail in this context. Furthermore, the system comprises a portable device 9, such as a portable communication device, a laptop computer, a personal digital assistant, or the like. It is obvious that different users and even the same user may have several different portable devices, in connection with which the invention can be applied. The system also comprises positioning means 10 for determining the position of the portable device 9. In the system of Fig. 1, these means 10 comprise a GPS positioning receiver which is placed in connection with the portable device 9, but it is obvious that other positioning means can be applied as well. In some applications, the position data can be determined, for example, by means of the mobile communication network 7, preferably by means of the base stations (not shown) of the mobile communication network 7. Thus, the portable device 9 does not need to comprise positioning means, but the position data is transferred from the mobile communication network 7 to the device running the action application such as reminder application, preferably the server 2.

[0012] In the following, the invention will be described in more detail by using reminders and reminder applications as non-restrictive examples of the actions. However, the invention is not restricted to reminders but also other actions can be used and activated by the present invention. Some other actions to be mentioned here are sending a message back to the sender of the action data, send location report of the device, send a periodic location request from the device to locate it, executing another application in the device, etc.

[0013] Figure 2 shows the structure of the device 2 according to an advantageous embodiment of the invention in a reduced block chart. Figure 2 primarily shows the blocks which are significant for applying the present invention. The server 2 comprises a control block 19 for controlling the functions of the server 2. Furthermore, the server 2 comprises memory means 20 and communication means 5. Via the communication means 5, the server can communicate with the communication network 6. Preferably, the functions of the reminder application can be largely implemented as program commands by means of the program code of a control block 19. This program code is preferably stored in memory means 20 of the server. Preferably, the definitions, user-specific data *etc.* related to the reminder application are also stored in the memory means 20. Furthermore, the server 2 comprises means 21 for maintaining time data. These means 21 comprise, for example, a real time clock, but the time data can also be obtained in another way; for example, it can be received via the communication network 6 from a service providing time data (not shown).

[0014] Figure 3 shows the structure of the portable device 9 according to an advantageous embodiment of the invention in a reduced block chart.

[0015] The portable device 9 comprises communication means 11, such as mobile communication means, including a transmitter and a receiver. By these communication means 11, it is possible to exchange information relating, *e.g.* to the reminder application, between the portable device 9 and the server 2. Further, the portable device 9 comprises a processor 12, such as a micro controller unit (MCU), memory means 13, and a user interface 14. The user interface 14 preferably comprises a display 15, a keypad 16, an earpiece and/or a speaker 17, as well as a microphone 18. By means of the user interface 14, the user can enter information to the portable device 9 and receive information, for example information related to reminders. Also, the portable device 9 may comprise means 22 for maintaining time data, if polling of the data of the reminder application is also performed in the portable device 9. This polling of the information of the reminder application will be described below in this description.

[0016] With respect to the present invention, the following essential functions can be defined: the maintenance of data of the reminder applications, such as reminders, the determination of the position data of the portable device 9, the maintenance of time data, the comparison between the position data related to reminders and the position data of the portable device, as well as the comparison between possible time data related to the reminders and the current moment of time. These different functions can be implemented in different parts of the system 1. The following is a presentation of some advantageous embodiments of the invention, in which said essential functions are implemented in different locations, as well as of particular features related to these different embodiments. Reminders related to the invention can also be called location-dependent reminders, referring to such reminders for which position data is one condition for presenting. Such reminders, as such, are not necessarily dependent on calendar data, such as the date, but it is possible to define time data as one condition for presenting them. However, it is obvious that, within the scope of the invention, location-

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dependent reminders can also be entered and used in other applications than a particular reminder application, so that the invention is not limited to reminder applications only. For example, it is possible to supplement a calendar application with properties of processing location-dependent reminders according to the invention.

[0017] In a first advantageous embodiment of the invention, the reminder application and the maintenance of time data are implemented in a server 2. Thus, the portable device 9 is primarily used for presenting information which is necessary for the use of this reminder application as well as for editing the reminder data. Thus, to use the reminder application in the portable device 9, the user starts an application program which is used for presenting data, entering data, and transmitting data between the server 2 and the portable device 9. Such an application program can be, for example, similar to a WWW browser, known as such, wherein the portable device 9 is primarily used as a remote terminal for presenting data related to the reminders to the user and for transmitting data entered by the user to the server 2. For entering data, it is possible to use, for example, a keypad 16, a microphone 18, a touch-sensitive means (not shown), or the like. Thus, the application program transmits information necessary for using the reminder application to the server 2, preferably via communication means 11. This data preferably contains user related information, such as a user identification and a password, a telephone number, or another corresponding identification. The server 2 examines the received information and determines the person whose reminder data are to be processed. The server 2 retrieves the user-specific data of the reminder application from the memory means 20 and transmits it to the portable device 9, in which the data is preferably presented on the display 15 and/or in the earpiece 17. The user can browse the reminders, edit them and add new reminders. In connection with adding such a location-dependent reminder, position data is defined, to be used as a criterion for presenting the reminder. Changes and/or new entries made in the reminder data are transmitted from the portable device 9 to the server 2, in which the data are stored in the user data. After this, the polling functions of the reminder application will monitor the meeting of the criteria related to the reminders preferably in the following way, with reference to Fig. 4.

[0018] In this embodiment, it is also assumed that the positioning means 10 are arranged in connection with the portable device 9. Thus, the positioning means 10 comprise, for example, a GPS receiver. The positioning means 10 perform positioning preferably at intervals and/or by a separate control command. In this embodiment, the position data is transmitted from the portable device 9 to the server 2, in which the received position data is compared with the conditions, such as position data, related to presenting the reminders and defined by the user in question. If the position data corresponds to the position data of a reminder, for example in the situation of Fig. 4 when the user is approaching a shop 24, this reminder is presented in the portable device 9. Thus, the server 2 transmits at least a message or another definition (presentation data) related to the reminder, indicating what kind of a reminder is to be formed in the portable device 9. This data can be, for example, a text-format notice, a picture, a sound, an animation, a vibration, or a combination of these. The portable device 9 receives the presentation data related to the reminder and presents this data as visual and/or audio information in the user interface 14. The user can then acknowledge the received reminder and either delete it or re-activate it. Information about the user's choice is transmitted to the server 2, in which the reminder is either deleted or re-activated. Re-activation may be necessary, if the user does not, in spite of the reminder, want to perform the task requested in the reminder at the moment in question. Thus, next time when the user comes within the range meeting the conditions of the position data, the reminder will be presented again in the above-described manner. The invention can also be applied in such a way that operations by the user are not needed in connection with the reminder, but the reminder is automatically either deleted or re-activated. In the reminder data, it is also possible to define if the user is to be requested to acknowledge the reminder or if the deletion or re-activation is to be performed automatically.

[0019] After the processing of one reminder, the next reminder is preferably processed, if the number of set reminders is more than one. The reminder processing functions are iterated as long as there are active, user-specific reminders stored in the server 2. The server 2 can preferably process reminders of several different users, although the case of one user is primarily discussed in this specification.

[0020] In a second advantageous embodiment of the invention, the positioning means 10 are not necessarily implemented in the portable device 9, but the position data of the portable device 9 is obtained by other means. It can be determined, for example, in the mobile communication network 7. It is known as such that the mobile communication network 7 and the portable device 9 with mobile communication functions communicate at intervals also when there is no active call from the mobile station. Thus, the coordinate data of the base station serving the portable device 9 can be used as the default position data for the portable device 9. Also, systems have been developed, in which preferably three or more base stations can be used to determine the position of a portable device 9 at a relatively good accuracy. In this second advantageous embodiment, the position data is transmitted from the mobile communication network 7 to the server 2, in which this position data is used as described above in connection with the description of the first embodiment of the invention. In other respects, this second advantageous embodiment is essentially similar to the first advantageous embodiment. The dif-

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ference lies primarily in that the position data does not need to be transmitted from the portable device 9, wherein the power consumption of the portable device 9 can be reduced to some extent and the communication network 6 is not subjected to unnecessary loading in this respect and there are savings in the communication costs.

[0021] The present invention can also be applied in such a way that the reminder application is implemented both in the server 2 and in the portable device 9. Thus, the data of the reminder applications of the server 2 and the portable device 9 are synchronized preferably at intervals to secure that the reminder data of the same user are substantially identical in both reminder applications. In this third advantageous embodiment of the invention, the synchronization can be preferably implemented in such a way that when the reminder data are changed in either one of the reminder applications, the changed data are also transmitted to the other reminder application. Thus, for example in a situation, in which a person authorized by the user of the portable device 9 adds a new entry in the user's reminder data in the reminder application in the server 2, the server 2 will transmit the data of this new entry to the portable device 9, in which the data are stored in the memory means 13. If necessary, the user of this portable device 9 can be informed of the setting of such a reminder, wherein he/she can be prepared for the presentation of the reminder and even plan his/her travel route so that he/she can run the errand requested in the reminder.

[0022] Also in this third advantageous embodiment of the invention, the positioning means 10 can be implemented in the portable device 9 and/or elsewhere in the system, preferably in the communication network 6. Thus, the comparison between the position data defined for the reminders and the position data of the portable device 9 can be made either in the portable device 9 or in the server 2.

[0023] If said positioning means 10 are arranged in connection with the portable device 9 and the comparison is made in the portable device 9, the position data do not need to be transmitted to the communication network 6. If the comparison shows that the position data of the portable device 9 matches with the position data defined in a reminder, the notification defined for this reminder is presented in the user interface 14 of the portable device. Also, information about the fulfilment of the condition for presenting the reminder is transmitted to the server 2, in which the reminder is preferably deleted. Also, such reminders whose presentation condition has been met, are preferably deleted from the reminder application of the portable device 9. On the other hand, in some applications, it may be necessary to set reminders which are always repeated when the conditions are met. In this case, these reminders are not deleted. Such reminders can be used, for example, for setting a schedule, if the events of a schedule, for example lectures, are not compulsory, or otherwise as a memory help for persons who find it difficult to remember even regularly recurring events, for example for some old people. Consequently, in this embodiment, the data related to the reminder application do not need to be transferred to the communication network except when a condition for presenting a reminder is met. In this embodiment, the portable device 9 does not even need to be logged in the communication network 6 during the comparison, wherein possible blackouts in the data transmission connection do not disturb the comparing operation of the reminder application. Thus, changes in the data of the reminder application of the portable device 9 can be transmitted at the stage when the data transmission connection is possible again.

[0024] If the positioning means 10 are arranged in the communication network 6, the comparison between the position data of the reminders and the position data of the portable device 9 is preferably made in the server 2. Thus, the position data is transmitted from the communication network 6 to the server 2. If the comparison shows that the position data of the portable device 9 matches with the position data set for a reminder, this information is transmitted to the portable device 9, in which the notification set for this reminder is presented in the user interface 14 of the portable device. As above, also in this fourth advantageous embodiment of the invention, the reminder data are preferably deleted from the reminder applications of both the portable device 9 and the server 2. Also in this embodiment, it is possible that the position is determined in the portable device. In this case, the position data are transmitted from the communication network 6 to the portable device 9, in which the comparison is made as described above in connection with the description of the third advantageous embodiment of the invention.

[0025] Some different embodiments of the invention have been described above. In connection with all of these, it is possible to use not only position data but also time data as a criterion for presenting the reminder. Thus, the reminder data indicates the time when the reminder is to be presented if the position data of the portable device 9 match with the position data of the reminder. Thus, in addition to the comparison of the position data, the time data is compared with the current moment of time. The reminder in question is to be presented only if the moment of time matches with the time data. This use of the time data has the advantage that, for example, the reminder will not be presented when the task related to the reminder cannot be performed or the user does not want to perform it at that time. One example to mentioned is the opening hours of a shop. If the reminder relates to, for example, an errand in a shop, at a pharmacy or in another business, the reminder will preferably not be presented if the business is not open when the user is in the vicinity of this business. On the other hand, the user does not necessarily want to do the shopping, for example, on his/her way to work but first on his/her way home, wherein also such a point can be taken

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into account in the time data. Also in other respects, this time data does not need to match with the opening hours of the business, but it can be defined to slightly differ from it. For example, the person entering a reminder sets, as the terminal moment of a time window, a time before the closing time of the business, because the user will not necessarily have time to make a purchase if he/she enters the business right at the closing time or only slightly before it. In a corresponding manner, when setting the initial moment of the time window, it is also possible to set a time slightly before the opening time of the business, wherein the user will be able to decide, after noticing the reminder, whether or not he/she will wait for the business to open or do the shopping later on.

[0026] The comparison of the time data is preferably made in the same reminder application in which the comparison between the position data and the position data of the portable device 9 is made. The server 2 shown in Fig. 2 comprises means 21 for maintaining time data, wherein the current time is known in the server 2. Also, the portable device 9 shown in Fig. 3 comprises corresponding means 22 for maintaining time data, wherein the current time is also known in the portable device 9. If the device 2, 9 which makes the comparison does not comprise said means 21, 22 for maintaining time data, the time data can be transmitted via the communication network 6 from a device which maintains time data. For example, if the comparison is made in the portable device 9 which does not comprise means for maintaining time data, and the server 2 comprises said means 21 for maintaining time data, the portable device 9 may transmit a request to the server to transmit the time data. Thus, the time data is transmitted from the server 2 to the portable device 9, after which the time data can also be compared in the portable device 9.

[0027] In the systems according to the invention, it is not necessary to make the comparisons of the time data and the position data in the same device 2, 9. Thus, one device, for example the server 2, is used for comparing the time data, and another device, for example the portable device 9, is used for comparing the position data with the position data of the portable device 9. In this embodiment, the results of both of the comparisons are, however, processed in the device in which the final decision about presenting the reminder is made. To clarify this, an exemplary application will be used, in which the server 2 compares the time data and the portable device 9 compares the position data, and the final decision about presenting the reminder is made in the portable device 9. Thus, the server 2 compares, at intervals, the time data related to the reminders with the current moment of time. If the current time matches with the time data of a reminder, this information will be transmitted by the server to the portable device 9. Thus, the portable device 9 will still compare the position data of the reminder with the current position data of the portable device 9, and if they match, the data related to said reminder will be presented in the user interface 14 of the portable device. However, if the portable device 9 is not in a location matching with the position data of the reminder in question, the reminder will not be presented. The portable device 9 can make a new position data comparison later on. No comparison needs to be made for such reminders in which the time condition is not met. To reduce unnecessary communication, the server 2 will not transmit data related to the same reminder several times, even in the case the portable device 9 was not in the location indicated by the position data when the comparison was made. Preferably, data related to the reminder will only be transmitted when a change takes place in the conditions for presenting the reminder, *i.e.* primarily at the stage when the server 2 finds that the time condition is met and when the server finds that the time condition is no longer met. Preferably, after receiving the data, the portable device 9 stores it in a memory and uses this stored data to determine if there is a need to compare the position data of the reminder in question. Naturally, also in this embodiment, it is obvious that the comparison can also be made in another order, *i.e.* by comparing the position first, and if the position complies with the position setting for any reminder, the time data will then be compared.

[0028] In yet another advantageous embodiment of the invention, which is exemplified in the appended Fig. 5, the same reminder can be set for more than one person. Thus, the person who is going to set a reminder, enters the data of the reminder, such as the notification, position data and possible time data related to the reminder, preferably by his/her own terminal 23, such as a wireless communication device. Furthermore, the person defines the persons for which the reminder is set. These persons can, in an advantageous case, also include the person setting the reminder. This setting can be performed, for example, in such a way that the person setting the reminder selects, from the data of persons and/or groups of persons stored in the memory means of his/her own device and/or in the server 2, those for whom the reminder is to be set. After this, the server 2 enters the reminders in the data of the selected persons in the memory means of the server 2. Furthermore, the data are preferably transmitted to the portable devices 9a, 9b, 9c, 9d of said persons. After this, the system polls the reminder data, such as the time data and/or the position of each portable device 9a, 9b, 9c, 9d, as described above in this specification. The position of the portable devices 9a, 9b, 9c, 9d can be polled, for example, by positioning means 25 provided in the mobile communication network, or by positioning means arranged in connection with the portable devices. In case one of the portable devices (the portable device 9a in Fig. 5) is in the location 26 indicated by the reminder and possibly at the time set in the reminder, the notification related to the reminder will be presented in this portable device 9a. After this, the user of the portable device 9a can preferably choose, whether or not to perform the task requested in the reminder. In case the user

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of the portable device 9a performs the requested task, information about this is transmitted to the system, preferably to the server 2 and to the device of the person who set the task. The reminder can now be deleted from the system, unless it is such a reminder which is to be repeated every time the conditions are met. If the user in question does not, for any reason, perform the task requested in the notification, information about this is also preferably transmitted to the system and possibly also to the person who set the task. In this case, the reminder is not deleted, but the polling of the fulfilment of its conditions is continued. However, it can now be assumed that the user of the portable device 9a who indicated that he/she is not going to perform the task, is to be deleted from the watch of this reminder. Thus, the reminder can be presented in such another portable device 9b, 9c, 9d in which the same reminder has been set and which enters the location defined in the position data at a suitable time.

[0029] The user of the device 9a which presented the reminder can preferably select, what kind of a notification will be sent to the system and to the person who set the task. One alternative is a so-called anonymous notification, if the receiver of the notification does not necessarily want to disclose that he/she is in the location in question. Thus, the person who set the task will not necessarily be sent any notification, if the receiver of the notification will not perform the task requested. If the task is performed, a notification of this is preferably transmitted to the person who set the task, without information about the identity of the person who performed the task. In one alternative, such a notification is only transmitted to the person who set the task but the task is not deleted.

[0030] Another alternative is that the person who received the notification transmits a message to the person who set the task, irrespective of whether the person who received the notification will perform the task or not. Thus, the recipient of the notification can, for example, indicate the reason why he/she cannot perform the requested task at that moment.

[0031] If none of the persons defined in the reminder will perform the task even though they have been moving near the location set in the reminder, information about this is preferably transmitted to the person who set the task. He/she can then decide whether or not to try to ask yet another person to perform the task. In the positive case, the reminder is set in the data of this other person and deleted from the data of those persons who have indicated their refusal to perform the task.

[0032] In the above-described embodiment, the person who set the task can define also him/herself as a recipient of the reminder. Thus, if the person who set the reminder performs the requested task him/herself, the reminder can be deleted and the reminders to the other persons will be recalled as unnecessary.

[0033] By the above embodiments, it is also possible to provide services by which a group of people can meet each other. This is implemented so that the person who sets the task defines not only his/her friends but also him/herself as a recipient. Also, he/she preferably sets as a condition that the person who sets the task must be in a particular location and that the reminder must only be transmitted within a particular time range. In this way, for example when moving close to a particular location, a group of people can receive a reminder to meet each other in this location, for example in a cafe. Furthermore, the person who sets the task can set an additional condition that the reminder is only to be transmitted to a predetermined number of people, after which it is deleted. This gives the advantage that if several people are required to perform the task, or if the person who set the task or an appointment only wants to meet a few friends, the system will not call all the friends of the person who have joined the system and are located near the defined location. This may be necessary, for example, if the person who sets the task wants to play a game with only one of his/her friends and the number of players is limited. Such games include a number of popular sports, such as tennis, squash or snooker.

[0034] Yet another advantageous embodiment of the invention to be mentioned is the situation, in which for example the chairman of a meeting, the host of a business visit or another person arranging an event selects the persons whom he/she wants to participate in the meeting, business visit or other event. Thus, the host of the event sets a position-dependent notification in the system, with the location of the event as the position data. Furthermore, data is set about the persons invited to the event. In this application, when the conditions are met, a notification is delivered to the host of the event, but a notification, such as a greeting message, can also be set for the location-dependent reminder. This notification is delivered to an invited person when he/she is approaching the place where the event is held. The system according to this embodiment operates in such a way that when an invited person comes close to the place where the event is held, the system will detect this and transmit a notification about the arrival of the person to the host of the event. If a notification has been defined for the location-dependent reminder, this is transmitted to the person in question. An advantage of this application is, for example, that the receiving personnel do not need to notify about the arrival of persons and, on the other hand, the host of the event does not need to wait in advance for the arrival of invited persons at the location where the event is held. The host of the event can arrive, for example, after being informed by the system that one of the invited persons is approaching the place. Furthermore, when some of the guests are present, the host of the event can spend time with them and still, being informed of the arrival of the next person, meet him/her as well. The location-specific reminder is preferably deleted from the system after all the invited persons have arrived or after the event has ended.

[0035] The above-presented advantageous embodi-

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ments of the invention can still be supplemented with the feature, whereby the person setting a reminder can notify the system of a maximum storage time of the reminder (validity period of the reminder). This may be necessary, for example, in such tasks which are not sensible or possible to perform after a given time. For example, it is no longer sensible to maintain a reminder of buying tickets for an event after this event. Thus, the reminders may include two or more items of time data to be watched.

[0036] Some persons may have more than one portable device 9 at their disposal. However, the person does not necessarily have a separate subscriber identity module, such as a SIM card or USIM card (UMTS Subscriber Identity Module), for each portable device 9, but the person sets this identity module in the portable device 9 which he/she is going to use each time. Thus, it is advantageous that the person related to a reminder is not identified on the basis of the identity data of the portable device 9 of this person (for example, the International Mobile Equipment Identity, IMEI) but, for example, on the basis of the subscriber identity of this person (for example, the International Mobile Subscriber Identity, IMSI).

[0037] Above in this specification, it has been presented that the positioning means 10 used can be, for example, a GPS receiver and/or the mobile communication network 7, but it is obvious that also other positioning means can be used in connection with the present invention. One example to be mentioned is the utilization of short-range communication means, such as a wireless local area network (WLAN) and devices equipped with Bluetooth facilities. The portable device 9 is thus equipped with corresponding local communication means (not shown). In such a system, the portable device 9 can use the local communication means to listen, if there is a corresponding transmitting device in the vicinity. For example, if a business is equipped with a device implemented with local communication means to transmit a signal, the portable device 9 can detect this signal and thereby conclude that it is in the vicinity of this business. This information can be used in the portable device 9 as a criterion for meeting the position condition. Consequently, in such a system, it is not necessary to include coordinate data in the position data. If signals from several different local communication means can be received simultaneously, the signal can be provided with identifying data, for example the name of the business, type, *etc.* This identifying data can be compared with corresponding data in the reminder to determine whether the position condition of the reminder is met.

[0038] Consequently, when defining a reminder, one should in some way indicate the location, in whose vicinity the reminder is to be presented. The setting of the position condition can be implemented, for example, so that the person who sets the reminder enters the coordinate data and possibly a range or defines in another way the area in which the user must be located before the reminder is presented. On the other hand, it is possible to pre-define in the portable device 9, in the server 2, or in the communication network 6, some common position data or some position data which the user will often need, wherein a suitable one can be selected from such a list each time. Systems can also be developed, in which for example central firms, private entrepreneurs, *etc.* can store position data of their own business/businesses in the system, from which the person setting up a reminder can search for the desired position data.

[0039] The system according to the invention, in which the reminder application is run in at least the server 2, provides e.g. the advantage that also other persons than the user of the portable device 9 can enter reminders relating to the user. This is implemented preferably so that the user has informed the system of data on the persons who are authorized to set reminders for the user. Such persons authorized by the user can contact the server 2 by their own terminal 23 (Fig. 1), such as a computer, a wireless communication device, *etc.* The server 2 authenticates such a person, for example, on the basis of the user identity given by the person, the terminal identity, such as the IP address, the telephone number, or the like. The person can then enter a desired reminder in the user's reminders, including the respective conditions for its presentation, or if necessary, edit a reminder that has been set by him/her earlier. For example, the user's spouse may add a reminder in which he/she asks the user to go grocery shopping on his/her way home from work. The reminder is preferably supplemented with information about the person who entered the reminder.

[0040] It is also possible that another person sends information to the user's device about an action to be activated when the user leaves a certain area, for example, leaves the office the user is working. The information about the action include, which action is to be activated, the location or area to be watched, etc. The action can the be a reminder to be presented, a message to be sent to the user and/or the other person, a control signal for controlling some other equipment, etc. Such a control signal can be used, for example, to initiate a heating system/air conditioner to rise/decrease temperature of an apartment, lock the doors of the office and/or activate the alarm system of the office. The control signal can be formed *e.g.* in the user's device which receives the data relating to the action to be activated.

[0041] It is obvious that the server 2 must not be interpreted in a restricted way to cover only computers of a given type, but the server 2 can be any device provided with data processing facilities and used as a part of a larger system. Some advantageous examples to be mentioned include a mobile switching centre in a mobile communication system, a short message service centre, a server in the Internet data network, a server in a local area network, or the like.

[0042] Only a few advantageous applications of the

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invention have been exemplified above; however, it is obvious that a person skilled in the art will be able to utilize the above description to apply the invention also in other embodiments of the invention in accordance with the appended claims.

Claims

1. A method for activating actions, comprising the steps of defining an action, a portable device (9) related to it, and at least one item of position data as a condition for activating the action, and determining the position of the portable device (9), wherein when the position of the portable device (9) corresponds to the position data set for the action, said action is activated, **characterized in that** the information about actions is processed in a server (2), from which a data transmission connection can be set up to the device, to which the information about the action is transmitted from the server (2), to activate the action.

2. The method according to claim 1, **characterized in that** the information about the actions are also processed in the portable device (9), wherein information about the actions is transmitted between the portable device (9) and the server (2), to synchronize the action data of the server (2) and of the portable device (9) with each other.

3. The method according to claim 1 or 2, **characterized in that** time data is also set as a condition for activating the action, wherein the action is only to be activated during the time defined in the time data when the position of the portable device (9) corresponds to the position data defined in the action.

4. The method according to claim 1, 2 or 3, **characterized in that** the conditions for activating the action are examined in the server, wherein if the conditions for activating one of the actions is met, information about said action is transmitted to the portable device (9), in which the action is activated.

5. The method according to any of the claims 1 to 4, **characterized in that** the action data is supplemented with a validity time, wherein if the conditions for activating the action are not met within said validity time, the action data is deleted after the expiry of said validity time.

6. The method according to any of the claims 1 to 5, **characterized in that** a set of portable devices (9a, 9b, 9c, 9d) is defined for the action, wherein if the conditions for activating the action are met in one portable device from said set of portable devices, the action is activated.

7. The method according to any of the claims 1 to 6, **characterized in that** the action is activated in said portable device (9) meeting the conditions for activating.

8. The method according to any of the claims 1 to 6, **characterized in that** the action is activated in another device than said portable device (9) meeting the conditions for activating.

9. The method according to any of the claims 1 to 8, **characterized in that** the action is at least one of the following:

   - a reminder to be presented,
   - a message to be transmitted,
   - an application to be executed.

10. A system comprising means (14) for activating actions, which action is provided with a definition of a portable device (9) related to it and at least one item of position data as a condition for activating the action, and which system (1) also comprises positioning means (10) for determining the position of the portable device (9), and means (2) for comparing the position of the portable device (9) and the position data defined for an action, wherein said action is arranged to be activated when the position of the portable device (9) corresponds to the position data defined for the action, **characterized in that** the system (1) comprises a server (2) with means (19, 20) for processing information about actions and means (6) for transmitting information related to actions from the server (2) to the device in which the action is arranged to be activated.

11. The system (1) according to claim 10, **characterized in that** the portable device (9) comprises means (12, 13) for processing information about the actions, wherein the system comprises means (6) for transferring data related to actions between the portable device (9) and the server (2), to synchronize the action data of the server (2) and the portable device (9) with each other.

12. The system (1) according to claim 10 or 11, **characterized in that** as a condition for activating the action, also time data is defined, and that the system comprises means (21) for examining said time data, wherein the action is arranged to be activated only during the time defined in the time data, when the position of the portable device (9) corresponds to the position data defined in the action.

13. The system (1) according to claim 10, 11 or 12, **characterized in that** the server (2) comprises means (19, 20, 21) for examining conditions for activating actions.

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14. The system (1) according to any of the claims 10 to 13, **characterized in that** the action data is supplemented with a validity time, and that the system comprises means (21) for examining said validity time, wherein if the conditions for activating the action are not met within said validity time, the action data is arranged to be deleted after the expiry of said validity time.

15. The system (1) according to any of the claims 10 to 14, **characterized in that** it comprises means (14) for defining a set of portable devices (9a, 9b, 9c, 9d) for an action, means (19) for examining the fulfilment of the conditions for activating the action for each portable device from said set of portable devices (9a, 9b, 9c, 9d), and means (6, 11, 14) for activating the action.

16. The system (1) according to any of the claims 10 to 15, **characterized in that** the action is arranged to be activated in a portable device (9a, 9b, 9c, 9d) which meets the conditions for activating.

17. The system (1) according to any of the claims 10 to 15, **characterized in that** the action is arranged to be activated in another device than that meeting the conditions for activating.

18. The system (1) according to any of the claims 10 to 17, **characterized in that** the action is at least one of the following:

- a reminder to be presented,
- a message to be transmitted,
- an application to be executed.

19. A server (2) for use in a system comprising means (14) for activating actions, which action is provided with a definition of a portable device (9) related to it and at least one item of position data as a condition for activating the action, and which system (1) also comprises positioning means (10) for determining the position of the portable device (9), and means (2) for comparing the position of the portable device (9) and the position data defined for an action, wherein said action is arranged to be activated when the position of the portable device (9) corresponds to the position data defined for the action, **characterized in that** the server (2) comprises means (19, 20) for processing information about actions, and means (5) for transmitting information related to actions from the server (2) to the device in which the action is arranged to be activated.

20. A portable device (9) comprising means (14) for activating actions, for which action is defined a portable device (9) related to it and at least one item of position data as a condition for activating the action, and which portable device (9) is arranged to be used in a system (1) provided with positioning means (10) for determining the position of the portable device (9), and means (2) for comparing the position of the portable device (9) and the position data defined for an action, wherein said action is arranged to be activated in the portable device (9) when the position of the portable device (9) corresponds to the position data defined in the action, **characterized in that** the portable device (9) comprises means (11) for receiving data related to actions, which data are transmitted from the server (2) of the system which comprises means (19, 20) for processing information about actions, and means (5) for transmitting data related to actions from the server (2) to the device in which the action is arranged to be activated.

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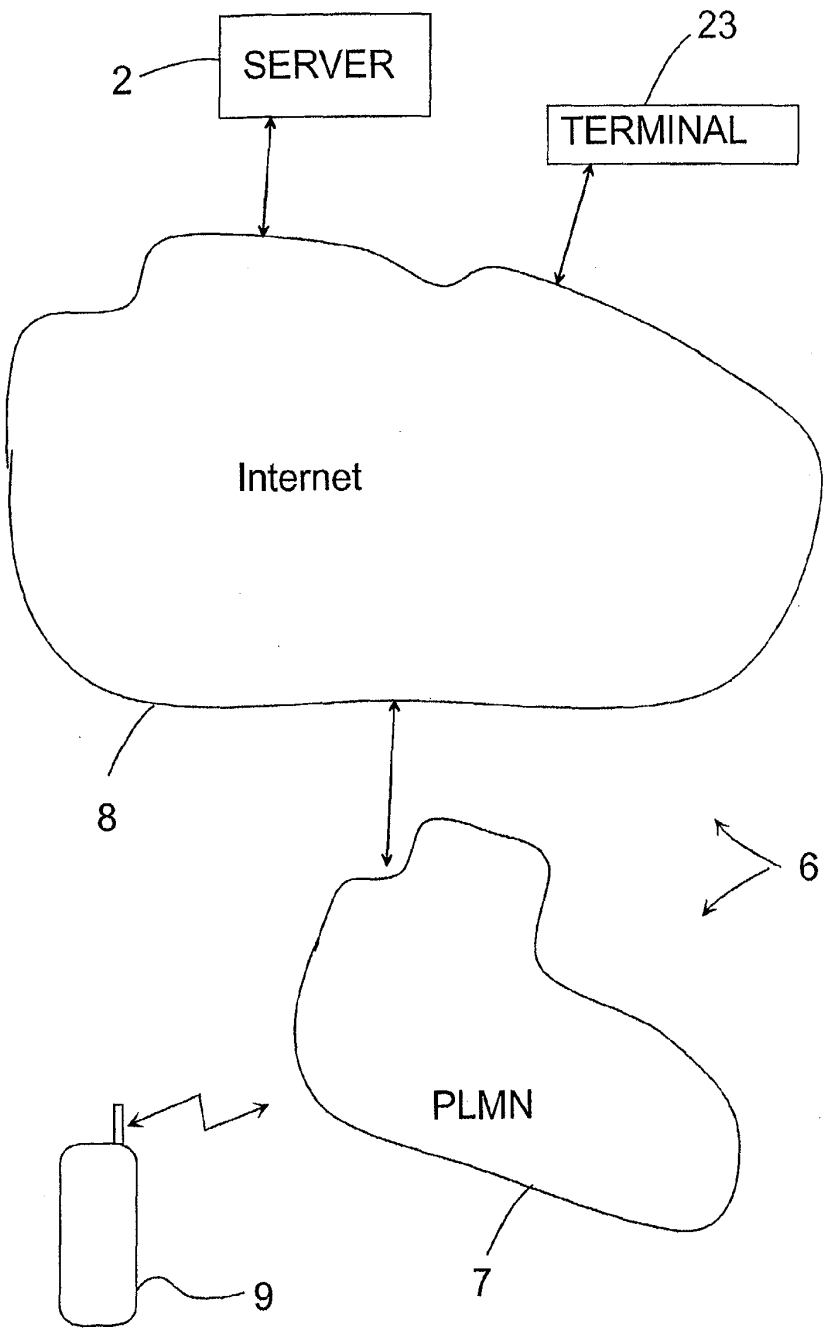

Fig. 1

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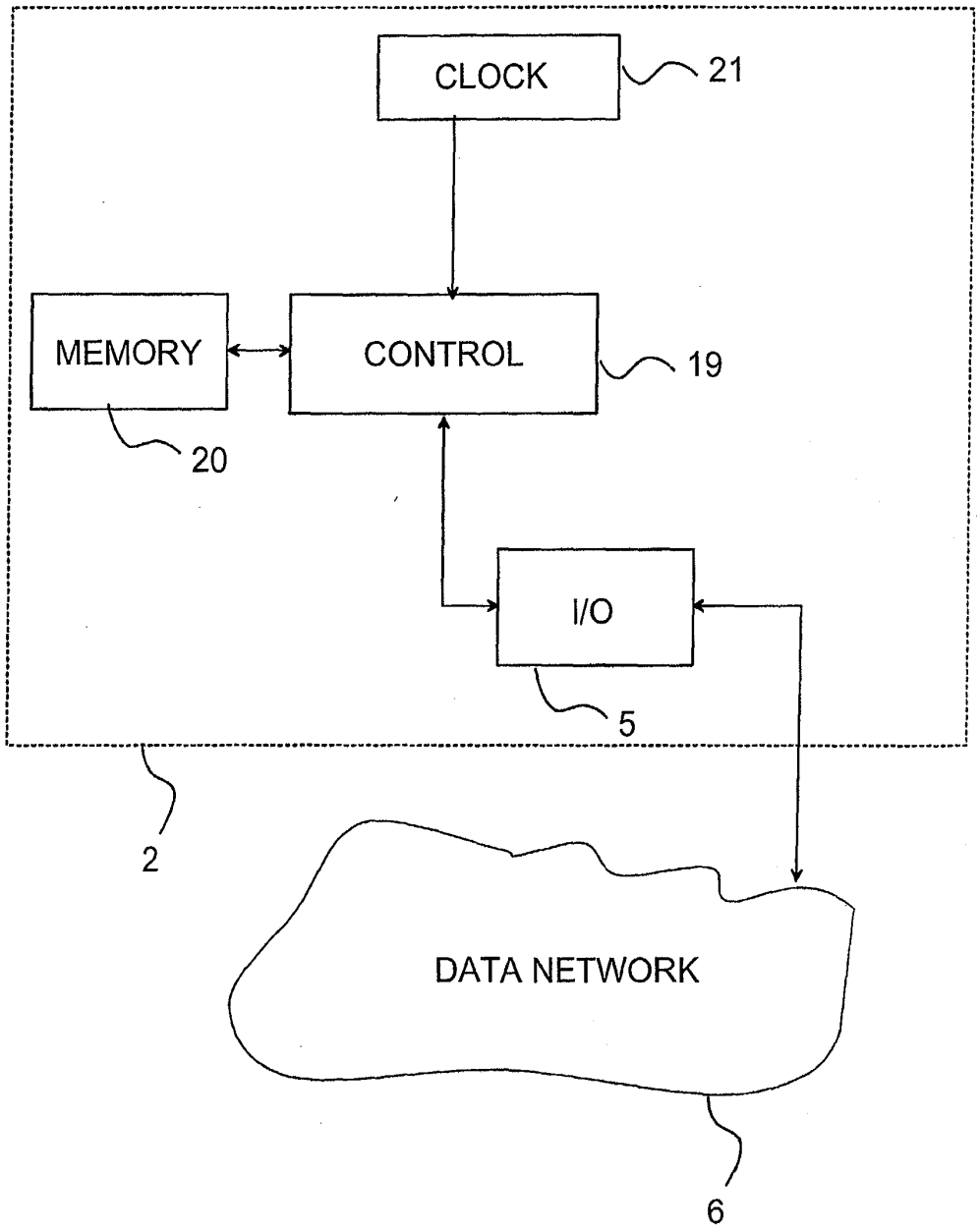

FIG. 2

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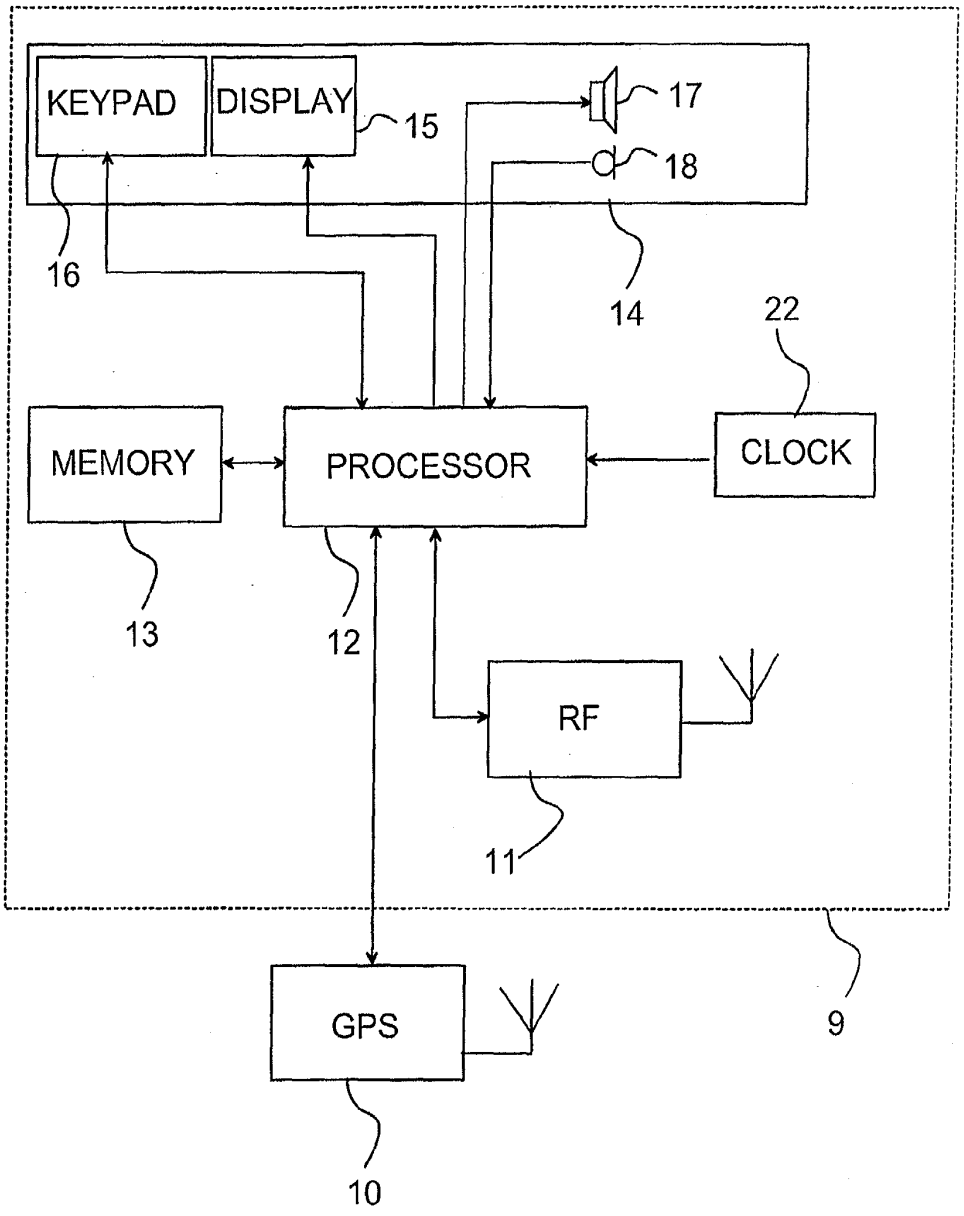

FIG. 3

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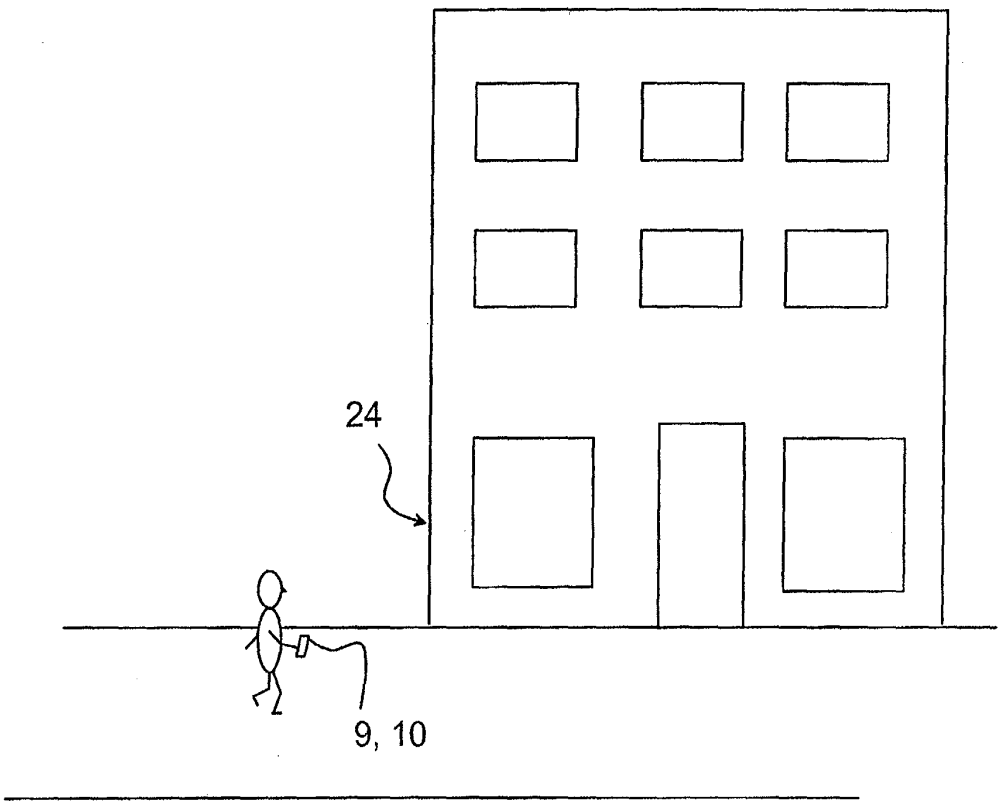

FIG. 4

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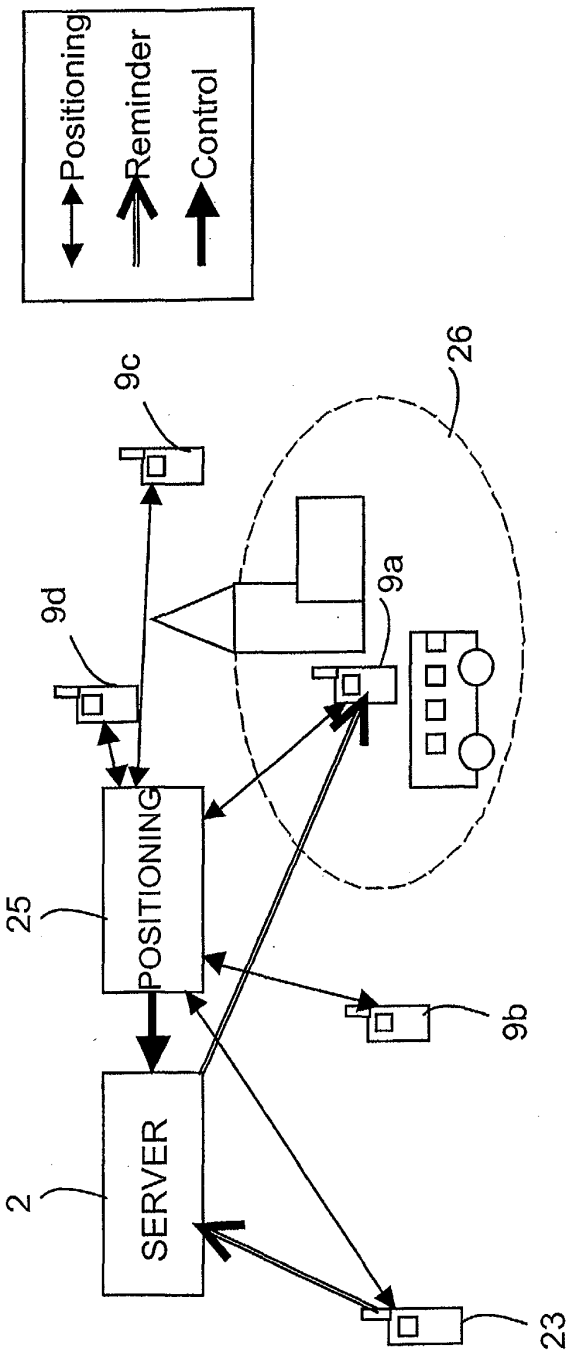

FIG. 5

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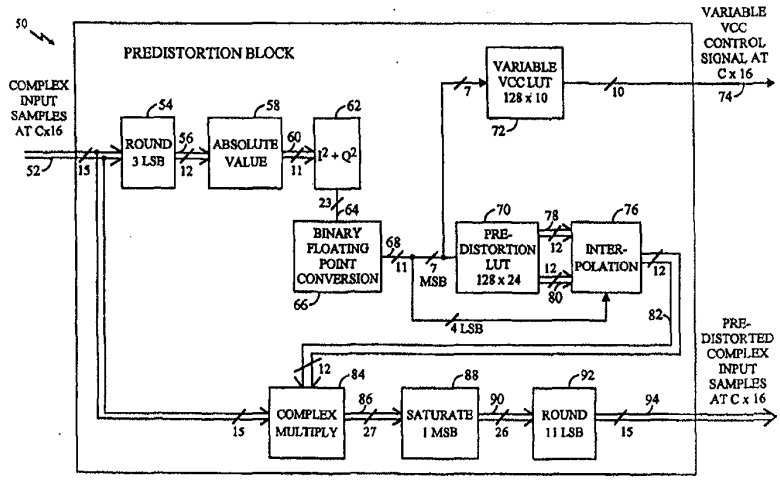
(54) Title: PREDISTORTION TECHNIQUE FOR HIGH POWER AMPLIFIERS



(57) Abstract

A predistortion technique for high power amplifiers includes an adaptive predistortion algorithm that operates independently of data samples to write a set of complex gain values, or predistortion parameters, to a lookup table (70). The algorithm may be processor-driven. The gain values are taken from the lookup table (70) and multiplied by a complex digital baseband waveform. The gain values may first be subjected to interpolation. The downconverted output of the amplifier (106) is measured to gauge the efficacy of the predistortion. Based on the effect of the predistortion upon the ratio of in-band power to out-of-band power, decisions are made on the set of predistortion parameters for the next iteration of the algorithm. The algorithm runs continuously, perturbing parameters and adapting the predistortion functions accordingly in an effort to continually reflect instantaneous amplitude-modulation and phase-modulation relationships that may change over time with temperature variation or component aging.

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PREDISTORTION TECHNIQUE FOR HIGH POWER AMPLIFIERS

BACKGROUND OF THE INVENTION

I. Field of the Invention

The present invention pertains generally to the field of wireless communications, and more specifically to predistortion techniques for high power amplifiers.

II. Background

The field of wireless communications has many applications including, e.g., cordless telephones, paging, wireless local loops, and satellite communication systems. A particularly important application is cellular telephone systems for mobile subscribers. (As used herein, the term "cellular" systems encompasses both cellular and PCS frequencies.) Various over-the-air interfaces have been developed for such cellular telephone systems including, e.g., frequency division multiple access (FDMA), time division multiple access (TDMA), and code division multiple access (CDMA). In connection therewith, various domestic and international standards have been established including, e.g., Advanced Mobile Phone Service (AMPS), Global System for Mobile (GSM), and Interim Standard 95 (IS-95). In particular, IS-95 and its derivatives, IS-95A, IS-95B, ANSI J-STD-008, etc. (often referred to collectively herein as IS-95), are promulgated by the Telecommunication Industry Association (TIA) and other well known standards bodies.

Cellular telephone systems configured in accordance with the use of the IS-95 standard employ CDMA signal processing techniques to provide highly efficient and robust cellular telephone service. An exemplary cellular telephone system configured substantially in accordance with the use of the IS-95 standard is described in U.S. Patent No. 5,103,459, which is assigned to the assignee of the present invention and fully incorporated herein by reference. The aforesaid patent illustrates transmit, or forward-link, signal processing in a CDMA base station. Exemplary receive, or reverse-link, signal processing in a CDMA base station is described in U.S. Application Serial No. 08/987,172, filed December 9, 1997, entitled MULTICHANNEL DEMODULATOR, which is assigned to the assignee of the present invention and fully incorporated herein by reference.

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In CDMA systems, over-the-air power control is a vital issue. An exemplary method of power control in a CDMA system is described in U.S. Patent No. 5,056,109, which is assigned to the assignee of the present invention and fully incorporated herein by reference.

A primary benefit of using a CDMA over-the-air interface is that communications are conducted over the same RF band. For example, each mobile subscriber unit (typically a cellular telephone) in a given cellular telephone system can communicate with the same base station by transmitting a reverse-link signal over the same 1.25 MHz of RF spectrum. Similarly, each base station in such a system can communicate with mobile units by transmitting a forward-link signal over another 1.25 MHz of RF spectrum. It is to be understood that while 1.25 MHz is a preferred CDMA channel bandwidth, the CDMA channel bandwidth need not be restricted to 1.25 MHz, and could instead be any number, such as, e.g., 5 MHz.

Transmitting signals over the same RF spectrum provides various benefits including, e.g., an increase in the frequency reuse of a cellular telephone system and the ability to conduct soft handoff between two or more base stations. Increased frequency reuse allows a greater number of calls to be conducted over a given amount of spectrum. Soft handoff is a robust method of transitioning a mobile unit from the coverage area of two or more base stations that involves simultaneously interfacing with two base stations. (In contrast, hard handoff involves terminating the interface with a first base station before establishing the interface with a second base station.) An exemplary method of performing soft handoff is described in U.S. Patent No. 5,267,261, which is assigned to the assignee of the present invention and fully incorporated herein by reference.

In conventional cellular telephone systems, a public switched telephone network (PSTN) (typically a telephone company) and a mobile switching center (MSC) communicate with one or more base station controllers (BSCs) over standardized E1 and/or T1 telephone lines (hereinafter referred to as E1/T1 lines). The BSCs communicate with base station transceiver subsystems (BTSs) (also referred to as either base stations or cell sites), and with each other, over a backhaul comprising E1/T1 lines. The BTSs communicate with mobile units (i.e., cellular telephones) via RF signals sent over the air.

As described in U.S. Patent No. 5,103,459, a forward-link CDMA communication signal is modulated at a BTS with Walsh code covering and I and Q spreading. The resultant digital complex baseband CDMA waveform is then converted to an analog signal, upconverted to a carrier frequency signal, amplified with a high power amplifier (HPA), and sent to an antenna for RF

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transmission to a mobile unit. Due to the nonlinearity inherent in the HPA, the HPA stage is typically characterized by out-of-band (also known as sideband) emissions at the output of the HPA. The CDMA waveform for each frequency assignment at the output of the antenna must meet various out-of-band emission requirements pursuant to specifications set by the FCC and other regulatory bodies. It is necessary, therefore, that out-of-band emissions be attenuated.

In conventional systems, the out-of-band emissions were attenuated as required using analog filters following the HPA. However, this required extremely precise tuning of the filter to achieve the necessary accuracy. For enhanced accuracy, it would be desirable to provide a method of digitally attenuating out-of-band emissions. To decrease the number of transistors required in the HPA architecture and allow for the production of more efficient HPAs, predistortion may be applied at the input of the HPA. From a design standpoint, it is highly desirable that the HPA be able to work over a large range of input powers. However, a problem in designing a working HPA over such a large range of input powers is that the HPA will have a nonlinear gain and phase response at different input powers. Such nonlinearities result in undesired out-of-band emissions at the output of the HPA. Adjustments to the bias currents that increase the efficiency of the HPA further increase such nonlinear effects. Moreover, it would further be advantageous to provide a predistortion method that accounts for changes over time due to temperature variations and component aging. Thus, there is a need for a digital, adaptive predistortion technique that minimizes out-of-band emissions introduced by an HPA.

SUMMARY OF THE INVENTION

The present invention is directed to a digital, adaptive predistortion technique that minimizes out-of-band emissions introduced by an HPA. Accordingly, in one aspect of the invention, a method of reducing out-of-band emissions from an amplifier advantageously includes the steps of multiplying a digital input signal to the amplifier with a set of digital predistortion parameters, measuring the output power level of the out-of-band emissions from the amplifier, and adjusting the set of parameters based upon the measured output power level of the out-of-band emissions from the amplifier. In another aspect of the invention, a device for reducing out-of-band emissions from an amplifier advantageously includes complex multiplication logic for multiplying digital predistortion parameters with a digital input signal, an

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amplifier coupled to the complex multiplication logic, and a processor logically coupled to the amplifier for digitizing an ouput signal from the amplifier, processing the digitized output signal, and modifying the digital predistortion parameters based upon the output signal.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of a cellular telephone system.

FIG. 2 is a block diagram of a circuit for converting a CDMA digital complex baseband waveform into a waveform suitable for RF transmission.

FIG. 3 is a block diagram of an adaptive predistortion circuit that can be used in the circuit of FIG. 2.

FIG. 4 is a block diagram illustrating the application of a software-implemented algorithm to the adaptive predistortion circuit of FIG. 3.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Various cellular systems for wireless telephone communication employ fixed base stations that communicate with mobile units via an over-the-air interface. Such cellular systems include, e.g., AMPS (analog), IS-54 (North American TDMA), GSM (Global System for Mobile communications TDMA), and IS-95 (CDMA). In a preferred embodiment, the cellular system is a CDMA system.

As illustrated in FIG. 1, a CDMA wireless telephone system generally includes a plurality of mobile subscriber units 10, a plurality of base stations 12, a base station controller (BSC) 14, and a mobile switching center (MSC) 16. The MSC 16 is configured to interface with a conventional public switched telephone network (PSTN) 18. The MSC 16 is also configured to interface with the BSC 14. The BSC 14 is coupled to each base station 12 via backhaul lines. In various embodiments the backhaul lines may be configured for voice and/or data transmission in accordance with any of several known interfaces including, e.g., standardized E1 and/or T1 telephone lines (E1/T1), Asynchronous Transfer Mode (ATM), or Internet Protocol (IP). It is to be understood that there can be more than one BSC 14 in the system. Each base station 12 advantageously includes at least one sector (not shown), each sector comprising an omnidirectional antenna or an antenna pointed in a particular direction radially away from the base station 12. Alternatively, each sector may comprise two antennas for diversity reception. Each base station 12 may

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advantageously be designed to support a plurality of frequency assignments, with each frequency assignment advantageously comprising 1.25 MHz of spectrum. Alternatively, each frequency assignment may comprise an amount of spectrum other than 1.25 MHz, such as, e.g., 5 MHz. The intersection of a sector and a frequency assignment may be referred to as a CDMA channel. The base stations 12 may also be known as base station transceiver subsystems (BTSs) 12. Alternatively, "base station" may be used in the industry to refer collectively to a BSC 14 and one or more BTSs 12. The BTSs 12 may also be denoted "cell sites" 12. (Alternatively, individual sectors of a given BTS 12 may be referred to as cell sites.) The mobile subscriber units 10 are typically cellular telephones 10, and the cellular telephone system is advantageously a CDMA system configured for use in accordance with the IS-95 standard.

During typical operation of the cellular telephone system, the base stations 12 receive sets of reverse-link signals from sets of mobile units 10. The mobile units 10 are conducting telephone calls or other communications. Each reverse-link signal received by a given base station 12 is processed within that base station 12. The resulting data is forwarded to the BSC 14. The BSC 14 provides call resource allocation and mobility management functionality including the orchestration of soft handoffs between base stations 12. The BSC 14 also routes the received data to the MSC 16, which provides additional routing services for interface with the PSTN 18. Similarly, the PSTN 18 interfaces with the MSC 16, and the MSC 16 interfaces with the BSC 14, which in turn controls the base stations 12 to transmit sets of forward-link signals to sets of mobile units 10.

In one embodiment, shown in FIG. 2, a complex baseband CDMA forward channel waveform is converted to a signal suitable for RF transmission with the aid of digital predistortion circuitry to reduce out-of-band emissions following the HPA stage. In other embodiments, multiple adjacent CDMA forward channel waveforms can be prepared for RF transmission with the aid of digital predistortion circuitry. In FIG. 2, a baseband-to-RF-conversion circuit 20 includes a predistortion block 22, a D/A converter 24, an upconverter 26, an HPA 28, a downconverter 30, and an A/D converter 32. The predistortion block 22 is coupled to an input complex baseband CDMA waveform 34. The predistortion block 24 is also coupled to the D/A converter 24. The D/A converter 24 is coupled to the upconverter 26, which in turn is coupled to the HPA 28. The HPA 28 is configured to send an output RF signal 36 to an antenna (not shown). Samples 38 taken periodically from the RF signal 36 are coupled to the downconverter 30. The downconverter 30 is coupled to the A/D converter 32, which in turn is coupled to the predistortion block 22.

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The predistortion block 22 includes an application block 40 for applying digital predistortion, an envelope calculation block 42, a predistortion lookup table, or LUT, 44, an update predistortion function 46, and a power measurement block 48 for measuring in-band power and out-of-band power. The application block 40 is coupled to the input baseband signal 34 and to the D/A converter 24. The input baseband signal 34 is also coupled to the envelope calculation block 42. The envelope calculation block 42 is coupled to the predistortion lookup table 44, which in turn is coupled to the application block 40. The power measurement block 48 is coupled to the A/D converter 32 and to the update predistortion function 46. The update predistortion function 46 is coupled to the predistortion lookup table 44.

The conversion circuit 20 may advantageously be implemented as part of a modulation ASIC in a BTS. Implementation of the D/A, A/D, upconversion, and downconversion functions on an ASIC, or on a DSP chip, is known in the art. Moreover, as those skilled in the art would understand, the conversion circuit 20 may instead be implemented with discrete hardware components available off-the-shelf. Alternatively, depending on design constraints, the HPA 28 may be a discrete amplifier while the remainder of the conversion circuit 20 is implemented as an ASIC.

In the conversion circuit 20, the nonlinearity in the HPA 28 is modeled as an amplitude-and-phase distortion that is a function of the instantaneous input-signal envelope. During operation, the complex digital baseband CDMA waveform 34 is predistorted with an approximation to the inverse nonlinearity in the HPA 28. In this way, the nonlinearities caused by the predistortion and the nonlinearities resulting from the HPA 28 cancel to some degree, yielding in reduced out-of-band emissions. Ideally, the nonlinearities would cancel exactly. However, this is difficult to achieve in practice because the nonlinearity of the HPA 28 can change over time. Thus, the predistortion function is continuously adapted to track changes in the nonlinearity of the HPA 28 over time.

The predistortion function applied at digital baseband is a function of the instantaneous signal envelope. In the envelope calculation block 42, the envelope of the CDMA waveform 34 at complex digital baseband is obtained by calculating I^2+Q^2, where I and Q are, respectively, the in-phase and quadrature-phase components of the digital CDMA waveform 34. The predistortion function is stored in the lookup table 44, which stores gain and phase values as a function of signal envelope. For envelope values that fall between entries in the lookup table 44, the gain and phase predistortion values are calculated by interpolation between adjacent entries in the lookup table 44. The predistortion

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function is modified over time by changing the gain and phase parameters in the lookup table. In one embodiment this modification is performed with software instructions executed by a processor, as described in detail below.

The digital predistorted signal is converted to an analog signal with the D/A (digital-to-analog) converter 24. The analog signal is then up-converted to the carrier frequency by the upconverter 26 and amplified by the HPA 28. The degree to which the predistortion function accurately models the inverse of the nonlinearity in the HPA 28 determines the amount of out-of-band power at the output of the HPA 28. When the predistortion function is the exact inverse of the nonlinearity, the out-of-band power is minimized. Hence, the feedback from the A/D converter 32 to the digital adaptive amplifier predistortion algorithm 22 is based upon the amount of power in-band and out-of-band.

The in-band and out-of-band power are measured by additional circuitry (not shown) in the power measurement block 48. The output of the HPA 28 is sampled, and the samples 38 are downconverted with the downconverter 30. The downconverted analog signal is converted to a digital signal with the A/D (analog-to-digital) converter 32. The in-band and out-of-band power are advantageously calculated digitally using digital signal processing methods known in the art. In one embodiment, Fast Fourier Transforms (FFTs) are used for the power calculations. In another embodiment, a filter (not shown) may be substituted for the FFT averaging.

Based on the amount of measured power in-band relative to the amount of measured power out-of-band (i.e., the ratio of in-band power to out-of-band power (RIO)), the adaptive amplifier predistortion algorithm 22 modifies the predistortion lookup table 44 accordingly. A relatively small change is made to the predistortion function, the resulting in-band power and out-of-band power are measured, and the small change is either kept or discarded depending on whether the overall performance improved or degraded.

In one embodiment the adaptive predistortion algorithm 22 uses a relatively small number of parameters. The algorithm 22 cycles through the parameters, making small changes to one parameter at a time and either keeps or rejects the change depending upon the resulting change in predistortion performance. The predistortion function may be defined by two curves representing the predistortion gain and predistortion phase values as a function of input-signal envelope. The adaptive predistortion algorithm 22 parameters comprise gain and phase values at specific values of the envelope prior to predistortion. Interpolating between the gain and phase parameter values over the entire range of possible signal envelopes generates the predistortion gain and phase curves.

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In one embodiment, illustrated in FIG. 3, an adaptive predistortion circuit 50 includes various mathematical and functional logic blocks and lookup tables, as shown. Thus, in the adaptive predistortion circuit 50, fifteen-bit complex input samples (i.e., both I and Q samples) 52 are sent to a rounding block 54 that rounds the three least-significant bits to reduce calculation complexity. In a particular embodiment, the samples 52 are taken at sixteen times the chip rate specified in IS-95 (i.e., 16 x 1.2288 MHz). The rounding block 54 then sends twelve-bit complex samples 56 to absolute value calculation logic 58, which derives the absolute value and sends resultant eleven-bit complex samples 60 to I^2+Q^2 calculation logic 62. The I^2+Q^2 logic squares and sums the complex samples 60 and sends a twenty-three-bit signal 64 to binary floating point conversion logic 66. The binary floating point conversion logic 66. The binary floating point conversion logic 66 outputs an eleven-bit signal 68. The most-significant seven bits of the eleven-bit signal 68, which represent a lookup table index, are coupled to a predistortion lookup table 70 and also to a variable Vcc lookup table 72. The variable Vcc lookup table 72 advantageously has dimensions 128 x 10 and outputs a ten-bit variable Vcc control signal 74 at sixteen times the IS-95 chip rate. The four least-significant bits of the eleven-bit signal 68, which represent an interpolation factor, are coupled to interpolation logic 76. The predistortion lookup table 70 is coupled to the interpolation logic 76 via first and second twelve-bit complex connections 78, 80. The interpolation logic 76 ouputs a twelve-bit complex signal 82 to complex multiplication logic 84. The complex multiplication logic 84 is coupled to the complex input samples 52. The complex multiplication logic 84 multiplies the fifteen-bit complex input samples 52 and the twelve-bit complex signal 82. The complex multiplication logic 84 sends a resultant twenty-seven-bit complex signal 86 to saturation logic 88, which saturates the most-significant bit of the twenty-seven-bit complex signal 84. The saturation logic 88 sends a resultant twenty-six-bit complex signal 90 to rounding logic 92, which rounds the eleven least-significant bits of the twenty-six-bit complex signal 90. The rounding logic 92 outputs resultant fifteen-bit predistorted complex input samples 94 at sixteen times the IS-95 chip rate.

The adaptive predistortion circuit 50 may advantageously be implemented as part of a modulation ASIC in a BTS. Implementation of mathematical functions such as rounding, saturation, addition, multiplication, binary floating point conversion, and absolute-value calculation on an ASIC is well known in the art. The lookup tables 70, 72 may advantageously be implemented on the ASIC, with addressable registers, or with RAM memory. Alternatively, as those skilled in the art would understand, the adaptive

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predistortion circuit 50 may be implemented with discrete hardware components available off-the-shelf.

In one embodiment the predistortion lookup table 70 is advantageously software downloadable. As described in greater detail below with respect to FIG. 4, a set of software instructions executed by a processor (not shown) serves to write values to the predistortion lookup table 70. The processor is advantageously a Pentium® microprocessor manufactured by Intel Corporation and available off-the-shelf. Alternatively, the processor could be a controller, a microcontroller, a state machine, firmware instructions, or any other equivalent device known to those of skill in the art.

In the embodiment of FIG. 3, the adaptive predistortion algorithm 50 minimizes the out-of-band emissions at the output of an HPA. The out-of-band emissions are caused by nonlinearities between the output of the ASIC (not shown) and the output of the HPA. The predistortion is applied digitally at complex baseband in the ASIC.

Most of the nonlinearities are introduced in the HPA and can be characterized by amplitude and phase modulation as a function of the instantaneous input-signal envelope. These relationships are also known as AM-AM and AM-PM distortion, respectively. The nonlinearities in the HPA are assumed to be "memoryless" and solely a function of the instantaneous input-signal envelope. Therefore, the AM-AM and AM-PM relationships completely characterize the HPA nonlinearity.

The predistortion algorithm 50 minimizes the out-of-band emissions at the output of the HPA by applying an inverse AM-AM-and-AM-PM distortion at digital baseband. If the applied predistortion function is exactly the inverse nonlinearity, the nonlinearities cancel and the combined system is linear, up to the point of amplifier saturation.

Thus, the HPA predistortion algorithm 50 advantageously characterizes the nonlinear AM-AM and AM-PM distortion in the HPA, and then applies the inverse nonlinear distortion. Since the HPA AM-AM and AM-PM distortions vary over respective HPAs, temperature, and aging, an adaptive predistortion algorithm 50 is necessary.

It is convenient to apply the predistortion function at complex digital baseband because the signal envelope can be accurately calculated by $\sqrt{I^2+Q^2}$, and an arbitrary nonlinearity can be applied by complex multiplication with a value taken from the predistortion lookup table 70. The complex multiplication operation 84 advantageously allows for both amplitude and phase predistortion.

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As those skilled in the art would understand, the index to the predistortion lookup table 70 is, conceptually, the signal envelope. Nevertheless, the lookup table index can be generated by any function of the signal envelope that satisfies the following requirements: (1) The index must be phase-independent; (2) the index must be monotonic with the signal envelope; (3) the index must span at least 40 dB dynamic range; and (4) the index must sufficiently sample the predistortion function. In one embodiment the predistortion function is advantageously defined by a software downloadable lookup table 70.

In the adaptive predistortion circuit 50, the predistortion is advantageously implemented at the lowest sample rate possible in order to minimize hardware complexity. The sample rate selection is based on the required bandwidth of the predistorted CDMA waveform. In one embodiment the sample rate used to represent the predistorted waveform without aliasing is sixteen times the IS-95 chip rate, with the CDMA waveform being centered at baseband.

The lookup table index is generated from the complex baseband input samples 52. The lookup table index may advantageously be generated by a phase-independent transformation from complex samples to real samples followed by a nonlinear compression to increase the dynamic range with fewer bits. The complex values 52 at the input to the predistortion circuit 50 are represented with fifteen bits for both I and Q. As up to three least-significant bits may be rounded without significantly degrading adaptive predistortion performance, the rounding logic 54 rounds three least-significant bits from the samples 52 because rounding three bits reduces the complexity.

Advantageously, the absolute-value calculation logic 58 may take the absolute value of the truncated samples 56 because only the envelope magnitude is important for predistortion purposes. The phase-independent transformation is accomplished by calculating the energy (I^2+Q^2) with the I^2+Q^2 calculation logic 62. As I and Q are represented with eleven bits, the resultant sum is a twenty-three-bit number 64.

If the index to the predistortion lookup table 70 were the most-significant bits of the energy value (I^2+Q^2), a fourteen-bit lookup table index would be required to span a 40 dB dynamic range. To reduce the number of bits necessary to span the dynamic range, the energy is advantageously compressed via the binary floating point conversion logic 66 with a nonlinear function that re-represents the energy in binary floating point. An exemplary binary floating point conversion is shown in Table 1 below. In one embodiment, the floating point conversion is implemented in hardware, using a four-bit exponent to span

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a 48 dB dynamic range. In addition to the four-bit exponent, some bits of the mantissa are required to form the index of the predistortion lookup table 70 to reduce the step size between adjacent entries.

Table 1: Lookup Table Index and Interpolation Factor Definition

23-bit energy	11-bit energy in floating point	7-bit LUT index (N)	4-bit interpolation factor (K)
$1b_6b_5b_4b_3b_2b_1b_0xxxxxxxxxxxxxx$	$1111b_6b_5b_4b_3b_2b_1b_0$	$1111b_6b_5b_4$	$b_3b_2b_1b_0$
$01b_6b_5b_4b_3b_2b_1b_0xxxxxxxxxxxxx$	$1110b_6b_5b_4b_3b_2b_1b_0$	$1110b_6b_5b_4$	$b_3b_2b_1b_0$
$001b_6b_5b_4b_3b_2b_1b_0xxxxxxxxxxxx$	$1101b_6b_5b_4b_3b_2b_1b_0$	$1101b_6b_5b_4$	$b_3b_2b_1b_0$
$0001b_6b_5b_4b_3b_2b_1b_0xxxxxxxxxxx$	$1100b_6b_5b_4b_3b_2b_1b_0$	$1100b_6b_5b_4$	$b_3b_2b_1b_0$
$00001b_6b_5b_4b_3b_2b_1b_0xxxxxxxxxx$	$1011b_6b_5b_4b_3b_2b_1b_0$	$1011b_6b_5b_4$	$b_3b_2b_1b_0$
$000001b_6b_5b_4b_3b_2b_1b_0xxxxxxxxx$	$1010b_6b_5b_4b_3b_2b_1b_0$	$1010b_6b_5b_4$	$b_3b_2b_1b_0$
$0000001b_6b_5b_4b_3b_2b_1b_0xxxxxxxx$	$1001b_6b_5b_4b_3b_2b_1b_0$	$1001b_6b_5b_4$	$b_3b_2b_1b_0$
$00000001b_6b_5b_4b_3b_2b_1b_0xxxxxxx$	$1000b_6b_5b_4b_3b_2b_1b_0$	$1000b_6b_5b_4$	$b_3b_2b_1b_0$
$000000001b_6b_5b_4b_3b_2b_1b_0xxxxxx$	$0111b_6b_5b_4b_3b_2b_1b_0$	$0111b_6b_5b_4$	$b_3b_2b_1b_0$
$0000000001b_6b_5b_4b_3b_2b_1b_0xxxxx$	$0110b_6b_5b_4b_3b_2b_1b_0$	$0110b_6b_5b_4$	$b_3b_2b_1b_0$
$0000000000b_6b_5b_4b_3b_2b_1b_0xxxxx$	$0101b_6b_5b_4b_3b_2b_1b_0$	$0101b_6b_5b_4$	$b_3b_2b_1b_0$
$00000000001b_6b_5b_4b_3b_2b_1b_0xxxx$	$0100b_6b_5b_4b_3b_2b_1b_0$	$0100b_6b_5b_4$	$b_3b_2b_1b_0$
$00000000001b_6b_5b_4b_3b_2b_1b_0xxx$	$0011b_6b_5b_4b_3b_2b_1b_0$	$0011b_6b_5b_4$	$b_3b_2b_1b_0$
$000000000001b_6b_5b_4b_3b_2b_1b_0xx$	$0010b_6b_5b_4b_3b_2b_1b_0$	$0010b_6b_5b_4$	$b_3b_2b_1b_0$
$0000000000001b_6b_5b_4b_3b_2b_1b_0x$	$0001b_6b_5b_4b_3b_2b_1b_0$	$0001b_6b_5b_4$	$b_3b_2b_1b_0$
$0000000000000b_6b_5b_4b_3b_2b_1b_0x$	$0000b_6b_5b_4b_3b_2b_1b_0$	$0000b_6b_5b_4$	$b_3b_2b_1b_0$

A seven-bit lookup table index advantageously yields negligible performance degradation. Therefore, the seven most-significant bits of the energy represented in binary floating point 68 are used as the lookup table index. Consequently, the predistortion lookup table 70 is a 128-entry lookup table 70. To decrease the step size between entries in the predistortion lookup table 70, linear interpolation may advantageously be used to increase the resolution. As there is negligible performance degradation when four bits are used for linear interpolation between lookup table entries, the four least-significant bits following the seven most-significant bits used for the lookup table index are used for lookup table interpolation. Four bits for linear interpolation yields sixteen possible interpolation offsets.

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The four-bit interpolation factor is used by the interpolation logic 76 to linearly interpolate between consecutive entries in the predistortion lookup table 70. Letting the seven-bit lookup table index be N and the four-bit interpolation offset be K, where N ranges from 0 to 127 and K ranges from 0 to 15, allows the real and imaginary interpolated values to be calculated by the following equations:

$$Val(N,K) = [(16-K)/16] \times LUT(N) + (K/16) \times LUT(N+1) \text{ for } N < 2^7-1;$$

$$Val(N,K) = LUT(N) \text{ otherwise}$$

Letting the complex predistortion values from the predistortion lookup table 70 be represented by LUT(N) and LUT(N+1), the linear interpolation may advantageously be performed by calculating the quantity G1 x LUT(N) + G2 x LUT(N+1). The values of G1 and G2 depend on the interpolation offset and are listed directly below in Table 2.

Table 2: Linear Interpolation Gains

Interpolation offset	G1	G2
0	16	0
1	15	1
2	14	2
3	13	3
4	12	4
5	11	5
6	10	6
7	9	7
8	8	8
9	7	9
10	6	10
11	5	11
12	4	12
13	3	13
14	2	14
15	1	15

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If LUT(N) and LUT(N+1) are K-bit values and G1 and G2 are four-bit values, then (K+4) bits are required to represent the multiplication result. The sum (G1 x LUT(N) + G2 x LUT(N+1)) is a (K+5)-bit value. From the (K+5)-bit value, one least-significant bit is saturated, yielding a (K+4)-bit value, and four most-significant bits are rounded, producing the final K-bit interpolated complex value 82.

The complex multiplication logic 84 implements the amplitude and phase predistortion function. In one embodiment the predistortion algorithm 50 requires at least 6 dB of gain predistortion and at least 90 degrees of phase predistortion dynamic range. Constraining the real and imaginary parts of the complex predistortion values in the predistortion lookup table 70 to be positive advantageously allows a simplified implementation to meet the above requirements. Rounding one less bit than the number of bits needed to represent the complex numbers in the predistortion lookup table 70 advantageously yields a 6 dB gain at 0 degrees and 90 degrees, and a 9 dB gain at 45 degrees. But maintaining strictly positive values for both the real and imaginary parts of the complex numbers in the predistortion lookup table 70 limits the phase predistortion dynamic range to exactly 90 degrees. Thus, for all phase angles, the requirement of 6 dB of gain predistortion is satisfied.

The number of bits used to represent the complex numbers in the predistortion lookup table 70 determines the resolution of the predistortion function. Using twelve bits to represent the real and imaginary parts 78, 80 of the complex numbers produces negligible performance degradation.

In one embodiment the size of the predistortion lookup table 70 is 128 entries by twenty-four bits, or a total memory requirement of 3072 bits. As the predistortion lookup table 70 is programmable and is updated during operation, it is advantageously double buffered, increasing the memory requirement by a factor of two to 6144 bits.

The same lookup table index used for adaptive predistortion lookup table 70 may be used to index the variable Vcc lookup table 72, which tables the variable Vcc control voltage values. In one embodiment the variable Vcc control voltage signal is accurately represented with ten bits. In one embodiment the memory requirement for the variable Vcc lookup table 72 is 128 entries by ten bits, yielding a total of 1280 bits. If the variable Vcc lookup table 72 is double buffered, the memory requirement increases to 2560 bits.

In one embodiment, shown in FIG. 4, a software routine (depicted functionally as 96) is used to generate complex coefficient parameters that are written to the predistortion lookup table (70 in FIG. 3), interpolated, and input as complex signals (82 in FIG. 3) to complex multiplication logic 84. The

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complex multiplication logic 84 receives and multiplies together a complex baseband signal 52 and predistortion parameters 98, generating a resultant signal 100. The complex multiplication logic 84 is coupled to an upconverter 102, which upconverts the signal 100 to a carrier frequency signal 104. The upconverter 102 is coupled to an HPA 106, which amplifies the signal 104, generating an output RF signal 108 for transmission by an antenna (not shown).

In the embodiment of FIG. 4, the calculations of the software routines 96 are performed in a processor, independently of actual data samples 110, which are downconverted by the downconverter 112 and then digitally sampled for use as modifiers, as described in detail below. The software routines 96 are used to write a set of complex values b_k to the lookup table. These values (also herein denoted gains, parameters, or coefficients) b_k are multiplied with the complex digital baseband waveform 52 in the complex multiplication logic 84. The output of the HPA 106 is sampled, downconverted by the downconverter 112, and measured to gauge the efficacy of the predistortion. The ratio of in-band to out-of-band power (RIO) is measured (depicted functionally as block 114). Based on the effect of the predistortion upon the RIO, decisions are made at decision block 116 on the set of predistortion parameters {p} for the next iteration of the algorithm. The routine 96 runs continuously, perturbing parameters and adapting the predistortion functions accordingly in an effort to continually reflect the instantaneous AM-AM and AM-PM relationships.

In connection with a functional block 118 for updating the ith parameter, the predistortion parameters are advantageously stored in software in a set of 2N+2 real parameters, 2N of which represent predistortion gain and phase as a function of the complex baseband signal magnitude. An additional two tilt parameters are advantageously added to adaptively equalize amplitude and phase variations that are a function of frequency. Each set of N parameters represents either the gain or phase at N input powers. The value of N is advantageously set to 8. The upper seven values are spaced evenly on a dB scale in power, spanning a 30 dB range. This configuration allows for predistortion points to cover a wide range of input powers, permitting the algorithm to function in the extremes of only a pilot signal being present at ten percent power, or with a fully loaded system at full power. An added predistortion point may advantageously be placed at 0 on a linear scale. This point is used to allow for predistortion gain and phase impact at extremely low input powers. In accordance with one embodiment, the parameter values for both one- and two-channel CDMA operation may be found in Table 3, below. A distinction is advantageously made between one- and two-channel CDMA

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operation to allow for maximum spanning of the appropriate ranges for each mode.

Table 3: Position of Predistortion Parameters in Linear Quanta

Predistortion Parameter	Number of CDMA Channels	
	1	2
1	0	0
2	167	332
3	297	590
4	528	1050
5	939	1867
6	1670	3320
7	2969	5905
8	5280	10500

The predistortion algorithm cycles through the parameters, $\{p\}$, alternating between modifying gain and phase in successive iterations. The algorithm starts at the lowest power and increases the power level every even iteration. Once the set of 2N predistortion parameters has been cycled through, the two tilt parameters, t_α and t_β, are modified, after which the cycle wraps back to the lowest power level. In other words, if g_k and ϕ_k are the predistortion gain and phase parameters, respectively, at the kth power level, then the iteration order is

$$\cdots \rightarrow g_1 \rightarrow \phi_1 \rightarrow g_2 \rightarrow \phi_2 \rightarrow \cdots \rightarrow g_{N-1} \rightarrow \phi_{N-1} \rightarrow g_N \rightarrow \phi_N \rightarrow t_\alpha \rightarrow t_\beta \rightarrow g_1 \rightarrow \phi_1 \rightarrow \ldots$$

A vector of step-sizes, $\{s\}$, contains the magnitude and direction information for the modification steps. On the jth iteration, the step s_i is added to the appropriate parameter, p_i, to generate a new set of parameters, $\{p'\}$. When the algorithm first commences, the parameters, $\{p\}\big|_{j=0}$, are initialized such that the predistortion value for all gains, g_k, is 0 dB, and that of phases, ϕ_k, is $\frac{\pi}{4}$ radians. Further, during the course of the predistortion algorithm, the gains, g_k, are limited to 6 dB, and the phases, ϕ_k, to the range $\left[0, \frac{\pi}{2}\right]$. In the event that steps attempt to modify the parameters beyond these limits, the modified parameters are set to the value that is sought to be exceeded.

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There is a finite probability that the empirical measurement of RIO, performed in connection with functional block 114, may be a low-probability estimate of the "exact" value. Thus, there is a need to verify the previous measurement. Therefore, at a reevaluation point, no parameters are modified for a single iteration and the RIO value is remeasured and replaces the previous best value, RIO*, regardless of whether there is a reduction in out-of-band emissions. In one embodiment reevaluation is performed after twenty-three iterations of not finding a reduction in out-of-band emissions, allowing a full cycle of the predistortion parameters between reevaluations.

In one embodiment a digital filter (not shown) is added to filter the signal in the ASIC just before the signal is output by the D/A (24 in FIG. 2). The filter, which is applied to an intermediate frequency waveform at thirty-two times the IS-95 chip rate, serves to counteract ripple, which limits the efficacy of predistortion, in the frequency region of interest. Ideally, the filter is the inverse of a sinc function introduced by the sample-and-hold property of the D/A. It is advantageous to modify the filter adaptively to account for variation across components and variation introduced by aging. In one embodiment a seven-tap FIR filter is used. The tap coefficients for the filter are shown in Table 4, below. Two of the filters taps, labeled t_α and t_β, are allowed to vary between –31 and 0, inclusive. By changing the value of these taps, the gain and phase of the filter is modified, with the goal being that the modifiable taps will converge to the inverse of the sinc function.

Table 4: Seven-Tap Tilt FIR Filter Tap Coefficients

Tap Number	Tap Value
1	-1
2	3
3	$-31 \le t_\alpha \le 0$
4	183
5	$-31 \le t_\beta \le 0$
6	3
7	-1

Because the amplifier is more linear at lower powers, a predistortion step that reduces the average power of the signal may result in lower out-of-band emissions even though such a step may not bring the predistortion curves closer to the optimal inverse of the amplifier. Further, as the signal to noise

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ratio (SNR) of the signal is desired to be maintained, such a reduction in power is undesirable because it will reduce the digital range that is employed. Therefore, in connection with a functional block 120 for power control modification, the predistortion curves are modified to ensure that the average power before predistortion is the same as the average power after predistortion, i.e., that the nominal gain of predistortion is 0 dB. A gain/attenuation factor is applied multiplicatively to the signal prior to predistortion. This factor is integrated into the predistortion curve that is written to the lookup table (70 in FIG. 3), as described above in connection with FIG. 3.

The predistortion algorithm does not operate directly upon the signal; instead, the algorithm writes to the lookup table. The complex multiplication is then performed in the ASIC. Because the algorithm never encounters the actual signal, it is necessary to approximate the characteristics of the signal in order to determine the nominal gain introduced by predistortion on the present signal. The average digital power of the signal is determined by using the channel gains, sector gain, rate set information, frame rate, and gating information. Both the I and the Q components of the CDMA waveform at the input to predistortion are assumed to be bandlimited Gaussian random variables. This assumption results in a Rayleigh distribution for the waveform envelope,

$$y = \sqrt{I^2 + Q^2},$$

$$f_y(y) = \frac{y}{\sigma^2} e^{-y^2/2\sigma^2}, \qquad y \geq 0.$$

The Rayleigh distribution can be fully characterized by a single parameter, σ. As the moments of a Rayleigh distribution are

$$E[y^k] = (2\sigma^2)^{k/2} \Gamma\left(1 + \frac{k}{2}\right),$$

the parameter, σ, can be determined by $\sigma = \sqrt{E[y^2]/2}$. The average power for any waveform, however, is simply

$$P_{ave} = \frac{1}{N} \sum_{i=1}^{N} y_i^2.$$

But P_{ave} also equals $E(y^2)$. Therefore,

$$\sigma = \sqrt{\frac{P_{ave}}{2}}.$$

The average power of a CDMA channel at the output of a chip-rate-times-sixteen filter can be calculated, to within a constant, from the traffic channel statistics and the sector gain:

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$$P_{ave} = Kg_S^2\left[4^2\left(c_{pilot}^2 + c_{paging}^2 + c_{sync}^2\right) + \sum_{i,non-gated\,TC} c_i^2\left(\frac{22+(RS_i==2)}{24}g_{R,i}^2 + \frac{2-(RS_i==2)}{24}4^2\right) + \right.$$

$$\left. \sum_{i,gated\,TC} ((PCG - FO_i)\%15 < 8)\left(c_i^2\left(\frac{22+(RS_i==2)}{24}g_{R,i}^2 + \frac{2-(RS_i==2)}{24}4^2\right)\right)\right].$$

The variables, $c_i, RS_i, g_{R,i}$, and FO_i are the channel gain, rate set, rate gain, and frame offset of the ith channel, respectively. The comparisons in the above equation yield 1 if true or 0 if false. The rate gain of a channel, $g_{R,i}$, is determined by:

$$g_{R,i} = \begin{cases} 4 & , \text{ full rate} \\ 2\sqrt{2} & , \text{ half rate} \\ 2 & , \text{ quarter rate} \\ \sqrt{2} & , \text{ eighth rate} \end{cases}$$

Additionally, *PCG* is the current power control group index (ranging from 0 to 15), g_S is the sector gain (a constant scaling factor for the entire forward CDMA waveform, or waveforms), and K is a scaling constant that combines all of the filter gains in the ASIC from the chip generation to the chip-rate-times-sixteen baseband waveform. The rate gain of the second term of both summations over i (which, as shown above, is set to 4) may advantageously be multiplied by factor of $\sqrt{2}$ or $\sqrt{3}$ if the BTS is in soft handoff with another BTS.

Once the power is calculated, the complete probability distribution of the CDMA envelope as a function of input power is known. Further, as the predistortion parameters, $\{p\}$, fully define the predistortion curves for all input powers, the distribution after predistortion can be determined. From this distribution, the average power after predistortion can be calculated. Thus,

$$P_{ave,pd} = \sum p_y(y)\left(10^{g(y)/20} * y\right)^2,$$

where $p_y(y)$ is a sampled version of $f_y(y)$, and $g(y)$ is the gain in dB for the input power y. The value $g(y)$ is the spline-interpolated function generated from the predistortion gain parameters. This sum comprises twenty components equally spaced from 0 to the maximum envelope value (which depends on the number of CDMA channels). From this power, a power correction factor, $R = 10^{(P_{ave}-P_{ave,pd})/20}$, is applied. Because the predistortion curve is nonlinear, the correction factor R may not result in the power after predistortion equaling the input power. Therefore, the correction process may advantageously be repeated. In one embodiment the iterative process is continued until $P_{ave,pd}$ approaches to within $\pm .1$ dB of P_{ave}.

Due to the nonlinear nature of the predistortion gain, it is possible that the corrections may cause the power after predistortion to oscillate above and

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below the correction range without meeting the ±.1 dB specification. Therefore, in one embodiment, the correction loop is broken if the power does not converge acceptably after eight iterations.

The complex predistortion function is applied to the signal in the ASIC in the form of a lookup table. The software algorithm 96 creates and writes the lookup table each iteration. In one embodiment a seven-bit lookup table is employed. Therefore, the complex gain must be determined for each of the 2^7 lookup table entries. First, the gain and phase values are obtained by interpolating between the N-point gain and phase functions specified by the parameter set, {p'}, using a cubic spline function.

Once calculated, the gain and phase values at the lookup table energies, x_k, are combined to form the complex lookup table entries, $b(x_k)$:

$$b(x_k) = \lfloor 2048 * 10^{g(x_k)/10} e^{j\theta(x_k)} + .5 \rfloor.$$

As a complex linear gain is desired, and the predistortion gain is stored in dB, the predistortion gain must be converted to linear units by the operation $10^{g(x_k)/20}$. In one embodiment, an ASIC implementation of the complex multiplication (see FIG. 3), the eleven least-significant bits of the output of the multiplication are dropped. Therefore, for a predistortion gain, $g(x_k)$, of 0 dB not to change the magnitude of the signal, an additional gain of 2048 quanta must be applied. Finally, since the predistortion gain and phase values are floating-point numbers, the complex gain must be quantized in order to be written as the lookup table entries.

Once these entries are calculated and entered into the lookup table, the ASIC switches to use the new table. As there is a constant signal upon which the ASIC is continually applying predistortion, the lookup table is double-buffered. The complex gain, $b(x_k)$, is applied multiplicatively to the signal 52 via the complex multiplier 84. The now-predistorted signal 100 is then upconverted via the upconverter 102 to RF frequencies. At the RF frequency, the signal 104 is input to the non-linear HPA 106. After various RF manipulations through the upconverter 102, the downconverted output 123 of the HPA 106 is sampled digitally. The downconverted output 123 bears the effect of both the predistortion and the HPA 106, and is used to determined the efficacy of the parameter modifications.

To use a lookup table for a function, it is necessary to perform some type of interpolation scheme in order to determine the values of that function at various intermediate points. Various methods are known, including, e.g., "nearest-neighbor," "linear," "cubic," and "spline." The characteristics of each method affect the accuracy of the interpolation. In most methods little attention

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is paid to the first or higher-order derivatives, resulting in stiff, jagged fits to the function. However, the spline interpolation function seeks to maintain continuity through the second derivative. Splines are polynomial functions between the points of interpolation, with coefficients determined slightly nonlocally by virtue of attention to higher-order derivatives.

In one embodiment a cubic splice function is used for interpolation in the adaptive predistortion algorithm. An interpolation scheme that has a continuous second derivative is determined by

$$y(x) = Ay_j + By_{j+1} + Cy_j'' + Dy_{j+1}'',$$

where

$$A \equiv \frac{x_{j+1} - x}{x_{j+1} - x_j}$$

$$B \equiv 1 - A = \frac{x - x_j}{x_{j+1} - x_j}$$

$$C \equiv \frac{1}{6}\left(A^3 - A\right)\left(x_{j+1} - x_j\right)^2$$

$$D \equiv \frac{1}{6}\left(B^3 - B\right)\left(x_{j+1} - x_j\right)^2$$

However, in many cases the second derivative is unknown. The following set of N-2 equations can be used to determine the N 2nd derivatives $y_j'', 1 \le j \le N$:

$$\frac{x_j - x_{j-1}}{6} y_{j-1}'' + \frac{x_{j+1} - x_{j-1}}{3} y_j'' + \frac{x_{j+1} - x_j}{6} y_{j+1}'' = \frac{y_{j+1} - y_j}{x_{j+1} - x_j} - \frac{y_j - y_{j-1}}{x_j - x_{j-1}}.$$

Because these N-2 equations do not uniquely determine the N variables, two additional constraints are necessary. This is usually accomplished by setting the boundary second derivatives, y_1'' and y_N'', to zero. This method yields the so-called natural cubic spline. A detailed description of spline interpolation may be found in William H. Press et al., *Numerical Recipes in C* (Cambridge University Press, 2d ed. 1992).

To maximize the dynamic range of the A/D (32 in FIG. 2), the signal must be near the maximum and minimum values of the A/D without clipping (with a 12-bit A/D, clipping occurs at the values 0 and 4095). In one embodiment this is accomplished by attempting to ensure that the maximum and minimum values of the captured signal fall within the ranges of 148 to 748 for the minimum signal value and 3347 to 3947 for the maximum signal value. The algorithm performs this check as follows: A power-control-group worth of data is captured, which, in one embodiment, constitutes the maximum amount of data that the algorithm will consider in an iteration. If the maximum or minimum of the first 1000 samples falls outside the outer bounds of the specified ranges, then the data is discarded, an additional .25 dB of attenuation

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is introduced, and the next power control group is captured. Similarly, if the maximum or minimum of the 1000 samples falls inside the inner bounds of the respective ranges, then the given power control group is discarded, .25 dB of attenuation is removed, and the next power control group is captured. Only a subset of the captured data is observed to limit computation and to ensure that any required attenuation can be added or removed and another power control group be captured as quickly as possible. This advantageously limits the effect that changes in the power of the signal may have on automatic gain control (AGC) algorithms.

In connection with the functional block 114 for multistage RIO measurement, the downconverted output 123 of the HPA 106 is sampled by the A/D (see FIG. 2) and the data 124 is stored in the RIO measurement block 114. In one embodiment a field-programmable gate array (FPGA) (not shown) is used to store the data 124 in the RIO measurement block 114. The processor (not shown) then performs FFTs upon the data 124. In one embodiment sixty-four-point FFTs are used. The data samples 124 are windowed with a sixty-four-point Blackman window, and there is also an overlap of fifty percent between successive FFTs. The spectrum of the downconverted signal 123 is observed and the RIO is measured. The definition of RIO used by the algorithm measures the in-band power of the CDMA waveform and subtracts the out-of-band power in both the higher and lower sidebands. The bandwidth of the out-of-band measurements is advantageously wide, summing the out-of-band energy from ± 1.25 MHz out from the carrier to the limits of the range of the FFT. Emphasis is placed on the largest out-of-band emissions to enable the predistortion algorithm to lower the sideband levels over many frequencies. As the largest sidebands decrease in level, the focus shifts to other sidebands that are slightly lower. Accordingly, the algorithm seeks to bring down the out-of-band emissions to a uniformly low level.

In one embodiment the RIO measurement process 114 is a multistage measurement process 114. Initially, data that is a complete power control group (PCG) in length is captured and stored in the RIO FPGA. This is necessary because the computational requirement of the FFTs does not allow for real-time processing of the data. Additionally, this amount of data is sufficient for the maximum number of FFT averages that will be performed. All of the FFTs will have the advantage of operating on a contiguous set of data points that does not span a PCG boundary. Thus, there will be no changes in power due to rate changes or the addition or subtraction of telephone calls. Table 5, below, summarizes multiple stages of RIO measurement in accordance with one embodiment.

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Table 5: Multiple Stages of RIO Measurement

Name of Stage	# of FFT Averages	ΔRIO Threshold
Early-Bail	128	3 dB
Normal	256	.75 dB
Verification	509	0 dB

The first stage is an "early-bail" stage in which 128 FFT averages are performed and a value of RIO is obtained. This RIO value is compared to the previous best value of RIO, or RIO*. If the difference, RIO-RIO*, exceeds the early-bail threshold, no further processing of the captured data is performed and the parameter that resulted in the measurement reverts to its previous value. Step-size adjustments are also made, as described in detail below. In one embodiment an early-bail threshold of 3 dB is used. If the difference is less than the early-bail threshold, additional FFTs are performed on the data.

In the next, or "normal," stage, 256 FFT averages are performed and RIO is measured. Advantageously, the first 128 FFT averages are identical to those performed in the early-bail stage. Therefore, FFTs are performed on the additional data only, and the RIO measured from this data is averaged with the RIO measured after the early-bail stage. The resultant RIO value is then compared to the previous best value of RIO, RIO*. If the difference, RIO-RIO*, exceeds the normal threshold, which in one embodiment is .75 dB, no further computations are performed, the parameter change is discarded, and the step-sizes are modified accordingly. If the difference is not greater than the threshold, the data passes into the final, or "verification," stage.

The verification stage looks at the complete power control group. This translates into 512 FFT averages. However, due to the nature of the multistage process, three fewer FFTs are performed because certain data samples at the start and at the end of a given stage do not contribute to the second FFT specified by the overlap of fifty percent. If the thirty-two samples at the end of a given stage are reloaded in computing the first FFT for the next stage, two FFTs may be recovered. However, the benefit of the two additional FFTs is negligible, rendering such reloading unnecessary. At the verification stage, the difference between the measured RIO and the best RIO, RIO*, is compared to a threshold of zero. If the RIO is seen to have improved, then the parameter change is kept; otherwise, the parameter change is discarded.

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The multistage decision process yields two advantages. First, the average number of FFTs computed is reduced. Certain parameter modifications may be obviously bad, and a decision may be made sooner without significant computation. Second, more robust RIO measurements may be obtained. The variability of the peak-to-average ratio of the CDMA envelope implies that some segments of data, especially shorter ones, may not always contain peaks of a certain magnitude. As the nonlinearity of the HPA 106 is often more dramatic at higher input powers, particularly as saturation is approached, variability in the RIO measurement will be strongly correlated to the variability of the peaks. Thus, by increasing the number of FFTs performed, larger data is observed and variation is reduced. Additionally, regardless of the variability of the waveform, more averages reduce the variance of any measurement.

In the decision block 116, the effectiveness of the current predistortion functions is assessed. The RIO that has been measured is compared with the previous "best" value of RIO, denoted RIO^*. If RIO_j is seen to improve (i.e., if RIO_j becomes more negative or reflects a reduction in out-of-band emissions), the current parameter set, {p'}, becomes the initial parameter set for the next iteration, $\{p\}\big|_{j+1}$, i.e., the predistortion step made is kept. Additionally, the measured value, RIO_j, becomes the new "best" value of RIO, RIO^*. No changes are made to the step-sizes, {s}, or the sign of the step-size.

If RIO_j is found to be worse than RIO^*, the initial parameter set for the next iterations remains $\{p\}\big|_j$. Advantageously, this decision branch may occur at any stage of the RIO measurement process. In addition, the algorithm seeks to adapt step-sizes in such a manner that incorrect modifications vary RIO by only Δ dB. Therefore, if the RIO variation from the previous best measurement (RIO_j-RIO^*) is greater than Δ, the step-size of the modified coefficient, s_i, is divided by the constant factor, ξ. Likewise, if the specified difference is smaller than Δ, then the step-size is multiplied the factor ξ. Logically, the step-sizes will be bounded by the maximum predistortion gain and phase that is allowed, namely, 6 dB and $\frac{\pi}{2}$ radians, respectively. This adapting step-size algorithm causes the step-sizes to converge in such a manner that modifications in the parameters result in jumps in the level of the RIO that are on the order of Δ dB when the routine is in convergence. Further, the variation of the step-sizes prevents the algorithm from using only a fixed grid of points in the 2N-dimensional parameter space. Additionally, as an improvement in RIO was not

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found, the sign of the step-size flips. In other words, the next time the algorithm modifies the ith coefficient, it will take a step in the opposite direction.

As those of skill in the art would understand, the predistortion algorithm described herein need not be restricted to one precise set of software instructions, but could be modified while retaining features of the instant invention. Similarly, software instructions for the predistortion algorithm need not be limited to a specific programming language.

Thus, a novel and improved predistortion technique for high power amplifiers has been described. Those of skill in the art would understand that while the embodiments described herein relate to a cellular telephone system, many features of the instant invention lend themselves equally well to application in a satellite communication system, or in a point-to-point wireless system. Moreover, while the embodiments described herein relate to the forward-link RF waveform transmitted from a BTS to a mobile unit, those skilled in the art would appreciate that the principles of the invention could be incorporated into a mobile unit for application to a reverse-link RF waveform. It would further be understood by those of skill in the art that the embodiments disclosed herein relate not only to voice communication, but also to high-data-rate (HDR) data communication such as described in, e.g., TIA/EIA IS-95B.

Preferred embodiments of the present invention have thus been shown and described. It would be apparent to one of ordinary skill in the art, however, that numerous alterations may be made to the embodiments herein disclosed without departing from the spirit or scope of the invention. Therefore, the present invention is not to be limited except in accordance with the following claims.

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CLAIMS

What is claimed is:

1. A method of reducing out-of-band emissions from an amplifier, the method comprising the steps of:

multiplying a digital input signal to the amplifier with a set of digital predistortion parameters;

measuring the output power level of the out-of-band emissions from the amplifier; and

adjusting the set of digital predistortion parameters based upon the power level obtained from the measuring step.

2. The method of claim 1, further comprising the step of modifying the set of digital predistortion parameters to prevent the adjusting step from altering the average power level of the digital input signal.

3. The method of claim 2, wherein the modifying step comprises iteratively applying a power correction factor.

4. The method of claim 2, wherein the measuring, adjusting, and modifying steps are performed by a processor executing a set of software instructions.

5. The method of claim 1, further comprising the step of writing the set of digital predistortion parameters to a lookup table.

6. The method of claim 5, further comprising the step of interpolating between values in the lookup table.

7. The method of claim 6, wherein the interpolating step comprises executing a spline interpolation function.

8. The method of claim 1, wherein the measuring step comprises performing at least one stage of Fast Fourier Transform averages on digital samples of the output power level of the amplifier.

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9. The method of claim 1, wherein the measuring step comprises performing a plurality of stages of iterative Fast Fourier Transform averages on digital samples of the output power level of the amplifier.

10. The method of claim 1, wherein the measuring step comprises measuring the ratio of in-band power to out-of-band power at an output of the amplifier.

11. The method of claim 1, further comprising the step of initializing the set of digital predistortion parameters, wherein the set of digital predistortion parameters includes gain parameters and phase parameters.

12. The method of claim 1, wherein the adjusting step comprises incrementing each digital predistortion parameter by a step, the step size being derived from the difference between a result obtained from the measuring step and a previous result obtained from the measuring step.

13. The method of claim 12, further comprising the step of iteratively adapting the step size based upon the degree of difference between the result and the previous result.

14. The method of claim 1, further comprising the steps of converting the digital input signal to an analog input signal, upconverting the analog input signal to a carrier frequency, downconverting the output power level, and digitally sampling the downcoverted output power level.

15. A device for reducing out-of-band emissions from an amplifier, comprising:

complex multiplication logic for multiplying a plurality of digital predistortion parameters with a digital input signal;

an amplifier coupled to the complex multiplication logic; and

a processor logically coupled to the amplifier for digitizing an ouput signal from the amplifier, processing the digitized output signal, and modifying the plurality of digital predistortion parameters based upon the output signal.

16. The device of claim 15, further comprising a digital-to-analog converter coupled to the complex multiplication logic, an upconverter coupled

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to the digital-to-analog converter and to the amplifier, and a downconverter coupled to the amplifier and logically coupled to the processor.

17. The device of claim 15, further comprising a software-downloadable lookup table coupled to the processor and to the complex multiplication logic.

18. A device for reducing out-of-band emissions from an amplifier, comprising:

means for multiplying a digital input signal to the amplifier with a set of digital predistortion parameters;

means for measuring the output power level of the out-of-band emissions from the amplifier; and

means for adjusting the set of digital predistortion parameters based upon the power level obtained from the measuring step.

19. The device of claim 18, further comprising means for modifying the set of digital predistortion parameters to prevent the adjusting step from altering the average power level of the digital input signal.

20. The device of claim 19, wherein the means for modifying comprises means for iteratively applying a power correction factor.

21. The device of claim 19, wherein the means for measuring, means for adjusting, and means for modifying comprise a processor and a plurality of software instructions.

22. The device of claim 18, further comprising means for writing the set of digital predistortion parameters to a lookup table.

23. The device of claim 22, further comprising means for interpolating between values in the lookup table.

24. The device of claim 18, wherein the means for measuring comprises means for performing at least one stage of Fast Fourier Transform averages on digital samples of the output power level of the amplifier.

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25. The device of claim 18, wherein the means for measuring comprises means for performing a plurality of iterative Fast Fourier Transform averages on digital samples of the output power level of the amplifier.

26. The device of claim 18, wherein the means for measuring comprises means for measuring the ratio of in-band power to out-of-band power at an output of the amplifier.

27. The device of claim 18, further comprising means for initializing the set of digital predistortion parameters, wherein the set of digital predistortion parameters includes gain parameters and phase parameters.

28. The device of claim 18, wherein the means for adjusting comprises means for incrementing each digital predistortion parameter by a step, the step size being derived from the difference between a first result generated by the means for measuring and a second result previously generated by the means for measuring.

29. The device of claim 28, further comprising means for iteratively adapting the step size based upon the degree of difference between the first result and the second result.

30. The device of claim 18, further comprising means for converting the digital input signal to an analog input signal, means for upconverting the analog input signal to a carrier frequency, means for downconverting the output power level, and means for digitally sampling the downcoverted output power level.

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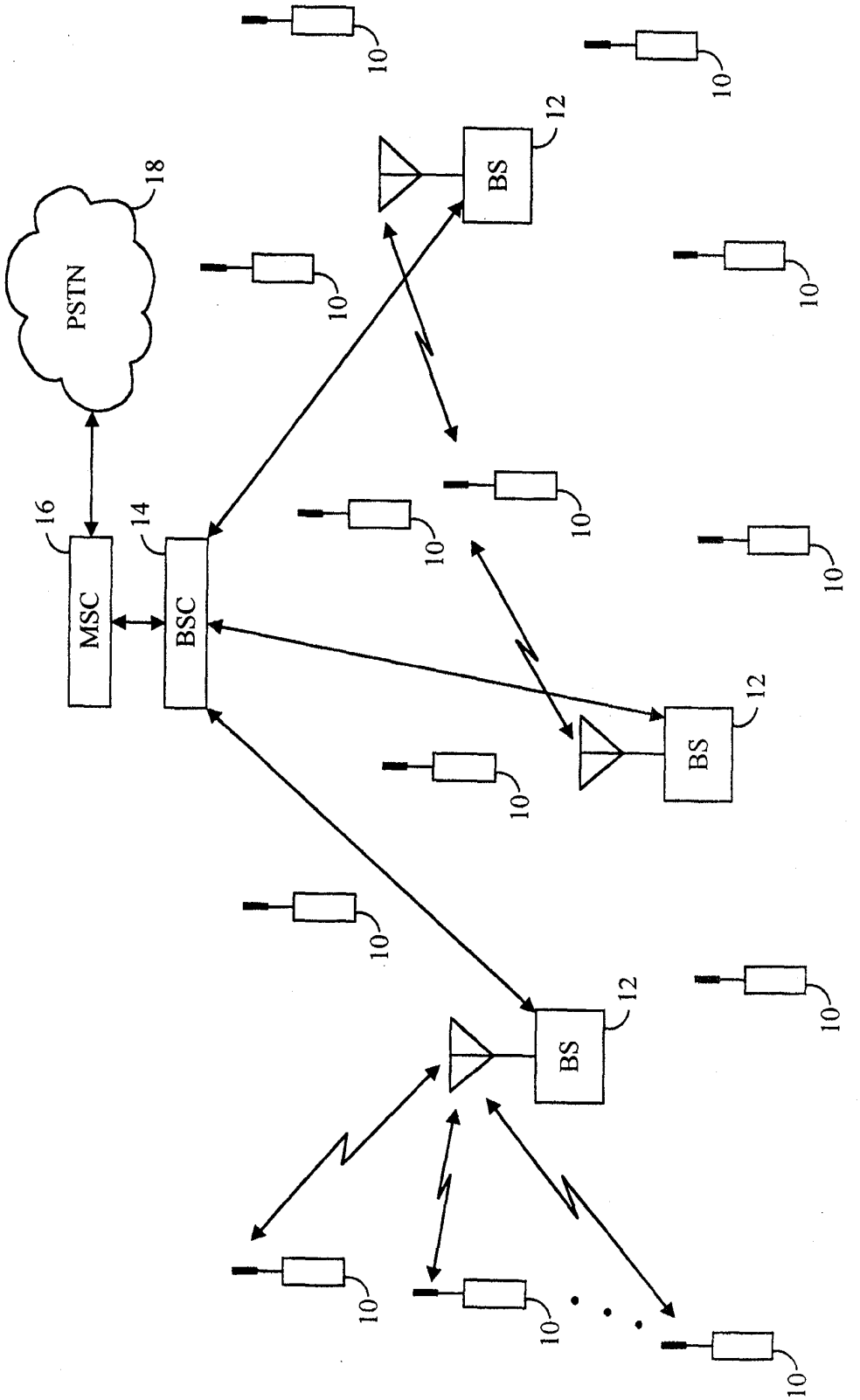

FIG. 1

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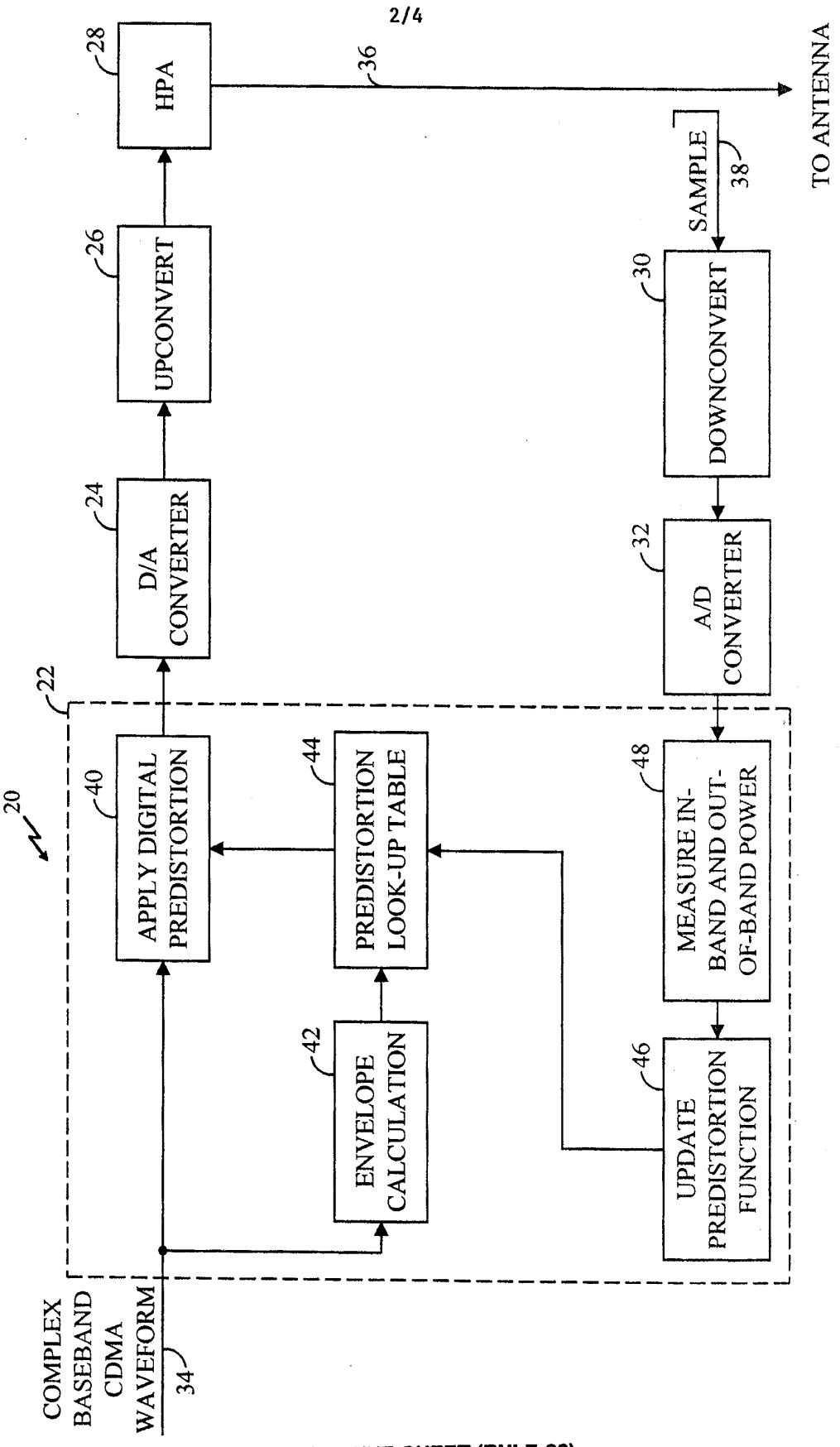

FIG. 2

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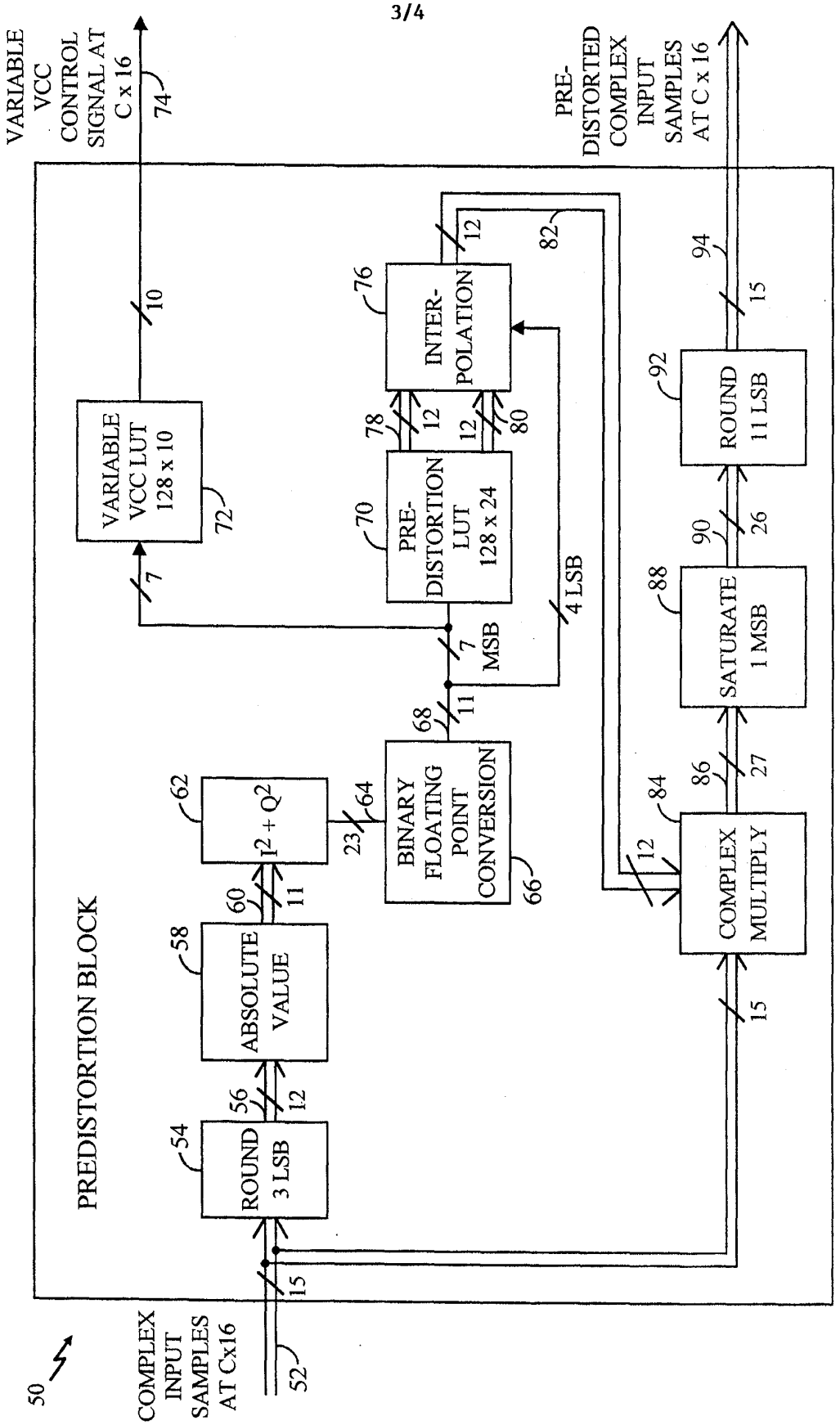

FIG. 3

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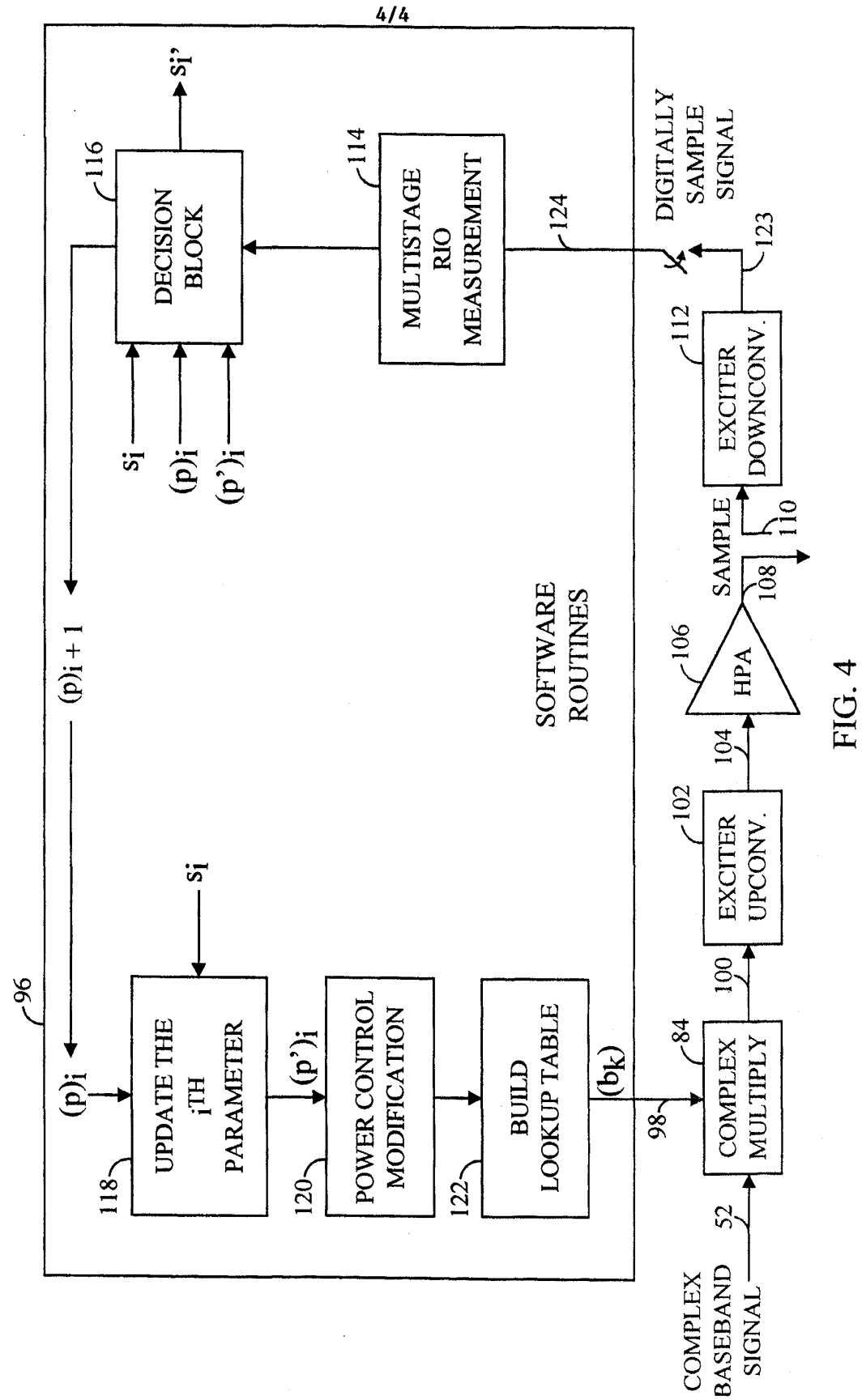

FIG. 4

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INTERNATIONAL SEARCH REPORT

Inter ɔnal Application No
PCT/US 99/14363

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H03F1/32

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H03F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	US 5 164 678 A (BOKSBERGER HANS ULRICH ET AL) 17 November 1992 (1992-11-17) the whole document	1-5,8-12 24,25 7
X A	US 5 574 992 A (CYGAN LAWRENCE F ET AL) 12 November 1996 (1996-11-12) the whole document	1-6, 15-17 7
X Y	EP 0 731 556 A (NIPPON ELECTRIC CO) 11 September 1996 (1996-09-11) the whole document	18-23, 27-30 24,25
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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
8 October 1999	20/10/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Segaert, P

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Form PCT/ISA/210 (second sheet) (July 1992)

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INTERNATIONAL SEARCH REPORT

Inte· onal Application No
PCT/US 99/14363

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

.formation on patent family members

Inter onal Application No
PCT/US 99/14363

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(Fifth Embodiment)

[0374] The present embodiment enables the determination of a vehicle that is in violation or a normal vehicle described in the above embodiments to be made easily and using a simple structure from outside the vehicle. Note that in the present embodiment the structure is the same as in the above embodiments, therefore, the same portions are given the same descriptive symbols and a detailed description thereof is omitted. Note also that, the structure of a portion of the relay device 50 of the above embodiments is used to form the observation device 52. In addition, the present embodiment has a simple structure to allow easy determination of whether a vehicle is a normal vehicle or is in violation.

[0375] As is shown in Fig. 35, in the observation device 52 of the present embodiment, a ground wave communication device 152 having a ground wave antenna 152A, and a lamp photographing device 158 provided with an image pickup device 158A such as a TV camera or art image sensor or the like are connected to an input / output port (I/O) 138 of a relay control device 130 constructed from a microcomputer. A display device 160 for displaying images photographed by the lamp photographing device 158 provided with the image pickup device 158A is also connected to the input / output port (I/O) 138. Furthermore, a printing apparatus 166 used for printing photographed images and the like is also connected to the input / output port (I/O) 138.

[0376] As shown in Fig. 36, in the present embodiment, an observation lamp 39 is provided in the vicinity of the number plate 34 (or 36). Figs 36A and 36B show states where the observation lamp 39 is flashing on and off. Fig. 36A shows a state where the observation lamp 39 is on and Fig. 36B shows a state where the observation lamp 39 is off. By providing an observation lamp 39 in the vicinity of the number plate 34 attached to a vehicle and connecting it to the in-vehicle device 30 in this way, a display for observation is made on the number plate 34. As a result, confirmation cart be easily performed from outside the vehicle.

[0377] Next a description will be given of the processing for determining a normal vehicle or a vehicle in violation from outside the vehicle, namely, on the ground side.

[0378] As is shown in Fig. 37, in the observation device 52 of the present embodiment, firsily, in step 670, the above normal pattern is read. Note that, it is preferable if a normal pattern generated by the latest signal received in the observation device 52 from the general center 40 is used for this normal pattern. By using this normal pattern generated from a received signal, the latest normal pattern can be used and the secrecy of the normal pattern can be improved. Note also that it is also possible to store the normal pattern information on a floppy disk and to use the information read from the floppy disk.

[0379] In the next step 672, the vicinity of the number plate 34 or 36 is photographed for a predetermined time. This photography needs at least to include the observation lamp 39. In step 672, at least two images in synchronization with the normal pattern are extracted from a plurality of images photographed for the set time. Namely, the images in synchronization with the on time of the normal pattern or the off time of the normal pattern are extracted in synchronization with the flashing of the normal pattern.

[0380] For example, if the observation lamp 39 is flashed on and off in the pattern shown in Fig. 23, if the images are extracted at times T1 and T2, images where the lamp is on at the time T1 and the lamp is off at the time T2 are obtained.

[0381] Note that the vehicle photography in step 672 is not limited to being performed for a set time. For example, if an electronic shutter is provided in an image pickup device and the electronic shutter either opened or closed in synchronization with the above normal pattern (the detection timing), the image picking up in synchronization with the flashing of the observation lamp can be possible. As a result, it is also possible to pick up an image only during the time the lamp is on in synchronization with the flashing of the normal pattern.

[0382] In the next step 674, the turning on and turning off images at the predetermined timing using the normal pattern read in the above step 670 are displayed together with the images extracted in step 672 on the display unit 160. If an observer observes the images displayed on the display unit 160, it can be easily determined whether the vehicle is a normal vehicle or is in violation.

[0383] Fig. 38 shows the display screen of the display device 160 for both normal states and violation states when the observation lamp 39 is flashing in a normal pattern (see Fig. 23). When the observation lamp 39 is flashing in a normal pattern (see Fig. 23), then, as is shown in Fig. 38A, the display screen is divided into four sections with the following being displayed. Namely, the top portion (the portion comprising the sections 162A and 162C) is related to the time T1 of the detection timing. The center portion (the portion comprising the sections 162B and 162D) is related to the time T2 of the detection timing. In addition, the bottom of the screen (the section 162E) is related to the photographed image and displays the year, month, date, and time of the photography. The left side portion (the portion comprising the sections 162A and 162B) displays a state in which the observation lamp 39 ought to be in a normal pattern, while the right side portion (the portion comprising the sections 162C and 162D) displays the actual photographed image. When the observation lamp 39 is turned on in a state other than the normal pattern, that state is one of those shown in Fig. 38B, 38C, or 38D.

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[0384] By displaying the state in which the observation lamp 39 should be turned on or off in a normal pattern, and by displaying the actual photographed image, it is possible for an observer to easily determine whether a vehicle is a normal vehicle or is in violation.

[0385] The year, month, date, and time of the photography of the photographed image is also displayed on the display device 160A. Moreover, because it is possible to specify a vehicle front the number plate, if this screen is printed using the printing apparatus 166, it is possible to preserve as an output form the suitability or otherwise of the turning on of the observation lamp 39 in the normal pattern.

[0386] Note that, in the above embodiment, the use of the observation device having the above structure enables a determination of whether a vehicle is a normal vehicle or is in violation from outside the vehicle using a simple structure, however, it is also possible to form an even simpler device to support this determination. The structure of this supporting device is described below.

[0387] As is shown in Fig. 39, the supporting device 170 for supporting the determination of a normal vehicle is constructed from receiver 172 provided with an antenna 172A, a control device 174, and a notification device 176. The receiver 172 and the notification device 176 are connected to the control device 174. In the same way as the above ground wave communication device 152, the receiver 172 is intended to receive a normal pattern. Note that the receiver 152 only needs to receive the normal pattern and may be constructed from a simple receiver.

[0388] The control device 174 is a device for converting a signal representing a normal pattern received by the receiver 172 into a drive signal for a notification in the notification device 176. The notification device 176 is formed from at least one of a sound emitting device such as a speaker or a buzzer and a lamp, and notifies a normal pattern as a sound pattern or light pattern that corresponds with the normal pattern using the drive signal from the control device 174.

[0389] As described above, because the supporting device 170 can be formed with a simple structure, it is possible to construct it in a portable size. As a result, it is also possible for an observer to perform an observation while carrying the device.

[0390] Note that in the above description, an example was described in which a receiver was used for support however, it is also possible to attach a card read / write device instead of a receiver. It is also possible to store a normal pattern in an IC card and, by reading this card, even in areas of poor reception and the like, the observation pattern read from the IC card can be used for support.

(Sixth Embodiment)

[0391] In the present embodiment, the present invention is applied to an automatic charge system for performing charge processing automatically for a vehicle that has entered (i.e. driven into) a toll facility (i.e. an area in which a charge is applied). Note that the automatic charge system used in the present embodiment is a system for settling a usage toll (fare for travelling) based on information transfer using communication between an in-vehicle device mounted in a vehicle and an on-road device installed on the road. Moreover, because the present embodiment has substantially the same structure as the above embodiments, the same portions are given the same descriptive symbols and a detailed description thereof is omitted.

[0392] The concept of the structure of the automatic charge system 10 of the present embodiment is the same as in the structure shown in Fig. 15. The general center 40 established on the ground side of the structure according to the present embodiment is the same as the general center 40 shown in Fig. 2, and therefore a description thereof is omitted. Furthermore, the relay device has the same structure as the relay device 50 shown in Fig. 15, the in-vehicle device has the same structure as the in-vehicle device 30 shown in Fig. 17, and the observation lamp has the same structure as the observation lamp 227 shown in Fig. 18, therefore descriptions of these are omitted.

[0393] The operation of the present embodiment will now be described.

[0394] Firstly, the operation of the ground side apparatus (in this case, the general center 40) will be described in detail. In the present embodiment, the general center 40 performs the same processing as the processing in Fig. 4, and transmits information for charge processing to an in-vehicle device 30 mounted on the vehicle 32.

[0395] In the general center 40, GPS signals are received from GPS satellites 20, 22, and 24 (step 300 in Fig. 4). The general center 40 then determines its own, reference position i.e. that of the general center 40 (a reference latitude and longitude Po), and generates GPS correction information (step 302). Next, predetermined area in which a charge is applied information is read (step 304), and GPS correction information is transmitted together with area in which a charge is applied information is transmitted by FM broadcast or telephone circuit or the like (step 306).

[0396] As described above, the area in which a charge is applied information is set for a area in which a charge is applied formed from a predetermined plurality of areas. An example of a structure is one in which the size of the areas between the city center and the suburbs becomes smaller the closer to the city center. An example of area in which a charge is applied according to the present embodiment is shown in Fig. 40. The ground is divided into three areas, namely, a circular central area A, a donut shaped area B that is substantially concentric around and adjacent to the

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outer periphery of the area A, and an area C outside the areas A and B. It is possible to specify these areas by latitude and longitude as well as by their shape.

[0397] Note that, in the present embodiment, checkpoints CP for performing charge processing are provided at predetermined positions in the area D and inside the area C.

[0398] Moreover, the charge processing area information is set for the area in which a charge is applied. A formed from a plurality of areas, however, it is possible to set a different charge amount for each area. For example, it is possible to increase the charge amount in accordance with the proximity to the city center, or to alter the charge amount in accordance with the number of times of use, or to alter the charge amount in accordance with the level of congestion, or to alter the charge amount in accordance with the length of time of use. These are determined by the charge calculation conditions.

[0399] The charge calculation conditions have been described in the above embodiments and a detailed description thereof is omitted, however, the first charge calculation condition is the number of entries into an area, shown in the table indicating the tolls for each area. The second charge calculation condition is the time length of stay in an area, shown in the table indicating the tolls for each area. The third condition is the level of congestion in the area, shown in the table indicating the tolls for each area. The fourth condition is speed when traveling inside an area (or, alternatively, the average speed inside an area), shown in the table indicating the tolls for each area. The fifth condition is total area travel distance traveled inside an area, shown in the table indicating the tolls for each area.

[0400] By including these tables based on the charge calculation conditions in the area in which a charge is applied information, it is possible to specify, for the area in which a charge is applied, the area and the toll.

[0401] The area in which a charge is applied information is set for a area in which a charge is applied formed from a plurality of predetermined areas. For example, areas might be formed between an inner city area and the suburbs and these areas become smaller the closer they are to the inner city area. An example of area in which a charge is applied of this type is shown in Fig. 40. The ground is divided into 4 areas. In the center portion is a circular area A. Donut shaped circular areas B and C which are substantially concentric around and adjacent to the outer periphery of the area A. Last is the area D which is the area other than the areas A, B, C. These areas can each be specified by their latitude and longitude as well as by their shape. In the present embodiment, the areas A, B, and C are each area in which a charge is applied, while the area D is outside the area in which a charge is applied.

[0402] Next, the operation of the in-vehicle device 30 will be described. In the present embodiment, the in-vehicle device 30 is intended to perform identical to that in Fig. 5.

[0403] Namely, information is received from the ground, i.e. the general center 40 (or relay device 50) at predetermined times (for example every one minute) by the in-vehicle device 30 mounted on the vehicle (step 400). A determination is then made as to whether or not the received information is the latest information (step 402), and, if the received information is the latest information (i.e. if the determination in step 402 is affirmative), the area in which a charge is applied is led out while the GPS correction information is stored (step 404). If, however, the received information is not the latest information (i.e. the determination in step 402 is negative), GPS signals from the GPS satellites 20, 22, and 24 are received (step 406), the current date and time (year, month, date, and time) are read, and the current position (latitude and longitude P (t)) of the in-vehicle device, namely of the host vehicle thereof, is determined (step 410). The determined latitude and longitude P (t) are then matched with a map database stored in advance (step 412), the area to which the latitude and longitude P (t) belong are then decided (step 414), and the latitude and longitude P (t), the date and time t, and the area are then stored as vehicle location history (step 416). As a result, the area in which the vehicle 32 is present at predetermined times is stored with a date and time as history.

[0404] Accordingly, taking as an example a case in which the toll varies according to the number of times a vehicle enters into a area in which a charge is applied, as is shown in Fig. 40, if a vehicle travels through the area comprising the areas A to D along the route Rt from the start point STP to the end point EDP, because the start point STP and the end point EDP are outside the area in which a charge is applied, no charge is applied, however, because each of the partway points S1, S2, S3, and S4 are inside the area in which a charge is applied, a charge is applied, at each between the start point STP and the end point EDP. Namely, history information (charge history) in the sequence of areas C, B, A, B, C is stored.

[0405] Next, the charge processing in the in-vehicle device 30 will be described. This charge processing is processing to transmit history information after the receipt of a request for the transmission of the charge history (history information) from the ground side (checkpoint CP), and is described in detail below.

[0406] As is shown in Fig. 41, in step 420, by making a determination as to whether or not there has been a transmission request from the general center 40 (or relay device 50), a determination is made as to whether or not the conditions match. If the conditions do not match, the determination in step 420 is negative and the current routine is ended. If, however, the conditions do match, the determination in step 420 is affirmative and, in step 422, the history information is acquired. This history information is the list of the vehicle location history stored above (i.e. in a process corresponding to step 416 of Fig. 5). In the next step 423, the acquired history information is transmitted to the relay device 50. In the next step 425, a determination is made as to whether or not notification has been received from the relay

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device 50. If notification has been received, the determination is affirmative and the notification is performed. If notification has not been received, the determination is negative and the routine is ended.

[0407] Next, the operation of the ground facility and the in-vehicle device at the checkpoint CP will be described further.

[0408] Note that, in the present embodiment, the checkpoints CP are set as predetermined areas and, as is shown in Fig. 42, comprise the areas CPM and CPS. The area CPM is an area for performing tasks related substantially to the charge processing while the area CPS surrounding the area CPM is set as an area for canceling error for specifying the area CPM (buffer area). The reason for this is to counter any errors caused by the GPS system when the position of the vehicle is detected using a GPS system. The area D outside the areas CPM and CPS is outside area in which a charge is applied (Fig. 42) or is in the area in which a charge is applied (Fig. 40).

[0409] As is shown in Fig. 43, in the in-vehicle device, the routine proceeds to step 580 where a determination is made as to whether or not the current position is peripheral to the relay device 50 (the checkpoint CP). If the determination is negative, the routine proceeds to step 586, if the determination is affirmative, the routine proceeds to step 582. In step 582, a determination is made as to whether or not the previous area was a checkpoint area (the area when the current routine was last executed). If the previous area was not a checkpoint, then the vehicle has entered the checkpoint CP for the first time and, consequently, the determination in step 582 is negative. In the next step 584, area entry processing is performed and the routine proceeds to step 594. If, however, the previous area was a checkpoint area, the determination in step 582 is affirmative and the routine proceeds to step 594 with no further change.

[0410] This area entry processing is processing performed when a vehicle enters a checkpoint CP. For example, at the point PS2 partway along the route Ro (Fig. 42), a vehicle has entered the checkpoint Cp for the first time. By transmitting an ID code and the current position, for example, a notification can be made that the vehicle has entered the checkpoint CP. Due to this notification, the checkpoint CP, namely, the ground side (the relay device 50) can begin the initialization of the processing that accompanies the charge processing. Note that, in step 584, it is also possible to set the conditions for beginning the charge processing in the in-vehicle device. In the present embodiment, as described above, the charge processing can be performed at the device mounted in a vehicle in response to a transmission request from the relay device 50.

[0411] Note also that the ground side, namely, the relay device 50 is able, by the above notification, to transmit the latest charge tables as well as a normal pattern for flashing the observation lamp 227 on and off when the vehicle has been authorized as a normal vehicle. Moreover, if the vehicle is authorized as being in violation, it is possible to transmit information for performing the violation notification. The normal pattern is a pattern for causing the observation lamp 227 to flash on and off in a predetermined timing (for example, a timing in which the lamp is repeatedly switched on for a set time and then switched off for a set time) in order to enable confirmation from outside the vehicle that the host vehicle is a normal vehicle for which charge processing can be performed. If this pattern is used, the cyclic flashing can be confirmed from outside the vehicle and the vehicle can be confirmed as being a normal vehicle. In the same way, a pattern which causes the observation lamp 227 to flash on and off in a violation pattern different from the normal pattern (by flashing the observation lamp on and off repeatedly for a time t, or by leaving the lamp flashing) is used as the violation pattern in order to enable confirmation from outside the vehicle that the host vehicle is in violation.

[0412] If the determination in step 580 is negative, the routine proceeds to step 586 where a determination is made as to whether or not the distance to the checkpoint CP is less than or equal to a predetermined distance, which enables a determination to be made as to whether or not the vehicle is approaching the checkpoint CP. If the distance to the checkpoint CP is less than or equal to a predetermined distance, the determination in step 586 is affirmative and, in the next step 592, information indicating that the vehicle is approaching the checkpoint CP is provided by images and sound, and the routine returns to step 580. For example, it is possible for a fixed time to display information such as "approaching checkpoint" on the display panel 227S, or to provide this vocally from the sound device 228, or to display it on the display on the navigation system via the display device 224.

[0413] If the determination in step 586 is negative, the routine advances to step:588 where a determination is made as to whether or not the previous area was a checkpoint CP. If the previous area was not a checkpoint CP, the routine returns to step 580. In contrast, because the determination in step 588 is affirmative when the vehicle has departed from a checkpoint CP, the determination in step 588 is affirmative and, in the next step 590, the area departure processing is executed and the routine proceeds to step 594.

[0414] The above area departure processing is processing performed when a vehicle has departed to the area outside the checkpoint CP. For example, at the point PS5 partway along the route Ro (Fig. 42), a vehicle has left the checkpoint CP. In this processing, notification that the vehicle has left the checkpoint CP is made by the transmission of the ID code and current position. Note that, because it is possible to determine from the current position of a vehicle and from the previous position of a vehicle that the vehicle has left the checkpoint CP, this determination can be made from the history information at either the vehicle side or at the ground side.

[0415] Note also that, in the same way as described above, it is also possible to cause the observation lamp 227 to flash on and off or to be extinguished by a result of art authorization that the vehicle has departed.

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[0416] Consequently, at the point PS1 partway along the route Ro, information is provided in step 592 that the vehicle is approaching the checkpoint CP. At the partway point PS2, area entry processing for when a vehicle first enters the checkpoint CP is performed. At the partway points PS3and PS4, because the previous area was a checkpoint CP, the routine proceeds to the next step without change. At the partway point PS5, area departure processing for when a vehicle departs from a checkpoint CP is performed.

[0417] In step 594, a determination is made as to whether or not an inquiry for fixed data such as information on the type of vehicle and the ID code which comprises the vehicle ID and the like, namely, the vehicle number and the like has been made from the ground side. If this determination is affirmative, then, in the next step 596, ID inquiry processing is executed and then the routine proceeds to step 598. If the determination is negative, the routine proceeds without change to step 598.

[0418] This ID inquiry processing is carried out when a vehicle is within a checkpoint. For example, at the points PS3 and PS4, partway on the route Ro (see Fig. 42) a vehicle is within the checkpoint, therefore, information relating to the ID code is notified by transmitting the current position as well as fixed data such as the ID code and the vehicle model information. Note that a determination is made on the ground side as to whether or not the notification is normal or not, and the vehicle is authorized as being normal or as being in violation.

[0419] The above ID inquiry processing is processing in response to a confirmation from the relay device to the vehicle of whether or not the vehicle is a normal vehicle or is in violation.

[0420] In the next step 598, a determination is made as to whether or not the power supply has been cut. If power is being supplied, the determination is negative and the routine returns to step 580. If the power supply has been cut, the determination is affirmative and the routine is ended.

[0421] Next, the operation of the relay device will be described. In the relay device 50 according to the present embodiment, substantially the same processings as in Fig. 13 are carried out in Fig. 44.

[0422] Firstly, an initial processing is performed, namely, GPS signals from GPS satellites 20, 22, and 24 are received and determines the general center 40 reference position (a reference latitude and longitude Po). It then generates GPS correction information and performs processing to read the area in which a charge is applied information (step 470). It then makes an inquiry in order to obtain a response from the in-vehicle device (step 472), and then makes a determination as to whether or not the in-vehicle device 30 has responded (step 474). If there has not been a response (the determination in step 492 is negative), the inquiry is repeated until a predetermined time has elapsed.

[0423] If the in-vehicle device has responded (makes a notification) (i.e. the determination in step 474 is affirmative), a request is made for history information including the ID code and the like to be transmitted (step 476). When the in-vehicle device 30 has transmitted the history information including the ID code and it has been received (i.e. the determination in step 478 is affirmative), a calculation formula is decided based on the area included in the history information (step 480), and the toll is calculated using the set calculation formula (step 484).

[0424] The calculation formula is determined by the above calculation conditions. These calculation conditions are conditions for determining a charge amount (charge calculation conditions) and may be made up of the number of entries into an area, the length of time in an area, or the like. The charge calculation formula is determined by the calculation conditions. In formula (5) below, a charge calculation formula is shown as a general formula considering areas.

$$(\text{charge amount}) = f(N_A, N_B, N_C, N_H, N_I, N_J, t) \quad (5)$$

wherein,

N_A, N_B, N_C: the evaluation of the areas (i.e. the number of entries and length of time of stay for the area determined by the charge calculation conditions) - note that the above area may be formed from a plurality of areas
N_H : the level of congestion
N_I : the speed (average speed)
N_J : the total distance traveled within the area
T : the date and time

[0425] Next, a determination is made from the calculation result of step 484 as to whether or not there is a charge (step 486). If no charge has been generated, a determination is made as to whether or not a predetermined time has passed (step 492). If the predetermined time has not passed (i.e. if the determination in step 492 is negative), the routine returns to step 472. If the predetermined time has passed (i.e. if the determination in step 492 is affirmative), the present routine is ended.

[0426] If, however, a charge has been generated, an instruction is given to notify the in-vehicle device of the charge information by transmitting the generated charge, namely, the toll to the in-vehicle device as charge information (step 488). The toll is then settled from an settled account such as a bank account or a credit card associated with the user of the vehicle determined by the ID code (step 490).

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[0427] Thus, in the present embodiment, history information indicating the presence of a vehicle in a area in which a charge is applied is stored (accumulated) in the in-vehicle device. In addition, because this history information is transmitted is response to a transmission request from the ground side, there is no need to install antennas at entries and exits and the like and transfer information for collecting tolls (charge). Namely, it is only necessary to establish a point where information can be transferred between the ground and a vehicle, and the toll collection (the charge) can be easily performed by transferring information for collecting the toll (the charge) at that point.

[0428] In the above embodiment, a description was given of when charge processing was performed by storing history information for one area in which a charge is appliedhaped as a concentric circle, however, the present invention is not limited to this. For example, the present invention is also effective in separately existing area in which a charge is applied A, B, and C. In the example shown in Fig. 45, a checkpoint CP is present in the area D outside the area in which a charge is applied. When a vehicle travels along the route R1 through the area in which a charge is applied A and B (i.e. through the partway points PS6 and PS7), the driver only needs to pass through the checkpoint CP established in advance as the partway point PS8 for the charge. In this case, the transit through the checkpoint CP does not need to be included in the route R1. Namely, the charge processing can also be performed by the vehicle passing through the checkpoint CP after a predetermined time has passed, for example, after several hours or several days. Note that in order to differentiate between the transit by the vehicle through the checkpoint CP in this way after a predetermined time has passed, for example, after several hours or several days, and a transit through the checkpoint CP a short time later, namely, as preferential treatment and delayed treatment it is also possible to add an extra charge when the vehicle visits the checkpoint CP after a set time has passed, and to subtract a predetermined discount charge from the normal charge amount when the charge processing is performed within the set time.

[0429] Moreover, the above description was for a fixed area in which a charge is applied, however, the present invention is not limited to this, and the area in which a charge is applied may set so as to be movable. For example, as is shown in Fig. 46, the present invention is also effective when the area in which a charge is applied A and B have been altered (including the size thereof being altered) by being moved to the area in which a charge is applied A' and B'. In this case, even if the car has previously traveled along the route R1 shown in Fig. 45, the route R1 is no longer included in the area in which a charge is applied after the area in which a charge is applied have moved to A' and B'. In this case, it is preferable if information is successively provided from the ground side to the in-vehicle device to the effect that the area in which a charge is applied has moved. Furthermore, there is no need for the areas to be circular in shape.

[0430] Note that, in the present embodiment, when a bank account or card with which charge processing can be performed automatically has been determined, it is also possible to give a notification before the payment is deducted from this card or bank account. In this case, it is possible for a use to easily determine whether or not the payment of a toll generated as the result of a charge is able to be paid from a card or bank account belonging to the user.

[0431] Moreover, in the above embodiment, a description was given of when a charge was processed on the ground side, however, the present invention is also applicable to the processing of a charge by deducting the toll from an IC card on which toll balance information is stored.

(Seventh Embodiment)

[0432] In the present embodiment, the present invention is applied to an automatic charge system for performing charge processing automatically for a vehicle that has entered (a vehicle that has driven into) a toll facility (i.e. a area in which a charge is applied). Note that the automatic charge system used in the present embodiment is a system in which the position of a vehicle is detected using the in-vehicle device, and the usage toll (driving toll) is settled on the basis of the result of the detection. Moreover, because the present embodiment is substantially the same as the above embodiments, the same portions are given the same descriptive symbols and a detailed description thereof is omitted.

[0433] The concept of the structure of the automatic charge system 10 of the present embodiment is the same as the structure shown in Fig. 1. Note that, in the automatic charge system 10 of the present embodiment, the in-vehicle device 30 is provided if necessary with a ground wave antenna (described in detail below) for ground wave communication.

[0434] The in-vehicle device 30 detects the position of its host vehicle 32 using GPS signals from GPS satellites 20, 22, and 24. The in-vehicle device 30 then performs charge processing (calculation) based on the information of the detected position and information relating to the area in which a charge is applied and, based on the result of that processing, performs the toll collection processing. At this time, it is also possible, if necessary, for information to be transferred and received with the general center 40 via ground wave communication.

[0435] Moreover, the general center 40 established on the ground side of the structure according to the present embodiment is the same as the general center 40 shown in Fig. 2 and, therefore, a description thereof is omitted. Note that, in the present embodiment, a wireless communication device is employed as the ground wave communication device 122 that is intended to exchange information with or provide information to the in-vehicle device 30 of a vehicle in which a communication device is mounted.

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[0436] Next, the in-vehicle device of the present embodiment will be described. Because the in-vehicle device has substantially the same structure as the in-vehicle device 30 shown in Fig. 3, the same portions are given the same descriptive symbols and a detailed description thereof is omitted.

[0437] As is shown in Fig. 47, an in-vehicle GPS device 220 having a GPS antenna 220A mounted on the vehicle is connected to the input / output port 208 of the in-vehicle device 30 of the present embodiment. The in-vehicle GPS device 220 is intended to detect the position of its host vehicle 32 using GPS signals from GPS satellites 20, 22, and 24.

[0438] Memory 230 is also connected to the input / output port 208. This memory 230 includes a rewritable toll data table 230A for storing toll information indicating the tolls in area in which a charge is applied, and a map database 230B in which is stored map information for providing visual route assistance information to a driver.

[0439] In addition, a display unit 224 for providing visual route assistance information to a driver, a speaker unit comprising a sound device 228 provided with a speaker 228A for providing aural information to a driver, and an input device 226 such as a keyboard or a switch device are also connected to the input / output port 208. The display device 224 is capable of displaying map information. The sound device 228 is intended to convert either digital or analog sound signals output from the device body 12 into drive signals for the speaker 228A and output these.

[0440] Note that data and the like to be stored in the memory 230 may also be stored on a storage medium such as a hard disk or floppy disk using the FD device 236.

[0441] An IC card read / write device 234 which is capable of receiving and ejecting an IC card, on which is stored toll balance information and the like, is also provided for the input / output port 208. A storage area 232A for storing area information relating to a area in which a charge is applied (described below) is set in advance on the IC card 232. Balance information and GPS correction information can also be stored on the IC card 232.

[0442] In the in-vehicle device 30, fixed data such as the model of the vehicle and an ID code comprising the vehicle number and the like is stored in advance in the RAM 204 and the ROM 206. The in-vehicle device 30 refers to the area in which a charge is applied and the toll balance information on the loaded IC card 232 via the IC card read / write device 234 and writes toll balance information to the IC card 232. Note that the IC card may includes a prepaid card or a credit card. Also, at the input/output port 208, an observation lamp 227 is connected. This observation lamp 227 is for notification the charge processing state to the outside of the vehicle.

[0443] As an example of the above IC card 232, as is shown in Fig. 48A, a magnetic storage type card 231 having a bar-shaped magnetic storage area 231A for storing information corresponding to the storage area 232A, and, as is shown in Fig. 48B, an IC storage type card 233 having an IC storage section 233A for storing information corresponding to the storage area 232A may be used.

[0444] Note that, although not provided in the embodiment shown in Fig. 47, other types of in-vehicle device include an in-vehicle device provided with a wireless communication device to which ground wave communication device having a ground wave antenna is connected, and which exchanges information with the ground or provides information to the ground by communication. An example of this wireless communication device is an FM broadcast or an FM character broadcast, a known wave communication, and telephone circuit communication such as in a moving body communication device. Accordingly, a communication device for a moving body such as a portable telephone or a car phone or the like may be used as the ground wave communication device, so that wireless communication (conversation via a telephone circuit) can be made possible via the in-vehicle device 30 between the vehicle and a telephone device outside the vehicle.

[0445] As is shown in Fig. 49A, an observation lamp 227 is provided in the front surface portion 229A of a box housing 229. The box housing 229 can be installed on a vehicle dashboard such that light from the observation lamp 227 is emitted to the outside of the vehicle. This enables easy confirmation from outside the vehicle that the observation lamp 227 is flashing.

[0446] Note that, by providing a display lamp that flashes in synchronization with the observation lamp 227 at a different position to the observation lamp 227, for example, at a position opposing the observation lamp 227 (i.e. at the rear surface portion 229B of the housing 229), it is possible for the driver inside the vehicle to confirm the flashing of the observation lamp 227 by the flashing of the display lamp. For example, as is shown in Fig. 49B, it is possible to install a display panel 227S in the rear surface portion 229B of the housing 229 thus providing a structure in which it is an easy matter for the driver of the vehicle to confirm the current state of the charge processing. In this case, it is possible to display the following on the display panel 227S as the current state, namely, that the vehicle is approaching a area in which a charge is applied, a standard charge amount for the area in which a charge is applied, the current amount of the charge processing, that charge processing has begun, that charge processing has ended, that charge processing has not been performed (i.e. that a violation has been committed), and the like. Moreover, as is shown in Fig. 49C, an observation lamp 227 can be formed from a plurality of observation lamps 227A, 227B, 227C, and 227D. In this case, it is possible to use observation lamps as vehicle type determining lamps indicating the type of the vehicle in which the observation lamps are installed such as heavy, medium, light, and two-wheeled vehicles.

[0447] Note that the mounting position (attachment position) of the in-vehicle device 30 is not limited to being on the vehicle instrument panel as described above, and it is sufficient if it is in a position where it is able to exchange sig-

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nals with the ground using the antenna. For example, it may be mounted inside the vehicle at the rear seat or the like. Moreover, the in-vehicle device 30 may be formed with separate structures comprising an in-vehicle device main body and an antenna. If the in-vehicle device is structured in this way with a separate in-vehicle device main body and antenna, it is possible to install the antenna only on the instrument panel or at a position towards the rear seat or the like, as described above, and the mounting position information is taken as information recording the position where the antenna has been mounted.

[0448] Moreover, when the ignition is on, power is supplied at all times from the vehicle battery to the in-vehicle device. It is also possible to enable the in-vehicle device to acquire date and time information such as the year, month, date, as well as the current time from an unillustrated clock built into the vehicle 32.

[0449] Next, the operation of the present embodiment will be described.

[0450] Firstly, the operation of the ground device (in this case, the general center 40) will be described in detail. In the present embodiment, the general center 40 performs the same processing as the processing in Fig. 4; namely, it transmits information for charge processing to an in-vehicle device 30 mounted in the vehicle 32. Note that the processing of the general center 40 is not directly related to the in-vehicle device 30 of the present embodiment, however, this processing is useful for an in-vehicle device provided with a communication device.

[0451] The general center 40 receives GPS signals from GPS satellites 20, 22, and 24 (step 300 of Fig. 4). The general center 40 then determines its own reference position, namely the reference position of the general center 40 (a reference latitude and longitude Po), and generates GPS correction information (step 302). Note that in the present embodiment, this GPS correction information is stored on the IC card 232. Next, predetermined area in which a charge is applied information is read (step 304), and GPS correction information is transmitted together with area in which a charge is applied information is transmitted by FM broadcast or telephone circuit or the like (step 306).

[0452] The area information is set in a area in which a charge is applied formed from a predetermined plurality of areas. An example is a structure in which, between the city center and the suburbs, the areas become smaller the closer to the city center.

[0453] An example of area in which a charge is applied (Area) of the present embodiment is shown in Fig. 50. The ground is divided into 7 areas. In the center portion is a circular area A. Next is a substantially donut shaped circle concentric around and adjacent to the outer periphery of the area A, and divided into 4 areas B, C, D, and E. Next is a substantially donut shaped circle area F concentric around and adjacent to the outer periphery of the areas B, C, D, and E. Last is the area G which is other than the above areas A, B, C, D, E, and F. These areas can be specified by their latitude and longitude as well as by their shape.

[0454] Moreover, although the area information is set in a area in which a charge is applied formed from a predetermined plurality of areas, it is possible to set a different charge amount for each area. For example, the charge amount may be increased the closer to the city center, the charge amount may be altered in accordance with the number of usages, the charge amount may be altered in accordance with the level of congestion, and the charge amount may be altered in accordance with the length of time of the use. In the above example (Fig. 50), in the present embodiment, the areas A, B, C, D, E, and F are set as area in which a charge is applied while the area G is set outside the area in which a charge is applied. As was described above, the first charge condition of the charge calculation conditions for determining these charge amounts is the number of entries into an area shown in a table indicating the charges for each area. With this type of setting, the charge amount increases as the number of entries into the central portion of the area in which a charge is applied increases. For example, an example of the first charge calculation condition (number of times an area is entered) is shown in the table indicating the tolls for each area in Table 7. This table may also be stored as area information in the IC card 232.

Table 7

Area	Charge Amount
A	¥300/ entry
B	¥100/ entry
C	¥100/ entry
D	¥100/ entry
E	¥100/ entry
F	¥10/ entry
G	¥0/ entry

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[0455] The second charge calculation condition is the length of time in an area shown in the table indicating the tolls for each area. With this type of setting, the charge amount increases as the length of time of the stay in the central portion of the area in which a charge is applied increases. For example, an example of the second charge calculation condition (length of stay in an area) is shown in the table indicating the tolls for each area in Table 8. This table may also be stored as area information in the IC card 232.

Table 8

Area	Charge Amount
A	¥150/ minute
B	¥90/ minute
C	¥90/ minute
D	¥90/ minute
E	¥90/ minute
F	¥10/ minute
G	¥0/ minute

[0456] The third charge calculation condition is the level of congestion in an area shown in a table indicating the tolls for each area. The fourth charge calculation condition is the speed at which a vehicle traveled inside an area (or alternatively, average speed) shown in a table indicating the tolls for each area, and the fifth charge calculation condition is the total distance traveled inside an area when traveling inside an area shown in a table indicating the tolls for each area.

[0457] By including the tables based on the above charge calculation conditions in the area information, it is possible to specify, with respect to a area in which a charge is applied, the area and the tolls therefor.

[0458] Next, the operation of the in-vehicle device will be described.

[0459] As is shown in Fig. 51, in step 501, an area determination is made in the in-vehicle device as to the position where the host vehicle is located. (Refer to Fig. 5) In the next step 503, a determination is made as to whether or not the area determined in step 501 is a area in which a charge is applied. If the determination is negative, the routine proceeds to step 510, if the determination is affirmative, the routine proceeds to step 505. In the next step 505, a determination is made as to whether or not the determined area is the same as the previous area (i.e. the same area as the last time the present routine was performed). If the previous area was not a area in which a charge is applied, then the vehicle has entered a area in which a charge is applied for the first time. Consequently, the determination in step 505 is negative and, in the next step 506, area entry processing is executed and the routine advances to step 513. This area entry processing is processing performed when a vehicle has entered a area in which a charge is applieduch as by turning on or flashing the observation lamp 227. Note that, in this step 506, conditions are set for starting the charge processing in the in-vehicle device. On the other hand, if the previous area was a area in which a charge is applied, the determination instep 505 is affirmative and the routine advances to step 513 without further processing.

[0460] Note that, in the present embodiment, it is possible to notify the outside of the vehicle that charge processing is currently being performed by turning on or flashing on and off the observation lamp 227 when a vehicle has entered the area or when the charge processing described below has started. It is also possible to notify the outside of the vehicle that charge processing has been completed by flashing the observation lamp 227 when the charge processing is completed. Note that, when the observation lamp 227 is flashed on and off, it is preferable that a pattern for flashing the observation lamp 227 on and off in a predetermined timing (for example, a timing indicated by turning the lamp on and off repeatedly for fixed lengths of time) is determined in advance in order to enable confirmation from outside the vehicle. If this pattern is used, confirmation of cyclic flashing is possible from outside the vehicle, and it can be confirmed that the vehicle is normal. On the other hand, when it is not possible to accomplish the charge processing, a violation pattern is stored and processing may be performed to enable confirmation from outside the vehicle that the vehicle is in violation by flashing the observation lamp 227 on and off in a violation pattern that is different to the normal pattern (for example, by repeatedly turning the lamp on and off for times t, or by flashing the light continuously).

[0461] If the determination in step 503 is negative, the routine proceeds to step 510 where a determination is made as to whether or not the previous area was a area in which a charge is applied and, if the determination is negative, the routine returns to step 501. If, on the other hand, the determination in step 510 is affirmative, the vehicle has left the area in which a charge is applied and, therefore, due to the affirmative determination in step 510, the routine proceeds to step 512, where area departure processing is performed and the routine advances to step 513. This area departure

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processing is processing performed when a vehicle has departed from a area in which a charge is applieduch as by turning off or flashing the observation lamp 227 in a violation pattern. Note that, in the same way as described above, it is also possible to cause the observation lamp 227 to flash on and off or to be extinguished based on a result of an authorization that the vehicle has departed. For example, when the charge processing is performed normally, the lamp is turned off or is caused to flash on and off in a normal pattern, and when there is a violation such as when the balance is insufficient or if there is no IC card loaded, the lamp is left on or is caused to flash in a violation pattern. This enables easy confirmation of the charge state of a vehicle from outside the vehicle.

[0462] In the next step 513, a determination is made as to whether or not the power supply has been tamed off. If power is still being supplied, the determination is negative and the routine returns to step 501. If the power has been turned off, the determination is affirmative and the current routine is ended.

[0463] For example, if a vehicle has entered the area F at the point PS1 partway along the route Rt shown in Fig. 50, because the vehicle has entered the area for the first time, area entry processing is performed. Next, at the partway point PS2, the vehicle has departed from the area F and has entered the area B. Therefore, area departure processing and area entry processing are performed. In the same way, at the partway point PS3, the vehicle has departed from the area B and has entered the area A. Therefore, area departure processing and area entry processing are performed.

[0464] Next the processing in the in-vehicle device of the present embodiment will be described. In the in-vehicle device 30 mounted on a vehicle (the processing of step 501 in Fig. 51), when area determination processing is performed, information, namely area information (tables), stored in the storage area 232A of the IC card 232 is read (this corresponds to step 400 of Fig. 5), and a determination is made as to whether or not the read area information is the latest information (step 402). When the area information is the latest information, area information (tables) including the area in which a charge is applied is stored in memory, and GPS correction information is stored (this corresponds to step 404). Note that the GPS correction information and the balance information can also be read from the IC card 232.

[0465] If, however, the read area information is not the latest information (if the determination in step 402 is negative), because the area information (tables) already stored in the memory can be used, GPS signals are received from the GPS satellites 20, 22, and 24 (step 406), the current date and time (year, month, date, and time) are read (step 408), and the position thereof, namely, the position of the vehicle 32 (latitude and longitude P (t)) is determined (step 410). Note that, when the latitude and longitude P (t) are determined it is possible to use the stored GPS correction information.

[0466] Next, the determined latitude and longitude P (t) are matched with the map database stored in advance (step 412), and the area to which the latitude and longitude P (t) belong is decided (step 414). In the present embodiment, the latest area information read from the above IC card is used in step 414. Next the latitude and longitude P (t), the date and time t, and the area are stored as vehicle location history (step 416). As a result, the areas in which the vehicle 32 is located with dates and times, at predetermined times, are stored as history. Table 9 shows an example of a list of vehicle location information.

Table 9

Time t					Latitude and Longitude P (t)		Area A (t)	Charge
Year	Month	Date	Hour	Minute	Longitude	Latitude		
1997	11	05	08	13	E135-30-25	N35-20-13	G	*
1997	11	05	08	14	E135-30-49	N35-19-58	G	*
1997	11	05	08	15	E135-30-55	N35-19-32	F	*
1997	11	05	08	16	E135-31-01	N35-19-25	F	
• • •	• • •	• • •	• • •	• • •	• • •	• • •	• • •	
1997	11	05	11	24	E135-39-25	N35-15-18	B	
1997	11	05	11	25	E135-39-50	N35-15-25	B	
• • •	• • •	• • •	• • •	• • •	• • •	• • •	• • •	

[0467] As seen above, the areas in which the vehicle 32 is located at predetermined times are stored with dates and times, as history.

[0468] Next, the charge processing in the in-vehicle device 30 will be described. The charge processing in the present embodiment performs the same processing as the processing shown in Fig. 6. Note that, in the present embodiment, the execution of this charge processing is in a starling state together with the execution of the area entry process-

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ing.

[0469] A determination is made as to whether or not conditions match (step 420 of Fig 6) by making a determination in the in-vehicle device, as to whether or not it is the above predetermined data and time or as to whether or not an instruction has been given (in the present embodiment, whether or not the area entry processing has been performed) by the general center 40 in the case of the device mounted in a vehicle provided with a communication device. If the conditions do not match (if the determination in step 420 is negative), the current routine is ended.

[0470] If, however, the conditions do match (if the determination in step 420 is affirmative), the history information is obtained (step 422). This history information is a list of the vehicle location history that corresponds to the stored (processed in step 416 of Fig. 5) Table 3. Next, the calculation formula (charge calculation formula) is set (step 424). The calculation formula is determined by the above calculation conditions, and the charge calculation formula (2) shown as a general formula considering the area is set.

[0471] Next, the toll is calculated (step 426) using the calculation formula set above and the history information. For example, when using the first charge calculation condition in which the charge amount of the toll is determined by the number of entries into an area, because the unit price for each area is set by the table read from the IC card, it is possible to calculate the charge amount of the toll by multiplication the number of entries to the unit price of the table read from the IC card. When the toll calculation has ended, the charge processing is executed (step 428). This charge processing is processing to deduct the charge amount determined above from the balance of the IC card 232.

[0472] For example, when the calculation condition is solely the number of entries into an area and the history information is from the start point STP to the end point EDP, as is shown in Fig. 50, the charge amounts are as shown below for the route Rt and the route Rb.

Rt charge amount = 300x1 + 100x1 + 100x0 + 100x1 + 100x0 + 10x1 + 0x1 = ¥510

Rbt charge amount = 300x0 + 100x0 + 100x0 + 100x1 + 100x0 + 10x1 + 0x1 = ¥110

[0473] Thus choosing a route that avoids the central portion means the charge amount is less.

[0474] If the calculation condition is solely the length of time spent an area and the history information is from the start point STP to the end point EDP, as is shown in Fig. 50, the charge amounts are as shown below for the route Rt and the route Rb.

Rt charge amount = 150x2 + 90x4 + 90x0 + 90x2 + 90x0 + 10x2 + 0x2 = ¥860

Rb charge amount = 150x0 + 90x0 + 90x0 + 90x2 + 90x0 + 10x7 + 0x2 = ¥250

[0475] Thus choosing a route that avoids the central portion means the charge amount is less.

[0476] In this way, in the present embodiment, because area information relating to a area in which a charge is applied can be stored in an IC card capable of being loaded in an in-vehicle device, and the area in which a charge is applied is determined using that area information so that a charge amount can be obtained, even when a communication device is not incorporated in the in-vehicle device, it is still possible to specify the area in which a charge is applied with ease and perform the correct charge processing. Moreover, even if the area in which a charge is applied varies, this can be dealt with simply by updating the area information stored in the IC card.

[0477] Note that, in the above embodiment, a description was given for when the present invention was applied to a case in which no communication device was incorporated in the in-vehicle device, however, the present invention is not limited by whether a communication device is incorporated or not incorporated and can be applied to a case in which an in-vehicle device incorporating a communication device is provided. In particular, in an in-vehicle device incorporating a communication device, when the vehicle is located in an area where communication is obstructed or is outside the communication area, it is possible to perform the correct charge processing by implementing the above processing.

[0478] Furthermore, in the above description, the area in which a charge is applied was set as a fixed area, however, the present invention is not limited to this, and the area in which a charge is applied may be able to be movably set In this case, the term of validity of the area in which a charge is applied can be set and the table only referred to during this term of validity.

(Eighth Embodiment)

[0479] The system structure according to the eight embodiment of the present invention is shown in Fig. 52. In the system of the present embodiment, there is provided a charge processing device 701. Note that, in the present embodiment, because the charge processing device 701 includes the functions of a notification device mounted in a vehicle,

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it is described as the 701 in the description below.

[0480] The in-vehicle notification device 701 serving as a charge processing device mounted in a vehicle communicates with a notification station 730 via an inbuilt telephone unit 708 (described below) and an antenna ANTt so that data is exchanged. Moreover, the in-vehicle notification device 701 receives radio waves from satellites via the GPS antenna ANTg, and recognizes the position and traveling direction of the vehicle using an inbuilt GPS position measuring device (720 - 726: described below) and displays this together with a map indicating the area through which the vehicle is traveling. When there are insufficient number of satellites whose waves are receivable or when receiving waves from the satellites are impossible, the insufficient information is supplemented by vehicle position calculation by multiplication of the traveling speed and detection of the direction using a gyro. Alternatively, vehicle position recognition can be performed.

[0481] Fig. 53 shows the structure of the in-vehicle notification device 701. As is seen in Fig. 53, direct current voltage +B from the battery in the vehicle is constantly supplied to the in-vehicle notification device 701. A power supply circuit PSC supplies operating voltage to the CPUs of the GPS information processing RCU 720 and the notification control ECU 702. When the vehicle ignition switch IGsw is closed and the vehicle power supply is turned on, the power supply circuit PSC supplies operating voltage to all circuits of the in-vehicle notification device 701.

[0482] The GPS position measuring device (720 - 728) is provided with a receiving antenna ANTg, a GPS receiver 721, a GPS demodulator 722, a display device 724, a piezoelectric vibrating gyro 725, an altitude sensor 726, a GPS information processing ECU (Electronic Control Unit) 720, an operating board 723, a map search engine 727, and a map database 728. The 1.57542 GHz radio waves transmitted from each of the GPS satellites are received by the GPS receiver 721 via the receiving antenna ANTg, and the information contained in the radio waves, namely, information such as a function indicating the orbit of the satellites and the time and the like is demodulated by the GPS demodulator 722, and input into the GPS information processing ECU 720.

[0483] The GPS information processing ECU 720 is a computer system based on mainly a microprocessor (CPU) and provided with almanac data memory and memory for a data buffer as well as an input / output interface (an electric or electronic circuit). The CPU generates information indicating the position of its host vehicle (latitude, longitude, altitude) based on the information transmitted from the GPS satellites, and the search engine 727 reads map data of a page (screen) that includes the position from the map database 728 and displays this on the display device 724. The current position index that also shows the direction of travel is also displayed as well as the current position on the display device. The basic structures of the reception antenna ANTg, the GPS receiver 721, the GPS demodulator 722, and the display device 724, as well as the basic operation of the GPS information processing ECU 720 are the same as the structural elements of known devices already available on the market.

[0484] However, in order to implement the present invention, a program is added to the operating program of the GPS information processing ECU 720 that performs the following. Namely, the current position (ground position) of a vehicle (i.e. the in-vehicle notification device 701), the direction of travel, and the current time are transmitted to the notification control ECU 702 in response to a data transmission request from the notification control ECU 702. The notification control ECU 702 reads the transmitted charge area information and stores it in memory. The charge area is then displayed in superposition (as a half-tone dot meshing) in the area defined by the charge area information, namely, the charge area on the map displayed on the display device 724.

[0485] Analog signals output by the piezoelectric vibrating gyro 725 and the altitude sensor 726 are each input into the GPS information processing ECU 720, and the CPU of the ECU 720 reads the signals after converting them into digital data via an A/D converter. Information output from the GPS demodulator 722 and information for controlling the GPS demodulator 722 is input into or output from the CPU via the I/O port of the GPS information processing ECU 720. The GPS information processing ECU 720 calculates three-dimensional coordinates Ux, Uy, Uz of the position of its host vehicle with a "3 satellite position measuring calculation" or a "4 satellite position measuring calculation".

[0486] In the "3 satellite position measuring calculation", in a predetermined three dimension simultaneous equation three sets of data received from three satellites are each substituted as parameters, and by solving this simultaneous equation, any error in the clock on the receiving side, latitude and longitude of the reception point, which are unknown numbers, are determined. The altitude of the reception point is determined, in this example, by calculation from the signal output from the altitude sensor 726, and is substituted into the simultaneous equation as known data. In the "4 satellite position measuring calculation", in a predetermined four demension simultaneous equation four sets of data received from four satellites are each substituted as parameters, and by solving this simultaneous equation, any error in the clock on the receiving side, latitude, longitude, and altitude of the reception point, which are unknown numbers, are determined. In addition, because any error in the clock on the receiving side can be determined by performing the position measuring calculation of any of these, the time of the internal clock can be corrected based on this error information.

[0487] When the ground position information is calculated by GPS position measurement, the GPS information processing ECU 720 calculates the direction in which the vehicle is traveling by a comparison with the previously calculated ground position. On the basis of this lime calculated ground position, map data of the one page (one screen)

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that includes the current position is read from the map data memory 728 and is displayed on the display device 724. A current position index that also shows direction of travel is displayed at the current position on the display. In addition, when at least a portion of the area defined by the charge area information, namely the charge area, received from the notification control ECU 702 and saved in the internal memory, is included in the area displayed on the display device 724, the charge area is displayed in superposition (in half-tone dot meshing) over the area on the display screen. This additional display allows the driver to recognize area in which a charge is applied on the display screen of the display device 724. The notification control unit 702 is also a computer system centered around a microprocessor (CPU) and provided with art input / output interface (an electric or electronic circuit). The CPU is able to exchange transmissions of various types of information with the notification station 730 via the antenna ANTt, the telephone unit 708, and the modem 707. The extension serial input / output board 706 performs the serial input and output of data, as well as serial / parallel conversion input and output.

[0488] The voice of the driver that is input using the microphone MIC is converted into digital data indicating letters of words via a voice recognition unit 709, and is input into the CPU of the notification control ECU 702. Furthermore, the CPU notifies (aurally informs) the driver when necessary of messages (output information) using the in-vehicle speaker SP via the voice synthesizing unit 710 and the switching switch SW711. When voice data is output from the CPU, the switching switch SW711 switches the between the in-vehicle audio and the speakers SP to a connection between the voice synthesizing unit 710 and the speakers SP. At this time, the CPU simultaneously displays the message conveyed to the driver by voice via the vehicle speaker SP alphabetically on the display unit 704. As a result, the driver is able to confirm a message from the CPU both aurally and visually.

[0489] A card reader 705 for reading and writing data on an IC card CRD is connected to the notification control ECU 702. When an IC card CRD is inserted into a card insertion slot, the card reader 705 reads the data stored on the card CRD and transmits it to the notification control ECU 702. When the card reader 705 receives writing data from the notification control ECU 702, it overwrites (i.e. replaces previous data with this new writing data) this data in the IC card CRD. The information stored on the IC card is shown in Table 10. In the example shown in Table 10, the amount for a single issue of a card is ¥10,000. The balance of the card is ¥10,000 (i.e. the card is unused) and the card ID allocated by the issuer of the card is MYCAR003. The classification of the vehicle for which the card is applied for is a light vehicle and the vehicle ID (in this example, the number displayed on the vehicle number plate) is A123B568. The data in the charge table is for the charge area which the driver requests (applies for) directly after the issue of the card, and this data is written on the card by the issuer in accordance with the driver's application. If there is no such application (i.e. writing request), then there is no such writing.

Table 10

Data stored on card	
Item of information	Content of information
Card ID	MYCAR003
Card balance	¥10000
Vehicle classification	Light vehicle
Vehicle ID	A123B568
Charge table	• • • (Table 11)

[0490] An example of the data in a charge table is shown in Table 11. The data of one set (one point) of the charge area information in Table 11 is positional information indicating one point on an outline of the charge area. When there are only date of two sets (data of two points), date of each set means the positions of opposite corners in a rectangle (square), and the charge area is rectangular. An example thereof is shown in Fig. 58.

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Table 11

Charge table

Item of information	Content of information
Charge Area Information	[N350000, E1360000] (First point) [N345900, E1360100] (Second point)
Toll information /entry	Heavy vehicle Medium vehicle Light vehicle
Time spot: 7:00 – 9:00	¥500 ¥300 ¥200
Time spot: 17:00 – 19:00	¥500 ¥300 ¥200
Time spot: other	¥400 ¥200 ¥100
Table valid period	10 – 11 October, 1997
Table valid area information	… (First point) … (Second point)

[0491] When there are date of more than or equal to three sets, the positions (point) indicated by date of each set are joined in order of the writing of the data sets, and the polygonal area that emerges when the last point is joined with

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the first point indicates the charge area. Because there are two sets of position (point) data in the example shown in Table 11, the charge area is quadrangular (square). The toll information is differentiated by time slot and by type of vehicle. The term of validity of the table indicates the term of validity of the data. The table valid area information shows an outline that is shaped substantially the same as the charge area extended by approximately 600 meters outside the outline of a charge area prescribed in the charge area information. When a plurality of charge areas are set, this table valid area information is for allowing a charge table of a charge area that is near to it to be selected in the vehicle.

[0492] The card issuing and toll settlement spots shown in Fig. 52 (card issuing and toll settlement booths) 771 - 773 issue IC cards CRD. These spots (service centers) are provided in locations that provide easy access for a driver and that are as dose as possible to areas where the charge areas are set, such as in the vicinity of the notification station 730, in the catchment area of the notification station 730, outside the catchment area of the notification station 730, or the like. For example, they may be provided in local government buildings or branches thereof in the area in which the charge area is set In these spots, new IC cards can be issued, lost or damaged cards can be reissued, unpaid tolls (card balances in arrears) can be settled, and prepaid deposits can be increased (i.e. card balances increased) in accordance with the wishes of a driver by a service operator or by an automatic machine. When these processings are performed, the processing data is transmitted to the notification station 730 via a public phone network and an exchange 760. In accordance with the received processing data, the notification station 730 updates the data in the observation database WDB when a new card is issued, a lost or damaged card is reissued, or a prepaid deposit is increased, and updates the data in the arrears database CDB when an unpaid toll is settled.

[0493] The structure of the notification station 730 is shown in Fig. 54. In the notification station 730 there is a wireless communication device 731 that modulates transmission data from a controller 732 into radio wave signals and sends it to an antenna 740, and also receives radio waves via the antenna 740, demodulates the received data and feeds it to the controller 732. The controller 732 is a computer system that is centered around a microprocessor (MPU) and is provided with an input / output interface. A terminal PC (a complete set comprising a personal computer, display unit, keyboard, mouse, printer), a charge database (memory) FDB, and an information control unit 733 are connected to the controller 732. The arrears database CDB, the observation database WDB, and the entry / exit vehicle database TDB are connected to the information control unit 733.

[0494] A modem 734 is connected to the controller 732. The controller 732 is able to perform sound and data transmission with the control center 50 (Fig. 52) via this modem and the public communication circuit exchange 760 (Fig. 52).

[0495] Figs. 55 and 56 show outlines of the notification control operation of the (CPU of the) notification control ECU 702. Fig. 55 will be looked at first. The notification control ECU 702 waits for the ignition switch IGsw to be closed (Si: H), and when the ignition switch is closed, the notification control ECU 702 registers the data of the card CRD in its internal memory via the card reader 705 (steps S1 to S4). If no card CRD has been loaded, the notification control ECU 702 waits for a card to be loaded and then registers the data of the card CRD in internal memory. Note that, in the description below, inside the brackets the word "step" has been omitted with only the step number and the letter S denoted.

[0496] Next the card balance in the read card data is displayed on the display unit 704 (S5). Next the notification control ECU 702 starts the timer Tc for the time limit Tc (S6). A data transmission request is then made to the GPS information processing ECU 720, and data of the current position (ground position), the direction of travel, and the date and time is received from the GPS information processing ECU 720 and written to internal memory. The charge area information in the card data registered in internal memory is also sent to the GPS information processing ECU 720 (S7). When this charge area information is received, the GPS information processing ECU 720 adds the charge area display (half tone dot meshing) to the corresponding area of the map displayed on the display device 724 that corresponds to the charge area indicated by the charge area information.

[0497] Next, the notification control ECU 702 checks whether the date and time received from the GPS information processing ECU 720 are within the period in which the table is valid in the charge table registered in internal memory, or whether the current position received from the GPS information processing ECU 720 is within the area in which the table is valid (the table valid area) shown in the information of the area in which the table is valid (the table valid area information) in the charge table registered in internal memory (S8a). If the date and time are outside the period in which the table is valid, or if the current position is outside the area in which the table is valid, then in this case, the charge table does not fit the current area. Therefore, a charge table request is transmitted via the antenna ANTt (S9). At this time, the charge table request is transmitted together with the vehicle ID and card ID in the card data, the direction date and the position obtained from the GPS information processing ECU 720. When the notification station 730 receives the charge table request, it saves the card ID, the vehicle ID, the position, and the direction data in internal memory, and transmits the charge table (Table 11) in the charge database FDB (S41 - S44 in Fig. 47).

[0498] When it receives this charge table, the notification control ECU 702 checks whether the date and time are within the period in which the table is valid in the charge table, or whether the current position received from the GPS information processing ECU 720 is within the area in which the table is valid shown in the information of the area in which the table is valid (S8b). If the date and time are within the period in which the table is valid, and if the current posi-

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tion is within the area in which the table is valid, the notification control means 702 registers (replaces with new data) the received charge table in internal memory and in the IC card CRD (S10 - S11).

[0499] Next, looking at Fig. 56, thereafter the notification control ECU 702 checks at the time cycle Tc whether the current position is within a charge area indicated by the charge area information in the charge table or outside the charge areas (S12, S13, • • • S25 - S1 - S2 - S6 to S8a - S12, S13). If it is outside a charge area, and if the direction of travel is one that is approaching a charge area, then when the position is within 500 meters from the charge area, "charge area 500 meters ahead" is displayed on the display device 704 along with charge table information (Table 11; however, the charge area information and the information of the area in which the table is valid are excluded). At the same time, notification such as "charge area is 500 meters ahead" is made by voice synthesis via the voice synthesizing unit 710 and the speaker SP (S13 - S16 to S20). Moreover, when the current position is within 400 meters from the charge area, the display "charge area 500 meters ahead" on the display device 704 is altered to "charge area 400 meters ahead", and a notification of "charge area is 400 meters ahead" is also made (S13 - S16 - S17 - S21 to S24).

[0500] Note that the charge area is displayed in superposition on the map displayed on the display device 724 in the step S7 repeated in the cycle Tc. Moreover, because the current position of the vehicle is shown on the displayed map as a direction attached index, the driver can recognize the position of the vehicle relative to the charge area and the direction of travel from the display on the display device 724.

[0501] When the vehicle enters a charge area, the notification control ECU 702 writes "1" in the register (internal memory) so as to show that the vehicle has entered the area in which a charge is applied, and clears the information showing that the vehicle is within 500 meters of the charge area, and is within 400 meters of the charge area (RPF and RPS data in the register) (S27), and performs "charge processing" (S28).

[0502] In the charge processing (S28), the notification control ECU 702 extracts the toll for the vehicle classification in the card data from the charge tables registered in the internal register, and the card balance in the card data in the internal memory is updated to a value reduced by the amount of the toll, and also similarly updates the data of the IC card CRD (S28). The balance displayed (displayed in S5) on the display unit 704 is also updated (S29). The notification control ECU 702 then transmits the vehicle entry notification data showing that the vehicle has entered the charge area to the notification station 730. At this time, the vehicle ID and the card ID in the card data, as well as the current direction and position obtained from the information processing ECU 720, and the card balance are transmitted (S30). When the notification station 730 receives this vehicle entry notification, the card ID, the vehicle ID, the position, the direction, and the card balance are saved in the internal memory, and the information in the database is updated correspondingly to the contents of these sets of data. These contents are described below. The notification control ECU 702 checks whether the card balance is a negative value (insufficient toll payment) (S31), and if the card balance is a negative value, displays "insufficient payment - settlement required" on the display device 704. Notification such as "card balance is insufficient. Please settle debt" by voice synthesizer is also made using the voice synthesizing unit 710 and the speaker SP (S32).

[0503] After the above described "charge processing" has been executed when a vehicle has entered the charge area, the data in the register RAE is set at 1, therefore, because the routine proceeds from step 26 to step 25, there is no repetition of the "charge processing" within the same charge area. When the (position of the) vehicle departs from the charge area, the notification control ECU 702 advances from step S12 to S13, and in step S14, the data in the register RAE is altered to 0 to indicate an area outside the charge area. Vehicle departure notification (i.e. that the vehicle has departed from the charge area) is then made to the notification station (S15). Namely, vehicle departure data showing that the vehicle has departed from the charge area is transmitted to the notification station 730. At this time, the vehicle ID and the card ID in the card data, as well as the current direction and position obtained from the GPS information processing ECU 720 are transmitted (S15). When the notification station 730 receives this vehicle departure notification, the card ID, the vehicle ID, the position, and the direction are saved in the internal memory, and the information in the database is updated correspondingly to the contents of these sets of data. These contents are described below.

[0504] After the vehicle departure notification (S15), because the direction in which the vehicle is traveling is now a direction moving away from the charge area which the vehicle has lust transited, the notification control ECU 702 advances from step S16 to step S25, and the relative distance notification relating to the charge area (S17 to S24) is not performed.

[0505] When the vehicle transits one charge area (the first charge area) as described above and travels towards another charge area (the second charge area), when the (current position of the) vehicle leaves the area in which the table is valid that is indicated by the table valid area information of the first charge table representing the first charge area, the notification control ECU 702 moves from step S8a to S9 and transmits a charge table request. This transmission wave is received by a first notification station (S30) addressed in the first charge area, and the first notification station transmits the first charge table. When the notification control ECU 702 receives the first charge table, in step S8b, the charge table received is determined to be invalid. As a result, even if the notification control ECU 702 receives the first charge table after the vehicle has left the area in which the table is valid that is indicated by the table valid area information of the first charge table representing the first charge area, this is not written on the IC card CRD or the internal

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memory.

[0506] When the (current position of the) vehicle enters the table valid area of the second charge area, the notification control ECU 702 writes the second charge table transmitted by the second notification station in internal memory and on the IC card CRD, and notification control is performed in the manner described above according to the data.

[0507] As described above, when a vehicle reaches a point 500 meters before a charge area, that fact is notified to the driver via the display deivice 704 and the speaker SP, and information on the charge area is displayed on the display device 704. In addition, a notification is again made when the vehicle reaches a point 400 meters before the charge area. Therefore, the driver has enough time decide whether or not to enter a charge area, and has enough time to choose a detour route.

[0508] Fig. 57 shows an outline of the notification processing of the controller 732 of the notification station 730 shown in Fig. 54. When the notification control ECU 702 of the in-vehicle notification device 701 of the vehicle transmits a charge table request in step S9 including the card ID, the vehicle ID, the position, and the direction, the controller 732 of the notification station 730 receives the request and saves data representing the card ID, vehicle ID, position, and direction in internal memory, and in response to this request (S41, S42), transmits a charge table in the database FDB via the antenna 740 (S44). A search is then made (S45) via the control unit 733 as to whether or not the received card ID or vehicle ID is the ID of a vehicle that has been in a collision, or has been stolen, or whether the card is a problem card (i.e. lost or damaged, stolen, scrapped through reissue, or illegally copied) stored in the observation database WDB. If the card ID or vehicle ID is one of the above, the card ID, the vehicle ID = vehicle No..., the contents of the problem, the current position (reception data), and the current time are displayed on the terminal PC display unit and printed out as an observation data set and are also transmitted to the control center 750 and card issuing and toll settlement booths 771 to 773. These are able to perform data registration or take action in accordance with the content of the problem.

[0509] The notification control ECU 702 of the in-vehicle notification device 701 transmits vehicle entry notification data showing that a vehicle has entered a charge area. When the controller 732 of the notification station 730 receives this, the controller 732 saves the card ID, the vehicle ID, the current position, the direction, and the card balance in internal memory, specifies the entry road (the entrance / exit to the area) based on the position data, and increments by one the number of vehicles that have entered at this entry road in the entry and departure vehicle database TDB (S48). A check is then made as to whether or not the card balance is negative (minus) (S49). If the card balance is negative, the data (card ID, vehicle ID, current position, direction, and card balance) is supplied to the terminal PC and displayed on the display and printed out. A check is then made via the control unit 733 as to whether the card ID or vehicle ID are in the arrears database CDB. If they are in the arrears database, the card balance of the relevant item in the arrears database CDB is updated the new value. If they are not in the arrears database, this newly acquired data (card ID, vehicle ID, current position, direction, and card balance) is registered for the first time in the arrears database CDB (S50). The ID check and the like described above (S45, S46) are then performed.

[0510] The notification control ECU 702 of the in-vehicle notification device 701 transmits vehicle departure notification data showing that a vehicle has departed from a charge area. When the controller 732 of the notification station 730 receives this (S53), the controller 732 saves the card ID, the vehicle ID, the current position and the direction in internal memory, specifies the departure road (the entrance / exit to the area) based on the position data, and increments by one the number of vehicles that have departed at this departure road in the entry and departure vehicle database TDB (S54). The ID check and the like described above (S45, S46) are then performed.

[0511] When the transmitted settlement data (the card ID, the vehicle ID and the card balance) is sent from the card issuing and toll settlement spots 771 to 773, if the received card balance is positive, the controller 732 erases the data of the relevant ID in the arrears database CDB (erases the arrears register). If the card balance is still negative (minus), the card balance of the relevant ID is updated to the received card balance.

[0512] The data of the databases CDB, FDB, WDB, and TDB can be controlled (i.e. read, transferred, output, written, and erased) by the terminal PC and the control center 750. When the terminal PC or control center 750 accesses the controller 732, the controller 732 performs data processing (i.e. reading, transferring, outputting, writing, and erasure) in accordance with the instruction thereof (S58). The control center 750 is intended to carry out traffic control and charge collection control inside and outside the charge area, as well as observation and tracking of problem cards and vehicles. In order to carry out traffic control, the control center 750 regularly, and when appropriate, refers to the data in the vehicle entry and departure database TDB, and calculates the number of vehicles present within the charge area (the sum of the number of vehicles that have entered each charge area minus the number of vehicles that have exited each charge area) and differential values thereof (congestion trends, easing trends) for predetermined time spots so as to ascertain the trends in the traffic volume. The control center 750 publicly reports traffic information over short time periods, and over long time periods corrects or abolishes the charge tables. In the toll collection control, the task of collecting an unpaid toll from (the owner of) the vehicle for which the absolute value of the negative value of the card balance in the arrears database CDB is the large is performed. Data of the observation database WDB is used for finding problem cards and vehicles.

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[0513] An emergency notification switch is formed in an operation / display board 703 connected to the notification control ECU 702 of the in-vehicle notification device 701. When the driver operates this switch, the notification control ECU transmits in a predetermined cycle emergency data that includes the vehicle ID, the current position, and the direction via the antenna ANTt. When it receives this, the notification station 730 displays the fact that an emergency has occurred, the vehicle ID, the current position, and the direction on the terminal PC and also prints out this information. It also transmits the emergency data to the control center 750 (S51, S52).

[0514] The example described above is a charge system in which the inner side of each interchange in a highway road network (i.e. on the highway), intermediate points, specific areas in a surface road network, and the like are set as charge areas, and a charge is made on vehicle transiting these locations. However, the present invention is not limited only to a charge system, arid may also be implemented in a traffic information system for reporting information on traffic regulations in specific areas, or congestion information or the like, or in an automatic notification system for giving guidance and warnings (i.e. comments on areas, guidance, items of caution within an area, entry prohibitions, danger warnings) relating to specific areas.

(Ninth Embodiment)

[0515] In the present embodiment, the present invention is applied to an automatic charge system for performing the charge processing of a toll facility (area in which a charge is applied) automatically. Note that, because the present embodiment is substantially the same as the above embodiments, the same portions are given the same descriptive symbols and a detailed description thereof is omitted.

[0516] The conceptual structure according to the present embodiment is the same as that structure shown in Fig. 52. Note that, in the present embodiment, because the charge processing device 701 also functions as a charge processing device incorporated into a vehicle, in the description below, the charge processing device 701 in Fig. 53 is described as the in-vehicle charge device 701.

[0517] The in-vehicle charge device 701 serving as a charge processing device incorporated into a vehicle communicates with the notification station 730 via the in-built telephone unit 708 and the antenna ANTt so as to exchange data therewith. Moreover, radio waves are received from satellites via the GPS antenna ANTg enabling the position and direction of travel of the vehicle to be recognized using the inbuilt GPS position measuring device (720 to 728: described below), and these are displayed together with a map displaying the area being transited. When the number of receivable satellites is insufficient or when the wave reception from the satellite is insufficient, the missing information is supplemented by calculating the vehicle position by detecting the direction using a gyro and estimating the traveling speed. Alternatively, vehicle position recognition is performed.

[0518] Next, the in-vehicle charge device 701 will be described. Note that the structure of the in-vehicle charge device 701 is the sane as the structure in Fig. 53. Direct current voltage +B from the battery in the vehicle is constantly supplied to the in-vehicle charge device 701. A power supply circuit PSC supplies operating voltage to the CPUs of the GPS information processing ECU 720 and the charge control ECU 2. As a result, data is constantly held (stored) in the internal memory of the CPU of the charge control ECU 702 and in the internal memory that is outside the CPU but is inside the charge control ECU 702.

[0519] When the vehicle ignition switch (interruption instruction means) IGsw is closed (i.e. the vehicle power supply is turned on), the power supply circuit PSC supplies operating voltage to all circuits of the in-vehicle charge device 701. The opening of the ignition switch IGsw (Si = L) instructs that the measuring of the length of time elapsed with the vehicle staying inside the charge area is to be ended (interrupted). The closing of the ignition switch IGsw (Si = H) instructs that the measuring of the length of time elapsed with the vehicle staying inside the charge area is to be continued.

[0520] The GPS position measuring device (720 - 728) is provided with a receiving antenna ANTg, a GPS receiver 721, a GPS demodulator 722, a display device 724, a piezoelectric vibrating gyro 725, an altitude sensor 726, a GPS information processing ECU (Electronic Control Unit) 720, an operating board 723, a map search engine 727, and a map database 728. The 1.57542 GHz radio waves transmitted from each of the GPS satellites are received by the GPS receiver 721 via the receiving antenna ANTg, and the information contained in the radio waves, namely, information such as a function indicating the orbit of the satellites and the time and the like is demodulated by the GPS demodulator 722, and input into the GPS information processing ECU 720. The GPS information processing ECU 720 is a computer system based on mainly a microprocessor (CPU) and provided with almanac data memory and memory for a data buffer as well as an input / output interface (an electric or electronic circuit). The CPU generates information indicating the position of its host vehicle (latitude, longitude, altitude) based on the information transmitted from the GPS satellites, and the search engine 727 reads map data of a page (screen) that includes the position from the map database 728 and displays this on the display device 724. The current position index that also shows the direction of travel is also displayed as well as the current position on the display unit.

[0521] The basic structures of the reception antenna ANTg, the GPS receiver 721, the GPS demodulator 722, and

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the display device 724, as well as the basic operation of the GPS information processing ECU 720 are the same as the structural elements of known devices already available on the market.

[0522] However, in order to implement the present invention, a program is added to the operating program of the GPS information processing ECU 720 that performs the following. Namely, the current position (ground position) of a vehicle (i.e. the in-vehicle charge device 701), the direction of travel, and the current time are transmitted to the charge control ECU 702 in response to a data transmission request from the charge control ECU 702. The charge control ECU 702 reads the transmitted charge area information and stores it in internal memory. The charge area is then displayed in superposition (as a half-tone dot meshing) in the area defined by the charge area information, namely, the charge area on the map displayed on the display device 724.

[0523] Analog signals output by the piezoelectric vibrating gyro 725 and the altitude sensor 726 are each input into the GPS information processing ECU 720, and the CPU of the ECU 720 reads the signals after converting them into digital data via an A/D converter. Information output from the GPS demodulator 722 and information for controlling the GPS demodulator 722 is input into or output from the CPU via the I/O port of the GPS information processing ECU 720.

[0524] The GPS information processing ECU 720 calculates three-dimensional coordinates Ux, Uy, Uz of the position of its host vehicle with a "3 satellite position measuring calculation" or a "4 satellite position measuring calculation".

[0525] In the "3 satellite position measuring calculation", in a predetermined three dimension simultaneous equation three sets of data received from three satellites are each substituted as parameters, and by solving this simultaneous equation, any error in the clock on the receiving side, latitude and longitude of the reception point, which are unknown numbers, are determined. The altitude of the reception point is determined, in this example, by calculation from the signal output from the altitude sensor 726, and is substituted into the simultaneous equation as known data. In the "4 satellite position measuring calculation", in a predetermined four dimension simultaneous equation four sets of data received from four satellites are each substituted as parameters, and by solving this simultaneous equation, any error in the clock on the receiving side, latitude, longitude, and altitude of the reception point, which are unknown numbers, are determined. In addition, because any error in the clock on the receiving side can be determined by performing the position measuring calculation of any of these, the time of the internal clock can be corrected based on this error information.

[0526] When the ground position information is calculated by GPS position measurement the GPS information processing ECU 720 calculates the direction in which the vehicle is traveling by a comparison with the previously calculated ground position. On the basis of this time calculated ground position, map data of the one page (one screen) that includes the current position is read from the map data memory 728 and is displayed on the display device 724. A current position index that also shows direction of travel is displayed at the current position on the display. In addition, when at least a portion of the area defined by the charge area information, namely the charge area, received from the charge control ECU 702 and saved in the internal memory is included in the area displayed on the display device 724, the charge area is displayed in superposition (in half-tone dot meshing) over the area on the display screen. This additional display allows the driver to recognize area in which a charge is applied on the display screen of the display device 724.

[0527] The charge control ECU 702 is also a computer system centered around a microprocessor (CPU) and provided with an input / output interface (an electric or electronic circuit). The CPU is able to exchange transmissions of various types of information with the notification staff on 730 via the antenna ANTt, the telephone unit 708, and the modem 707. The extension serial input / output board 706 performs the serial input arid output of data, as well as serial / parallel conversion input and output.

[0528] The voice of the driver that is input using the microphone MIC is converted into digital data indicating letters of words via a voice recognition unit 709, and is input into the CPU of the charge control ECU 702. Furthermore, the CPU notifies (aurally informs) the driver when necessary of messages (output information) using the in-vehicle speaker SP via the voice synthesizing unit 710 and the switching switch SW711. When voice data is output from the CPU, the switching switch SW711 switches the connection between the in-vehicle audio and the speakers SP to a connection between the voice synthesizing unit 710 and the speakers SP. At this time, the CPU simultaneously displays the message conveyed to the driver by voice via the vehicle speaker SP alphabetically on the display unit 704. As a result, the driver is able to confirm a message from the CPU both aurally and visually.

[0529] A card reader 705 for reading and willing data on an IC card CRD is connected to the charge control ECU 702. When an IC card CRD is inserted into a card insertion slot, and when the charge control ECU 702 requests a data transmission, the card reader 705 reads the data stored on the card CRD and transmits it to the charge control ECU 702. When the card reader 705 receives writing data from the charge control ECU 702, it overwrites (i.e. replaces previous data with this new writing data) this data in the IC card CRD.

[0530] The information stored on the IC card is shown in Table 12. In the example shown in Table 12, the amount for a single issue of a card is ¥10,000. The balance of the card is ¥10,000 (i.e. the card is unused) and the card ID allocated by the issuer of the card is MYCAR003. The classification of the vehicle for which the card is applied for is a light vehicle and the vehicle ID (in this example, the number displayed on the vehicle number plate) is A123B568. The data

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in the charge table is for the charge area which the driver requests (applies for) directly after the issue of the card, and this data is written on the card by the issuer in accordance with the driver's application, If there is no such application (i.e. a writing request), then there is no such writing.

Table 12

Data stored on card	
Item of information	Content of information
Card ID	MYCAR003
Card balance	¥10000
Vehicle classification	Light vehicle
Vehicle ID	A123B568
Charge table	• • • (Table 13)

[0531] Three examples of charge table data are shown in Tables 13, 14, and 15. The charge table in the time units shown in Fig. 13 is used for charging the vehicle in the charge area indicated by the charge area information a toll that corresponds to the length of time that the vehicle is inside the area except parking not parked. The charge table in the distance units shown in Fig. 14 is used for charging a toll that corresponds to the distance traveled by a vehicle inside an area. The charge table charging for each entry shown in Fig. 15 is used for charging a toll that corresponds to the number of entries (uses).

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Table 13

Time unit charge table

Information Item	Information Content					
Charge area information	[N350000, E1360000] (First point) [N345900, E1360100] (Second point)					
Toll information /1 hour	Heavy vehicle		Medium vehicle		Light vehicle	
	First hour	After first hour	First hour	After first hour	First hour	After first hour
Time spot: 7:00 – 9:00	¥500	¥450	¥300	¥250	¥200	¥150
Time spot: 17:00 – 19:00	¥500	¥450	¥300	¥250	¥200	¥150
Time spot: other	¥400	¥350	¥200	¥150	¥100	¥50
Table valid period	10 – 11 October 1997					
Table valid area information	… (First point) … (Second point)					

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Table 14

Distance unit charge table

Information Item	Information Content					
Charge area information	[N350000, E1360000] (First point) [N345900, E1360100] (Second point)					
Toll information /1 hour	Heavy vehicle		Medium vehicle		Light vehicle	
	First kilometer	After first kilometer	First kilometer	After first kilometer	First kilometer	After first kilometer
Time spot: 7:00 – 9:00	¥500	¥450	¥300	¥250	¥200	¥150
Time spot: 17:00 – 19:00	¥500	¥450	¥300	¥250	¥200	¥150
Time spot: other	¥400	¥350	¥200	¥150	¥100	¥50
Table valid period	10 – 11 October 1997					
Table valid area information	… (First point) … (Second point)					

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Table 15

Charge table when charging per entry

Item of information	Content of information		
Charge Area Information	[N350000, E1360000] (First point) [N345900, E1360100] (Second point)		
Toll information / entry	Heavy vehicle	Medium vehicle	Light vehicle
Time spot: 7:00 – 9:00	¥500	¥300	¥200
Time spot: 17:00 – 19:00	¥500	¥300	¥200
Time spot: other	¥400	¥200	¥100
Table valid period	10 – 11 October, 1997		
Table valid area information	… (First point)	… (Second point)	

The data of one set (one point) of the charge area information in the charge tables is positional information indicating one point on an outline of the charge area. When there are only date of two sets (data of two points), date of each set means the positions of opposite corners in a rectangle (square), and the charge area is rectangular (an example thereof

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is the same as that shown in Fig. 58).

[0532] When there are date of more than or equal to three sets, the positions (points) indicated by date of each set are joined in order of the writing of the data sets, and the polygonal area that emerges when the last point is joined with the first point indicates the charge area. Because there are two sets of position (point) data in the examples shown in Tables 13 to 15, the charge area is quadrangular (square). The toll information is differentiated by time slot and by type of vehicle.

[0533] The term of validity of the table indicates the term of validity of the data. The information of the area in which the table is valid shows an outline that is shaped substantially the same as the charge area extended by approximately 600 meters outside the outline of a charge area prescribed in the charge area information. When a plurality of charge areas are set, this information of the area in which the table is valid is for allowing a charge table of a charge area that is near to it to be selected in the vehicle.

[0534] The card issuing and toll settlement spots (card issuing and toll settlement booths) 771 - 773 (see Fig. 52) issue IC cards CRD. These spots (service centers) are provided in locations that provide easy access for a driver and that are as close as possible to areas where the charge areas are set, such as in the vicinity of the notification station 730, in the catchment of the notification station 730, outside the catchment area of the notification station 730, or the like. For example, they may be provided in local government buildings or branches thereof in the area in which the charge area is set. In these spots, new IC cards can be issued, lost or damaged cards can be reissued, unpaid tolls (card balances in arrears) can be settled, and prepaid deposits can be increased (i.e. card balances increased) in accordance with the wishes of a driver by a service operator or by an automatic machine. When these processings are performed, the processing data is transmitted to the notification station 730 via a public phone network arid an exchange 760. In accordance with the received processing data, the notification station 730 updates the data in the observation database WDB when a new card is issued, a lost or damaged card is reissued, or a prepaid deposit is increased, and updates the data in the arrears database CDB when an unpaid toll is settled.

[0535] The structure of the information station 730 is shown next. Note that the structure of the information station 730 is the same as the structure shown in Fig. 54. In the notification station 730 there is a wireless communication device 731 that modulates transmission data from a controller 732 into radio wave signals and sends it to an antenna 740, and also receives radio waves via the antenna 740, demodulates the received data and feeds it to the controller 732. The controller 732 is a computer system that is centered around a microprocessor (MPU) and is provided with an input / output interface. A terminal PC (a complete set comprising a personal computer, display unit, keyboard, mouse, printer), a charge database (memory) FDB, and an information control unit 733 are connected to the controller 732. The arrears database CDB, the observation database WDB, and the entry / exit vehicle database TDB are connected to the information control unit 733.

[0536] A modem 734 is connected to the controller 732. The controller 732 is able to perform sound and data transmission with the control center 50 (Fig. 52) via this modem and the public communication circuit exchange 760 (Fig. 52).

[0537] An outline of the charge control operation of the (CPU of the) charge control ECU 702 is shown in Figs. 59 and 60. Fig. 59 will be looked at first. The charge control ECU 702 waits for the ignition switch IGsw to be dosed (Si : H), and when the ignition switch is closed, the charge control ECU 702 registers the data of the card CRD in its internal memory via the card reader 705 (steps M1 to M4). If no card CRD has been loaded, the charge control ECU 702 waits for a card to be loaded and then registers the data of the card CRD in internal memory. Note that, in the description below, inside the brackets the word "step" has been omitted with only the step number and the letter M denoted.

[0538] Next, the card balance in the read card data is displayed on the display unit 704 (M5). Next, the charge control ECU 702 starts the timer Tc for the time limit Tc (M6). A data transmission request is then made to the GPS information processing ECU 720, and data of the current position (ground position), the direction of travel, and the date and time is received from the GPS information processing ECU 720 and written to internal memory. The charge area information in the card data registered in internal memory is also sent to the GPS information processing ECU 720 (M7). When this charge area information is received, the GPS information processing ECU 720 adds the charge area display (half tone dot meshing) to the corresponding area of the map displayed on the display device 724 that corresponds to the charge area indicated by the charge area information.

[0539] Next, the charge control ECU 702 checks whether the date and time received from the GPS information processing ECU 720 are within the period in which the table is valid in the charge table registered in internal memory, or whether the current position received from the GPS information processing ECU 720 is within the area in which the table is valid shown in the information of the area in which the table is valid in the charge table registered in internal memory (M8). If the date and time are outside the period in which the table is valid, or if the current position is outside the area in which the table is valid, then in this case, the charge table does not fit the current area. Therefore, a charge table request is transmitted via the antenna ANTt (M9). At this time, the charge table request is transmitted together with the vehicle ID and card ID in the card data, the position obtained from the GPS information processing ECU 720, and the direction data. When the notification station 730 receives the charge table request it saves the card ID, the vehicle ID, the position, and the direction data in internal memory, and transmits the charge table (Table 13, 14, or 15) in the

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charge database FDB (M41 - M44 in Fig. 61).

[0540] When it receives this charge table, the charge control ECU 702 checks whether the date and time are within the period in which the table is valid in the charge table, or whether the current position received from the GPS information processing ECU 720 is within the area in which the table is valid shown in the information of the area in which the table is valid (M10, M11). If the date and time are within the period in which the table is valid, and if the current position is within the area in which the table is valid, the charge control ECU 702 registers (replaces with new data) the received charge table in internal memory and in the IC card CRD (M12).

[0541] Next as seen in Fig. 59, thereafter the charge control ECU 702 checks at the time cycle Tc whether the current position is within a charge area indicated by the charge area information in the charge table or outside the charge areas (M13 to M34 - M1 to M11 - M13). If it is outside a charge area, and if the direction of travel is one that is approaching a charge area, then when the position is within 500 meters from the charge area, "charge area 500 meters ahead" is displayed on the display device 704 along with charge table information (however, the charge area information and the information of the area in which the table is valid are excluded). At the same time, notification such as "charge area is 500 meters ahead" is made by voice synthesis via the voice synthesizing unit 710 and the speaker SP (M13 to M19).

[0542] Moreover, when the current position is within 400 meters from the charge area, the display "charge area 500 meters ahead" on the display unit 704 is altered to "charge area 400 meters ahead", arid a notification of "charge area is 400 meters ahead" is also made (M13 to M16 - M20 to M23).

[0543] Note that the charge area is displayed in superposition on the map displayed on the display device 724 in the step M7 repeated in the cycle Tc. Moreover, because the current position of the vehicle is shown on the displayed map as a direction attached index, the driver can recognize the position of the vehicle relative to the charge area and the direction of travel from the display on the display unit 724.

[0544] When the vehicle enters a charge area, the charge control ECU 702 writes "1" in the register (internal memory) so as to show that the vehicle has entered the area in which a charge is applied, and clears the information showing that the vehicle is within 500 meters of the charge area, and is within 400 meters of the charge area (RPF and RPS data in the register) (13, 24, 25), and notifies the notification station 730 that a vehicle has entered the charge area (M26). At this time, an entry report with data indicating the vehicle ID and the card ID in the card data, as well as the current position and direction obtained from the GPS information processing ECU 720, and the card balance attached thereto is transmitted to the notification station 730. When the notification station 730 receives this vehicle entry notification, the card ID, the vehicle ID, the position, the direction, and the card balance are saved in the internal memory, and the information in the database that corresponds to the contents of these sets of data is updated. These contents are described below.

[0545] While the current position is inside the charge area, the charge control ECU 702 repeatedly executes the "intermediate charge processing" (M27) at a cycle Tc. In this "intermediate processing" (M27), the toll information in the charge tables (= charge tables of the IC card CRD) in internal memory is referred to and a check is made as to whether the charge table is for a time charge (Table 13), for a distance traveled (Table 14), or for a charge per transit (use) (Table 15). If the charge table is for a charge per transit the routine proceeds to the next step M34.

[0546] When the charge table is for a time charge (Table 13), the toll Ft/hour for the current time for the vehicle classification (light, medium, heavy) registered in the IC card CRD is extracted from the charge table and the time toil AFA for the time Tc (seconds) is calculated as follows:

$$AFA = Tc\ (secs) \times Ft / ¥3600.$$

[0547] The sum (RAF + AFt), the value RAF of the toll accumulation thus far, as indicated by the data in the toll accumulation register RAF allocated in the internal memory of the charge control ECU 702, is calculated, and this sum (RAF + AFt) is updated in the toll accumulation register RAF (M27).

[0548] When the charge table is for a distance traveled charge (Table 14), the toll Fd/Km for the current time for the vehicle type classification (light, medium, heavy) registered in the IC card CRD is extracted from the charge table and the travel toll AFd for the time Tc (seconds) is calculated as follows:

$$AFd = Tc\ (secs) \times speed\ (KM/h) \times Ft / ¥3600.$$

[0549] The sum (RAF + AFd), the value RAF of the toll accumulation thus far, as indicated by the data in the toll accumulation register RAF allocated in the internal memory of the charge control ECU 702, is calculated, and this sum (RAF + AFd) is updated in the toll accumulation register RAF (M27).

[0550] If the (current position of the) vehicle departs from the charge area, the charge control ECU 702 advances from steps M13 and M14 to step M28. Ij step M28, the data in the register RAE is altered to "0" which indicates that the vehicle has left the charge area, and the "charge deduction processing" (M29) is performed.

[0551] In the "charge deduction processing" (M29), the charge control ECU firstly refers to the charge information

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in the charge table in internal memory and checks whether or not the charge table is one for when a charge is made for each single transit. If this is the case, the toll that corresponds to the vehicle type classification in the card data in the charge table is extracted and the card balance in the card data in the internal memory is updated to a value from which this toll amount has been deducted. In the same way, the data of the IC card CRD is also updated. The data in the toll accumulation register RAF is then cleared.

[0552] If the charge table is not one for when a charge is made for each single transit, the card balance in the card data in internal memory is updated to a value from which the value of the toll accumulation register RAF has been deducted. In the same way, the data of the IC card CRD is also updated. The data in the toll accumulation register RAF is then cleared.

[0553] Next, the charge control ECU 702 updates the balance displayed (displayed in step M5) on the display device 704 (M30) and transmits the vehicle departure notification data to the notification station 730. At this time, the vehicle ID and the card ID in the card data, as well as the current position and direction obtained from the GPS information processing ECU 720, and the card balance are also transmitted (M31). When it receives this vehicle departure notification, the notification station 730 saves the card ID, the vehicle ID, the position, the direction, and the card balance in internal memory, and the information in the database is updated correspondingly to the contents of these sets of data. These contents are described below.

[0554] The charge control ECU 702 checks whether or not the card balance is a negative value (insufficient toll payment) (M32), and if the card balance is a negative value, displays "insufficient payment - settlement required" on the display device 704. Notification such as "card balance is insufficient. Please settle debt" by voice synthesizer is also made using the voice synthesizing unit 710 and the speaker SP (M33).

[0555] After the vehicle departure notification (M31), because the direction in which the vehicle is traveling is a direction away from the charge area just transited, the charge control ECU 702 advances from step M15 to step M32 and does not execute the relative distance notification for the charge area (M16 to M23).

[0556] When the vehicle transits one charge area (the first charge area) as described above and travels towards another charge area (the second charge area), when the (current position of the) vehicle leaves the area in which the table is valid that is indicated by the table valid area information of the first charge table representing the first charge area, the charge control ECU 702 moves from step M8 to M9 and transmits a charge table request This transmission wave is received by a first notification station (M30) addressed in the first charge area, and the first notification station transmits the first charge table. When the charge control ECU 702 receives the first charge table, the charge table received in step M10 is determined to be invalid. As a result, even if the charge control ECU 702 receives the first charge table after the vehicle has left the area in which the table is valid that is indicated by the table valid area information of the first charge table representing the first charge area, this is not written on the IC card CRD or the internal memory. When the (current position of the) vehicle enters the table valid of the second charge area, the charge control ECU 702 writes the second charge table transmitted by an unillustrated second notification station in internal memory and on the IC card CRD, and notification control is performed in the manner described above according to the data.

[0557] As described above, when a vehicle reaches a point 500 meters before a charge area, that fact is notified to the driver via the display device 704 and the speaker SP, and information on the charge area is displayed on the display device 704. In addition, a notification is again made when the vehicle reaches a point 400 meters before the charge area. Therefore, the driver has enough time to decide whether or not to enter a charge area, and has enough time to choose a detour route.

[0558] The check in step M1 as to whether or not the ignition key switch IGsw is closed (Si = H) is intended to determine whether or not the vehicle is parked. When the vehicle enters a charge area in which the above described time toll charge table (Table 13) is applied, then when the ignition key switch IGsw is open (Si = L: an interrupt instruction to interrupt the timing for the charging), the charge control ECU 702 waits for the ignition key switch IGsw to be closed (Si = H: an instruction for the timing for the charging), and does not perform the "intermediate charge processing" of step M27 while waiting. Therefore, the time the vehicle is parked inside the charge area does not fall within the length of time the vehicle has stayed inside the charge area for a charge amount for a two hour toll to be calculated.

[0559] Fig. 61 shows an outline of the notification processing of the controller 732 of the notification station 730 (see Fig. 54). When the charge control ECU 702 of the in-vehicle charge device 701 of the vehicle transmits a charge table request in step M9 that includes the card ID, the vehicle ID, the position, and the direction, the controller 732 of the notification station 730 receives the request and saves data representing the card ID, vehicle ID, position, and direction in internal memory, and in response to this request (M41, M42) transmits a charge table in the database FDB via the antenna 740 (M44). A search is then made (M45) via the control unit 733 as to whether or not the received card ID or vehicle ID is the ID of a vehicle that has been in a collision, or has been stolen, or whether the card is a problem card (i.e. lost or damaged, stolen, scrapped through reissue, or illegally copied) stored in the observation database WDB. If the card ID or vehicle ID is one of the above, the card ID, the vehicle ID = vehicle No..., the contents of the problem, the current position (reception data), and the current time are displayed on the terminal PC display unit and printed out as art observation data set and are also transmitted to the control center 750 and card issuing and toll settlement booths

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771 to 773. These establishments are able to perform data registration or take action in accordance with the content of the problem.

[0560] The charge control ECU 702 of the in-vehicle charge device 701 transmits vehicle departure notification data showing that a vehicle has departed from a charge area. When the controller 732 of the notification station 730 receives this, the controller 732 saves the card ID, the vehicle ID, the current position, the direction, and the card balance in internal memory, specifies the departure road (the entrance / exit to the area) based on the position data, and increments by one the number of vehicles that have departed at this entry road in the entry and departure vehicle database TDB (M48). A check is then made as to whether or not the card balance is negative (minus) (M49). If the card balance is negative, the data (card ID, vehicle ID, current position, direction, and card balance) is supplied to the terminal PC and displayed on the display unit and printed out. A check is then made via the control unit 733 as to whether the card ID or vehicle ID are in the arrears database CDB. If they are in the arrears database, the card balance of the relevant item in the arrears database CDB is updated to the new value. If they are not in the arrears database, this newly acquired data (card ID, vehicle ID, current position, the direction, and card balance) is registered for the first time in the arrears database CDB (M50). The ID check and the like described above (M45, M46) are then performed.

[0561] The charge control ECU 702 of the in-vehicle charge device 701 transmits vehicle entry notification data showing that a vehicle has entered a charge area. When the controller 732 of the notification station 730 receives this (M53), the controller 732 saves the card ID, the vehicle ID, the current position and the direction in internal memory, specifies the entry road (the entrance / exit to the area) based on the position data, and increments by one the number of vehicles that have entered at this entry road in the entry and departure vehicle database TDB (M54). The ID check and the like described above (M45, M46) are then performed.

[0562] When the transmitted settlement data (the card ID, the vehicle ID and the card balance) insert from the card issuing and toll settlement spots 771 to 773, if the received card balance is positive, the controller 732 erases the data of the relevant ID in the arrears database CDB (erases the arrears register). If the card balance is still negative (minus), the card balance of the relevant ID is updated to the received card balance.

[0563] The data of the databases CDB, FDB, WDB, and TDB can be controlled (i.e. read, transferred, output, written, and erased) by the terminal PC and the control center 750. When the terminal PC or control center 750 accesses the controller 732, the controller 732 performs data processing (i.e. reading, transferring, outputting, writing, and erasure) in accordance with the instruction thereof (M58). The control center 750 is intended to carry out traffic control and charge collection control inside and outside the charge area, as well as observation and tracking of problem cards and vehicles. In order to carry out traffic control, the control center 750 regularly, and when appropriate, refers to the data in the vehicle entry and departure database TDB, and calculates the number of vehicles present within the charge area (the sum of the number of vehicles that have entered each charge area minus the number of vehicles that have exited each charge area) and differential values thereof (congestion trends, easing trends) for predetermined time spots so as to ascertain the trends in the traffic volume. The control center 750 publicly reports traffic information over short time periods, and over long time periods corrects or abolishes the charge tables. In the toll collection control, the task of collecting an unpaid toll from (the owner of) the vehicle for which the absolute value of the negative value of the card balance in the arrears database CDB is the largest is performed. Data of the observation database WDB is used for finding problem cards and vehicle.

[0564] An emergency notification switch is formed in an operation / display board 703 connected to the charge control ECU 702 of the in-vehicle charge device 701. When the driver operates this switch, the charge control ECU transmits in a predetermined cycle emergency data that includes the vehicle ID, the current position, and the direction via the antenna ANTt. When it receives this, the notification station 730 displays the fact that an emergency has occurred, the vehicle ID, the current position, and the direction on the terminal PC and prints out this information. It also transmits the emergency data to the control center 750 (M51, M52).

[0565] The embodiment described above is a charge system in which charges are levied in area units in a road network, and it is possible to set either a portion or all of a highway road network, or specific areas of a general road network as charge areas and to charge vehicles that transit those areas.. However, the present invention is not limited only to a road network charge system, and may also be implemented in a tourist area, an event area or the like as an entry fee collection system.

(Tenth Embodiment)

[0566] In the present embodiment, the present invention is applied to an automatic charge system for performing the charge processing of a toll facility (area in which a charge is applied) automatically. Note that, because the present embodiment is substantially the same as the above embodiments, the same portions are given the same descriptive symbols and a detailed description thereof is omitted.

[0567] The conceptual structure according to the present embodiment is the same as that structure shown in Fig. 52. Note that, in the present embodiment, because the charge processing device 701 also functions as a charge

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processing device incorporated into a vehicle, in the description below, the charge processing device 701 in Fig. 53 is described as the in-vehicle charge device 701.

[0568] The in-vehicle charge device 701 built into a vehicle communicates with the notification station 730 (control station) via the in-built telephone unit 708 and the antenna ANTt so as to exchange data therewith. Moreover, radio waves are received from satellites via the GPS antenna ANTg enabling the position and direction of travel of the vehicle to be recognized using the inbuilt GPS position measuring device (720 to 728) and these are displayed together with a map displaying the area being transited. When the number of receivable satellites is insufficient or when the wave reception from the satellite is insufficient, the missing information is supplemented by calculating the vehicle position by detecting the direction using a gyro and estimating the traveling speed. Alternatively, vehicle position recognition is performed.

[0569] Next, the in-vehicle charge device 701 will be described. Note that the structure of the in-vehicle charge device 701 is the same as the structure in Fig. 53. Direct current voltage +B from the battery in the vehicle is constantly supplied to the in-vehicle charge device 701. A power supply circuit PSC supplies operating voltage to the CPUs of the GPS information processing ECU 720 and the charge control ECU 702. As a result data is constantly held (stored) in the internal memory of the CPU of the charge control ECU 702 and in the internal memory that is outside the CPU but is inside the charge control ECU 702.

[0570] When the vehicle ignition switch (interruption instruction means) IGsw is closed (i.e. the vehicle power supply is turned on), the power supply circuit PSC supplies operating voltage to all circuits of the in-vehicle charge device 701. The opening of the ignition switch IGsw (Si = L) instructs that the measuring of the length of time elapsed with the vehicle staying inside the charge area is to be ended (interrupted). The closing of the ignition switch IGsw (Si = H) instructs that the measuring of the length of time elapsed with the vehicle staying inside the charge area is to be continued.

[0571] The GPS position measuring device (720 - 728) is provided with a receiving antenna ANTg, a GPS receiver 721, a GPS demodulator 722, a display device 724, a piezoelectric vibrating gyro 725, an altitude sensor 726, a GPS information processing ECU (Electronic Control Unit) 720, an operating board 723, a map search engine 727, and a map database 728. The 1.57542 GHz radio waves transmitted from each of the GPS satellites are received by the GPS receiver 721 via the receiving antenna ANTg, and the information contained in the radio waves, namely, information such as a function indicating the orbit of the satellites and the time and the like is demodulated by the GPS demodulator 722, and input into the GPS information processing ECU 720. The GPS information processing ECU 720 is a computer system based on mainly a microprocessor (CPU) and provided with almanac data memory and memory for a data buffer as well as an input / output interface (an electric or electronic circuit). The CPU generates information indicating the position of its host vehicle (latitude, longitude, altitude) based on the information transmitted from the GPS satellites, and calculates the direction in which the vehicle is traveling and the traveling speed based on a time series estimation using the position information. The search engine 727 reads map data of a page (one screen) that includes the position from the map database 728 in accordance with the position information generated by the CPU, and displays this on the display unit 724. The current position index that also shows the direction of travel is displayed on the current position on the display device.

[0572] The basic structures of the reception antenna ANTg, the GPS receiver 721, the GPS demodulator 722, and the display device 724, as well as the basic operation of the GPS information processing ECU 720 are the same as the structural elements of known devices already available on the market.

[0573] However, in order to implement the present invention, a program is added to the operating program of the GPS information processing ECU 720 that performs the following. Namely, the current position (ground position) of a vehicle (i.e. the in-vehicle charge device 701), the direction of travel, the speed of travel, and the current time are transmitted to the charge control ECU 702 in response to a data transmission request from the charge control ECU 702. The charge control ECU 702 reads the incoming charge area information transmission and stores it in internal memory. The charge area is then displayed in superposition (as a half-tone dot meshing) in the area stipulated by the charge area information, namely, the charge area on the map displayed on the display unit 724.

[0574] Analog signals output by the piezoelectric vibrating gyro 725 and the altitude sensor 726 are each input into the GPS information processing ECU 720, and the CPU of the ECU 720 reads the signals after converting them into digital data via an A/D converter. Information output from the GPS demodulator 722 and information for controlling the GPS demodulator 722 is input into or output from the CPU via the I/O port of the GPS information processing ECU 720.

[0575] The GPS information processing ECU 720 calculates three-dimensional coordinates Ux, Uy, Uz of the position of its host vehicle using a "3 satellite position measuring calculation" or a "4 satellite position measuring calculation".

[0576] In the "3 satellite position measuring calculation", in a predetermined three dimension simultaneous equation three sets of data received from three satellites are each substituted as parameters, and by solving this simultaneous equation, any error in the latitude and longitude of the reception point which are unknown numbers, as well as in the clock on the receiving side is determined. The altitude of the reception point is determined, in this example, by cal-

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culation from the signal output from the altitude sensor 726, and is substituted into the simultaneous equation as known data. In the "4 satellite position measuring calculation", in a predetermined four dimension simultaneous equation four sets of data received from four satellites are each substituted as parameters, and by solving this simultaneous equation, any error in the latitude, longitude, and altitude of the reception point, which are unknown numbers, as well as in the clock on the receiving side is determined. In addition, because any error in the clock on the receiving side can be determined by performing the position measuring calculation of any of these, the time of the internal clock can be corrected based on this error information.

[0577] When the ground position information is calculated by GPS position measurement, the GPS information processing ECU 720 calculates the direction in which the vehicle is traveling and the speed at which the vehicle is traveling by a comparison with the previously calculated ground position. On the basis of this time calculated ground position, map data of the one page (one screen) that includes the current position is read from the map data memory 728 and is displayed on the display unit 724. A current position index that also shows direction of travel is displayed at the current position on the display. In addition, when at least a portion of the area defined by the charge area information, namely the charge area, received from the charge control ECU 702 and saved in the internal memory is included in the area displayed on the display unit 724, the charge area is displayed in superposition (in half-tone dot meshing) over the area on the display screen. This additional display allows the driver to recognize area in which a charge is applied on the display screen of the display unit 724.

[0578] The charge control ECU 702 is also a computer system centered around a microprocessor (CPU) and provided with an input / output interface (an electric or electronic circuit). The CPU is able to exchange transmissions of various types of information with the notification station 730 via the antenna ANTt, the telephone unit 708, and the modem 707. The extension serial input / output board 706 performs the serial input and output of data, as well as serial / parallel conversion input and output.

[0579] The voice of the driver that is input using the microphone MIC is converted into digital data indicating letters of words via a voice recognition unit 709, and is input into the CPU of the charge control ECU 702. Furthermore, the CPU notifies (aurally informs) the driver when necessary of messages (output information) using the in-vehicle speaker SP via the voice synthesizing unit 710 and the switching switch SW711. When voice data is output from the CPU, the switching switch SW711 switches the connection between the in-vehicle audio and the speakers SP to a connection between the voice synthesizing unit 710 and the speakers SP. At this time, the CPU simultaneously displays the message conveyed to the driver by voice via the vehicle speaker SP alphabetically on the display unit 704. As a result, the driver is able to confirm a message from the CPU both aurally and visually.

[0580] A card reader 5 (read / write means) for reading and writing data on an IC card CRD (storage means) is connected to the charge control ECU 702. When an IC card CRD is inserted into a card insertion slot, and when the charge control ECU 702 requests a data transmission, the card reader 705 reads the data stored on the card CRD and transmits it to the charge control ECU 702. When the card reader 705 receives writing data from the charge control ECU 702, it overwrites (i.e. replaces previous data with this new writing data) this data in the IC card CRD.

[0581] The information stored on the IC card is shown in Table 16. In the example shown in Table 16, the amount for a single issue of a card is ¥10,000. The balance of the card is ¥10,000 (i.e. the card is unused) and the card ID allocated by the issuer of the card is MYCAR003. The classification of the vehicle for which the card is applied for is a light vehicle and the vehicle ID (in this example, the number displayed on the vehicle number plate) is A123B568. The data in the charge table is for the charge area which the driver requests (applies for) directly after the issue of the card, and this data is written on the card by the issuer in accordance with the driver's application. If there is no such application (i.e. writing request), then there is no such writing.

Table 16

Data stored on card	
Item of information	Content of information
Card ID	MYCAR003
Card balance	¥10000
Vehicle classification	Light vehicle
Vehicle ID	A123B568
Charge table	• • • (Table 17)

[0582] Three examples of charge table data are shown in Tables 17, 18, and 19. The charge table in the time units

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shown in Fig. 17 is used for charging the vehicle in the charge area shown by the charge area information a toll that corresponds to the length of time that the vehicle is inside the area excepted parking not parked. The charge table in the distance units shown in Fig. 18 is used for charging a toll that corresponds to the distance traveled by a vehicle inside an area. The charge table charging for each entry shown in Fig. 195 is used for charging a toll that corresponds to the number of entries (times used).

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Table 17

Time unit charge table

Information Item	Information Content					
Charge area information	[N350000, E1360000] (First point) [N345900, E1360100] (Second point)					
Toll information /1 hour	Heavy vehicle		Medium vehicle		Light vehicle	
	First hour	After first hour	First hour	After first hour	First hour	After first hour
Time spot: 7:00 – 9:00	¥500	¥450	¥300	¥250	¥200	¥150
Time spot: 17:00 – 19:00	¥500	¥450	¥300	¥250	¥200	¥150
Time spot: other	¥400	¥350	¥200	¥150	¥100	¥50
Table valid period	10 - 11 October 1997					
Table valid area information	··· (First point) ··· (Second point)					

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Table 18

Distance unit charge table

Information Item	Information Content					
Charge area information	[N350000, E1360000] (First point) [N345900, E1360100] (Second point)					
Toll information /1 hour	Heavy vehicle		Medium vehicle		Light vehicle	
	First kilometer	After first kilometer	First kilometer	After first kilometer	First kilometer	After first kilometer
Time spot: 7:00 – 9:00	¥500	¥450	¥300	¥250	¥200	¥150
Time spot: 17:00 – 19:00	¥500	¥450	¥300	¥250	¥200	¥150
Time spot: other	¥400	¥350	¥200	¥150	¥100	¥50
Table valid period	10 – 11 October 1997					
Table valid area information	… (First point) … (Second point)					

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Table 19

Charge table when charging per entry

Item of information	Content of information
Charge Area Information	[N350000, E1360000] (First point) [N345900, E1360100] (Second point)
Toll information / entry	Heavy vehicle Medium vehicle Light vehicle
Time spot: 7:00 - 9:00	¥500 ¥300 ¥200
Time spot: 17:00 - 19:00	¥500 ¥300 ¥200
Time spot: other	¥400 ¥200 ¥100
Table valid period	10 - 11 October, 1997
Table valid area information	··· (First point) ··· (Second point)

[0583] The data of one set (one point) of the charge area information in the charge tables is positional information indicating one point on an outline of the charge area. When there are only date of two sets (data of two points), date of each set means the positions of opposite corners in a rectangle (square), and the charge area is rectangular (an exam-

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ple thereof is shown in Fig. 58).

[0584] When there are data of more than or equal to three sets, the positions (points) indicated by date of each set of data are joined in order of the writing of the data sets, and the polygonal area that emerges when the last point is joined with the first point indicates the charge area. Because there are two sets of position (point) data in the examples shown in Tables 17 to 19, the charge area is quadrangular (square). The toll information is differentiated by time slot and by type of vehicle.

[0585] The term of validity of the table means the term of validity of the data. The information of the area in which the table is valid shows an outline that is shaped substantially the same as the charge area extended by approximately 600 meters outside the outline of a charge area prescribed in the charge area information. When a plurality of charge areas are set, this information of the area in which the table is valid is used to allow a charge table of a charge area that is near to it to be selected in the vehicle.

[0586] The card issuing and toll settlement spots (card issuing and toll settlement booths) 771 - 773 (see Fig 52) issue IC cards CRD. These spots (service centers) are provided in locations that provide easy access for a driver and that are as close as possible to areas where the charge areas are set, such as in the vicinity of the notification station 730, in the area under the jurisdiction of the notification station 730, outside the area under the jurisdiction of the notification station 730, or the like. For example, they may be provided in local government buildings or branches thereof in the area in which the charge area is set. In these spots, new IC cards can be issued, lost or damaged cards can be reissued, unpaid tolls (card balances in arrears) can be settled, and prepaid deposits can be increased (i.e. card balances increased) in accordance with the wishes of a driver by a service operator or by an automatic machine. When these processings are performed, the processing data is transmitted to the notification station 730 via a public phone circuit and an exchange 760. In accordance with the received processing data, the notification station 730 updates the data in the observation database WDB when a new card is issued, a lost or damaged card is reissued, or a prepaid deposit is increased, and updates the data in the arrears database CDB when an unpaid toll is settled.

[0587] The information station 730 will be described next. Note that the structure of the information station 730 is the same as the structure shown in Fig. 54. In the notification station 730 there is a wireless communication device 731 that modulates transmission data from a controller 732 into radio wave signals and sends it to an antenna 740, and also receives radio waves via the antenna 740, demodulates the received data and feeds it to the controller 732. The controller 732 is a computer system that is centered around a microprocessor (MPU) and is provided with an input / output interface. A terminal PC (a complete set comprising a personal computer, display unit, keyboard, mouse, printer), a charge database (memory) FDB, and art information control unit 733 are connected to the controller 732. The arrears database CDB, the observation database WDB, and the entry / exit vehicle database TDB are connected to the information control unit 733.

[0588] A modem 734 is connected to the controller 732. The controller 732 is able to perform sound and data transmission with the control center 50 (Fig. 52) via this modem and the public communication circuit exchange 760 (Fig. 52).

[0589] An outline of the charge control operation of the (CPU of the) charge control ECU 702 is shown in Figs. 62 and 630. Fig. 62 will be looked at first The charge control ECU 702 waits for the ignition switch IGsw to be closed (Si: H), and when the ignition switch is closed, the charge control ECU 702 registers the data of the card CRD in its internal memory via the card reader 705 (steps P1 to P4). If no card CRD has been loaded, the charge control ECU 702 waits for a card to be loaded and then registers the data of the card CRD in internal memory. Note that in the description below, inside the brackets the word "step" has been omitted with only the step number and the letter P denoted.

[0590] Next, the card balance in the read card data is displayed on the display unit 704 (P5). Next, the charge control ECU 702 starts the timer Tc for the time limit Tc (P6). A data transmission request is then made to the GPS information processing ECU 720, and data of the current position (ground position), the direction of travel, the speed of travel, and the date and time is received from the GPS information processing ECU 720 and written to internal memory (M7).

[0591] Next, the charge control ECU 702 checks whether the date and time received from the GPS information processing ECU 720 are within the period in which the table is valid in the charge table registered in internal memory, or whether the current position received from the GPS information processing ECU 720 is within the area in which the table is valid shown in the information of the area in which the table is valid in the charge table registered in internal memory (P8). If the date and time are outside the period in which the table is valid, or if the current position is outside the area in which the table is valid, then in this case, the charge table does not fit the current area. Therefore, a charge table request is transmitted via the antenna ANTt (P9). At this time, the charge table request is transmitted together with the vehicle ID, the balance (credit information), and card ID in the card data, as well as the current position (ground position) and the movement direction data obtained from the GPS information processing ECU 720. When the notification station 730 receives the charge table request it saves the card ID, the balance, and the vehicle ID, the current position, and the movement direction in internal memory at the card ID address, and transmits the charge table (Table 17, 18, or 19) in the charge database FDB (P41 - P44 in Fig. 68).

[0592] When it receives this charge table, the charge control ECU 702 checks whether the date and time are within

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the period in which the table is valid in the charge table, or whether the current position received from the GPS information processing ECU 20 is within the area in which the table is valid shown in the information of the area in which the table is valid (P10, P11). If the date and time are within the period in which the table is valid, and if the current position is within the area in which the table is valid, the charge control ECU 702 registers (replaces with new data) the received charge table in internal memory and in the IC card CRD (P12). Interruption of the reception is also permitted (P13). The "reception interruption" is executed in reply when a radio wave signal arrives in the antenna ANTt, and an unillustrated receiver in the telephone unit 708 generates a transmission arrival signal showing that a transmission has arrived (i.e. that it has received a signal). The contents thereof are described below with reference made to Fig. 67. When permission is given to interrupt reception, the charge control ECU 702 supplies charge area information from the charge tables to the GPS information processing ECU 720 (P14). When it receives this charge area information, the GPS information processing ECU 720 adds the charge area display (half tone dot meshing) to the corresponding area of the map displayed on the display unit 724 that corresponds to the charge area indicated by the received charge area information.

[0593] Next, as seen in Fig. 63, thereafter the charge control ECU 702 checks at the time cycle Tc whether the current position is within a charge area indicated by the charge area information in the charge table or outside the charge areas (PA13 to P32 - P1 to P11 - P13A). If it is outside a charge area, and if the direction of travel is one that is approaching a charge area, then when the position is within 500 meters from the charge area, "charge area 500 meters ahead" is displayed on the display unit 704 along with charge table information (however, the charge area information and the information of the area in which the table is valid are excluded). At the same time, notification such as "charge area is 500 meters ahead" is made by voice synthesis via the voice synthesizing unit 710 and the speaker SP (PA13 to P19).

[0594] Moreover, when the current position is within 400 meters from the charge area, the display "charge area 500 meters ahead" on the display unit 704 is altered to "charge area 400 meters ahead", and a notification of "charge area is 400 meters ahead" is also made (P13A to P16 - P20 to P23).

[0595] Note that the charge area is displayed in superposition on the map displayed on the display device 724 in the step P14 repeated in the cycle Tc. Moreover, because the current position of the vehicle is shown on the displayed map as a direction attached index, the driver can recognize the position of the vehicle relative to the charge area and the direction of travel from the display on the display device 724.

[0596] When the vehicle enters a charge area, the charge control ECU 702 writes "1" in the register (internal memory) so as to show that the vehicle has entered the area in which a charge is applied, and clears the information showing that the vehicle is within 500 meters of the charge area, and is within 400 meters of the charge area (RPF and RPS data in the register) (PA13, P24, P25), and notifies "vehicle the entry" to the notification station 730, namely, notifies that a vehicle has entered the charge area (P26). At this time, a vehicle entry notification is transmitted to the notification station 730 with the data representing each of the vehicle ID, the balance, and card ID, as well as the date and time, the current position, and the movement direction data obtained from the GPS information processing ECU 720 attached thereto. When the notification station 730 receives this vehicle entry notification, it saves the date and time, the card ID, the balance, the vehicle ID, the position, and the direction in internal memory, and creates a control station movement history table corresponding to the card ID in the vehicle entry and departure database TDB in which it writes the above data.

[0597] The charge control ECU 702 next executes "vehicle entry processing" (P27). The contents thereof are shown in Fig. 64. Firstly, a one minute timer for setting the sampling cycle of the movement history data is started (P271). Next, the integral distance register, the fractional distance register, the integral distance register, the fractional distance register, and the movement history table are cleared (P272). Thereafter, the time, balance, position, distance traveled (the data in the integral distance register and fractional distance register), the length of time of stay (the data in the integral time register and fractional time register), the state of the card reader 705 (i.e. ready: normal, not ready: abnormal), the existence or otherwise of a card CRD loaded in the card reader 705, and the state of the GPS (i.e. whether or not position data has been generated) are written in the movement history table. Note that, as is described below, after the writing, this writing is performed in cycles of one minute while the vehicle is in the charge area. One example of the movement history table is shown in Table 20.

Table 20

Movement history table							
Date and time	Balance	Position	Distance traveled	Length of stay	Card reader	Card	GPS
01/01/1998 10:10	09750	N350000, E1370000	XX	XX	Normal	Present	Normal

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Table 20 (continued)

Movement history table							
Date and time	Balance	Position	Distance traveled	Length of stay	Card reader	Card	GPS
01/01/1998 10:11	09750	N350000, E1370001	XX	XX	Normal	Present	Normal
01/01/1998 10:12	09750	N350000, E1370002	XX	XX	Normal	Present	Normal

[0598] Fig. 63 will now be referred to again. After a vehicle has entered a charge area and notification of a "vehicle entry" is transmitted to the notification station 730, the charge control ECU 702 repeatedly performs the "intermediate processing" (P28) at the cycle Tc while the vehicle is inside the charge area. The contents of this "intermediate processing" (P27) are shown in Fig. 65.

[0599] When the routine advances to the "intermediate processing" (P27) shown in Fig. 65, the charge control ECU 702 firstly updates the data of the fractional time register (fractional value) to a value larger by the amount of the elapsed time Tc (P281). It then checks whether the updated fractional value is now greater than one minute (P282). If it is greater than one minute, the data in the integral time register is incremented by one, and the data of the fractional time register is updated to a value that is smaller by one minute (P283). Next, the distance traveled during the time Tc, namely,

$$Dc = Tc \text{ (seconds)} \times \text{speed (Km / h)} / 3600) \text{ (Km)}$$

is calculated (P285). The data of the fractional distance register (fractional value) is then updated to a value larger by the amount of the distance traveled Dc during Tc (P285). A check is then made as to whether the updated fractional value is now greater than one kilometer (P286). If it is greater than one kilometer, the data in the integral distance register is incremented by one, and the data of the fractional distance register is updated to a value that is smaller by one kilometer (P287).

[0600] A check is next made as to whether the one minute timer shows the time over (P288). If the time has elapsed, the one minute timer is restarted (P289), and the time, balance, position, distance traveled (the data in the integral distance register and fractional distance register), the length of stay (the data in the integral time register and fractional time register), the state of the reader (i.e. ready: normal, not ready: abnormal), the existence or otherwise of a card (i.e. loaded or not loaded), and the state of the GPS (i.e. whether or not position data has been generated) at that instant are written (P290). By repealing this intermediate processing (P28), and by writing data to the movement history table at one minute cycles, data indicating the state at one minute intervals is stored in the movement history table, as is shown in Table 20.

[0601] Fig. 63 will now be looked at once again. When the (current position of the) vehicle departs from the charge area, the charge control ECU 702 advances from steps PA13 and PA14 to step P29 where the data of the register RAE is altered to "0" to indicate that the vehicle is outside the charge area and the "vehicle departure processing" (P30) is performed. The contents of the "vehicle departure processing" (P30) are shown in Fig. 66. In the same way as the above "intermediate processing" (P28), the "vehicle departure processing" (P30) accumulates the timing values of the elapsed time during the period Tc (P301 to 303) and accumulates the traveling distances of the distance traveled during the time Tc (P305 to 307), and writes the final history inside the area in the movement history table (P308).

[0602] Referring again to Fig. 63, when the above "vehicle departure processing" (P30) has ended, the charge control ECU 702 transmits "vehicle departed", which means that the vehicle has left the charge area, to the notification station 730 (P31). At this time, the vehicle ID, the balance and the card ID in the card data, as well as the data of the movement history table are also transmitted to the notification station 730. The notification station 730 adds the received history data to the control history table of the vehicle entry and departure database TDB, which table was allocated to the card ID at the time of the "vehicle entry", and checks the charge process state. These contents are described below.

[0603] After the vehicle departure notification (P31), because the direction in which the vehicle is traveling is now a direction moving away from the charge area which the vehicle has just transited, the notification control ECU 702 advances from step P15 to step P32, and the relative distance notification relating to the charge area (P16 to P23) is not performed.

[0604] When the vehicle transits one charge area (the first charge area) as described above and travels towards another charge area (the second charge area), when the (current position of the) vehicle leaves the area in which the table is valid that is indicated by the table valid area information of the fist charge table representing the first charge

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area, the charge control ECU 702 moves from step P8 to P9 and transmits a charge table request. This transmission wave is received by a first notification station (S30) addressed in the first charge area, and the first notification station transmits the first charge table. When the charge control ECU 702 receives the first charge table, the charge table received in step SP10 is determined to be invalid. As a result, even if the charge control ECU 702 receives the first charge table after the vehicle has left the area in which the table is valid that is indicated by the table valid area information of the first charge table representing the first charge area, this is not written on the IC card CRD or the internal memory. When the (current position of the) vehicle enters the table valid area of the second charge area is valid, the charge control ECU 702 writes the second charge table transmitted by an unillustrated second notification station in internal memory and on the IC card CRD, and charge control is performed in the manner described above according to the data.

[0605] As described above, when a vehicle reaches a point 500 meters before a charge area, that fact is notified to the driver via the display unit 704 and the speaker SP, and information on the charge area is displayed on the display unit 704. In addition, a notification is again made when the vehicle reaches a point 400 meters before the charge area. Therefore, the driver has enough time to decide whether or not to enter a charge area, and has enough time to choose a detour route.

[0606] The check in step P1 as to whether or not the ignition key switch IGsw is closed (Si = H) is intended to determine whether or not the vehicle is parked. When the vehicle enters a charge area in which the time toll charge table (Table 17) is applied, then when the ignition key switch IGsw is open (Si = L: an interrupt instruction to interrupt the timing for the charging), the charge control ECU 702 waits for the ignition key switch IGsw to be closed (Si = H: an instruction for the timing for the charging), and does not perform the "intermediate processing" of step P28 while waiting. Therefore, the time that the vehicle is parked inside the charge area does not fall within the length of time that the vehicle has stayed inside the charge area in order for a charge amount for a time toll to be calculated.

[0607] When the notification station 730 receives the charge table request from the in-vehicle charge device 701, it transmits a "charge table" to the ID. Furthermore, in a fixed cycle of approximately several minutes, it transmits a "charge request" to all vehicle. It then transmits a "movement history request" either in a fixed cycle of approximately several minutes or in an irregular cycle to each ID in sequence, and collects the data of the movement history tables from each ID. Moreover, when a "vehicle departure" notification is received, when there is uncharged traveling distance or staying time, a charge request is transmitted to the ID of the charge device ID (card ID) that supplied the "vehicle departure" notification. Furthermore, a check for errors in the charge processing is made when the "vehicle departure" notification is received and, if charge errors are discovered, these are pointed out and message data urging measures to deal with them is transmitted to the relevant.

[0608] Fig. 67 shows the contents of "reception interruption 1" DRI1 executed by the charge control ECU 702 as a response when a radio wave signal arrives in the antenna ANTt, and an unillustrated receiver in the telephone unit 708 generates a transmission arrival signal showing that a transmission has arrived (i.e. that it has received a signal). When the charge control ECU 702 proceeds to the reception interruption DRI1, it checks whether address belongs to the host card ID (received date is for the own card ID)(including when all vehicles are specified) (P402). If this is the case, a determination is made as to whether the received data is a charge request a movement history request, a charge table, or a message (P403).

[0609] If the received data is a charge request, then if the charge table of the card CRD is one for charging for each entry (Table 19), the charge control ECU 702 extracts the toll corresponding to the vehicle type classification from among the card data, and updates the card balance in the card data in internal memory to a value from which the toll amount has been deducted (P404, P405). In the same way, the data of the IC card CRD is also updated, and the updated balance is displayed on a display unit. A check is then made as to whether or not the card balance is a negative value (insufficient toll payment, and if the card balance is a negative value, displays "insufficient payment - settlement required" on the display device 704. Notification such as "card balance is insufficient Please settle debt" by voice synthesizer is also made using the voice synthesizing unit 710 and the speaker SP (P413). If the charge table of the card CRD is one for charging for distance traveled (Table 18), the charge control ECU 702 extracts the toll per kilometer corresponding to the vehicle type classification from among the card data in the charge table, multiplies this by the value of the integral distance register, and updates the card balance in the card data in internal memory to a value from which the obtained value has been deducted (P406, P407). The integral distance register is then cleared (P408) and, in the same way, the data of the IC card CRD is also updated, and the updated balance is displayed on a display unit (P413).

[0610] If the charge table of the card CRD is one for charging for length of time of stay (Table 17), whether value of the date in the integral time register is more than or equal to 60 (1 hour) is checked (P410). If value of the date in the integral time register is more than or equal to 60 (1 hour), toll per unit time corresponding to the vehicle type classification from among the card data in the charge table is extracted, and updates the card balance in the card data in internal memory to a value from which the obtained value has been deducted (P409~P411). The integral time register is then updated to a value from which 60 has been deducted (P412), and, in the same way, the data of the IC card CRD is also updated, and the updated balance is displayed on a display unit (P413).

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[0611] When the received data is a "movement history request", the charge control ECU 702 transmits the data in the movement history table to the notification station 730 (P414), and the movement history table is cleared (P415). When the received data is a "charge table", the routine advances to the updating of the card data explained in step P12 above (Fig. 62). If the received data is a "message", that message is displayed on a display and reported by voice synthesis.

[0612] If the charge table is for charging for each entry, then when a charge request is transmitted, the notification station 730 writes that the charge has been completed in the control station movement history table generated for each card ID in the vehicle entry and departure database TDB at the time the "vehicle entry" notification is made, and thereafter, charge requests are transmitted only to those ID at which no charge completion has been written, and no charge request is transmitted to the charge completed IDs. If the charge table is for charging for distance traveled, the notification station 730 transmits charge requests repeatedly to all IDs in a cycle of several minutes or in an irregular cycle. When the value of the integral distance register is greater than or equal to 1 (Km), the charge device that receives the charge request performs charge processing by multiplying that value by the toll per kilometer, and then clears the integral distance register. Therefore, each time the notification station 730 generates a charge request, the charge device only performs charge processing for the integral value (kilometer units) portion from among the distance traveled from the time the previous charge request was received until the current charge request is received. Fraction distance is handled next. In the same way, if the charge table is for charging for length of stay, the notification station 730 transmits charge requests repeatedly to all IDs in a cycle of several minutes or in an irregular cycle. When the value of the integral time register is greater than or equal to 60 (1 hour), the charge device that receives the charge request performs charge processing for the toll for periods of one hour, and then updates the data in the integral time register to a value that is smaller by 60 minutes. Therefore, each time the notification station 730 generates a charge request the charge device only performs charge processing for the integral time portion from among the time lapsed since the time the previous charge request was received until the current charge request is received. Fraction time is handled next.

[0613] In the case of a "vehicle departure", because the timing thereof and the timing of the charge request do not match, even if the charge table is for charging in distance units or time units, it is possible for there to be a "vehicle departure" when there is an integral distance or integral time to be charged. When the notification station 730 receives a "vehicle departure" notification, it checks the integral distance data or the integral lime data, and if that is greater than or equal to 1 (Km) or 60 (1 hour), it transmits a charge request to the ID that made the notification of the "vehicle departure".

[0614] Fig. 68 shows the contents of interrupt processing of the controller unit 732 of the notification station 730. This interrupt processing DRI2 is executed in response to the arrival of a message in the modem unit 734 or the detection of the arrival (incoming) a radio wave signal in the antenna 740 in the communication device 731. When the incoming message is received, if the message is from the charge control ECU 702 of the in-vehicle charge device 701 of a vehicle, the unit 732 receives the message (P42), and, if it is a charge table request, saves the data indicating the date and time, the card ID, the balance, the vehicle ID, the position, and the direction that is attached to the message in internal memory, and, in response to the request, transmits the charge tables in the database FDB via the antenna 740 (P41 to P44). A search is then made (P45) via the control unit 733 as to whether or not the received card ID or vehicle ID is the ID of a vehicle that has been in a collision, or has been stolen, or whether the card is a problem card (i.e. lost or damaged, stolen, scrapped through reissue, or illegally copied) stored in the observation database WDB. If the card ID or vehicle ID is one of the above, the card ID, the vehicle ID = vehicle No..., the contents of the problem, the current position (reception data), and the current time are displayed on the terminal PC display unit and printed out as an observation data set, and are also transmitted to the control center 750 and card issuing and toll settlement booths 771 to 773. These establishments are able to perform data registration or take action in accordance with the content of the problem.

[0615] The charge control ECU 702 of the in-vehicle charge device 701 transmits vehicle departure notification data showing that a vehicle has departed from a charge area. When the controller 732 of the notification station 730 receives this, the controller 732 saves the date and time, the card ID, the vehicle ID, the current position, the distance traveled (the portion that has not been charge processed), the length of time of stay (the portion that has not been charge processed), the direction, and the card balance in internal memory. When the charge table is for charging for distance traveled, the controller 732 checks whether or not the distance traveled is greater than or equal to one kilometer and, if the distance is greater than or equal to one kilometer, transmits a charge request to the card ID. When the charge table is for charging for length of time of stay, the controller 732 checks whether or not the length of time of stay is greater than or equal to sixty minutes and, if the length of time of stay is greater than or equal to sixty minutes, transmits a charge request to the card ID. A check is then made as to whether or not there is any usage error information for the charge device in the history table on the control side (the control history table) at the relevant ID in the vehicle entry and departure database TDB, or whether or not the card balance is negative (minus). If there is no usage error information and if the card balance is positive, the history table on the control side at the relevant ID is erased. Note that the usage error information is written in the control history tables in the "Toll collection and movement history collection"

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CRC (Fig. 69) described below, based on the history data in the control history table when that shows a usage error. Next, a departure road (area entry / exit) is specified based on the position data, and the number of departed vehicles at the relevant departure road in the vehicle entry and departure database TDB is incremented by one (P48).

[0616] If the card balance is negative (-), this data (card ID, vehicle ID, current position, direction, and card balance) is supplied to the terminal PC and displayed on the display and printed out A check is then made via the control unit 733 as to whether the card ID or vehicle ID are in the arrears database CDB. If they are in the arrears database, the card balance of the relevant item in the arrears database CDB is updated to the new value. If they are not in the arrears database, this newly acquired data (card ID, vehicle ID, current position, direction, and card balance) is registered for the first time in the arrears database CDB (P49, P50). The ID check and the like described above (P45, P46) are then performed.

[0617] An emergency notification switch is formed in an operation / display board 703 connected to the charge control ECU 702 of the in-vehicle charge device 701. When the driver operates this switch, the charge control ECU transmits in a predetermined cycle emergency data that includes the vehicle ID, the current position, and the direction via the antenna ANTt. When it receives this, the notification station 730 displays the fact that an emergency has occurred, the vehicle ID, the current position, and the direction on the terminal PC and prints out this information. It also transmits the emergency data to the control center 750 (P51, P52).

[0618] The charge control ECU 702 of the in-vehicle charge device 701 transmits vehicle entry notification data showing that a vehicle has entered a charge area. When the controller 732 of the notification station 730 receives this (P53), the controller 732 generates the control movement history table addressed at the card ID of the in-vehicle charge device 701 in the vehicle entry / departure database TDB, and writes therein the received date and time, the balance, the position, the distance traveled (0), the length of time of stay (0), the state of the reader, the existence or otherwise of a card, and the state of the GPS. It then specifies the entry road (the entrance / exit to the area) based on the position data, and increments by one the number of vehicles that have entered at this entry road in the entry and departure vehicle database TDB (P54). The ID check and the like described above (P45, P46) are then performed.

[0619] When the transmitted settlement data (card ID, vehicle ID, and card balance) arrives from the card issuing and toll settlement spots 771 to 773, if the received card balance is positive, the controller 732 erases the data of the relevant ID in the arrears database CDB (erases the arrears register). If the card balance is still negative (minus), the card balance of the relevant ID is updated to the received card balance (P41, P55 to P57).

[0620] The data of the databases CDB, FDB, WDB, and TDB can be controlled (i.e. read, transferred, output, written, and erased) by the terminal PC and the control center 750. When the terminal PC or control center 750 accesses the controller 732, the controller 732 performs data processing (i.e. reading, transferring, outputting, writing, and erasure) in accordance with the instruction thereof (P58). The control center 750 is intended to carry out traffic control and charge collection control inside and outside the charge area, as well as observation and tracking of problem cards and vehicles. In order to carry out traffic control, the control center 750 regularly, and when appropriate, refers to the data in the vehicle entry and departure database TDB, and calculates the number of vehicles present within the charge area (the sum of the number of vehicles that have entered minus the number of vehicles that have exited at enterence and exit of each charge area) and differential values thereof (congestion trends, easing trends) for predetermined time spots so as to ascertain the trends in the traffic volume. The control center 750 publicly reports traffic information over short time periods, and over long time periods corrects or abolishes the charge tables. In the toll collection control, the task of collecting an unpaid toll from (the owner of) the vehicle for which the absolute value of the negative value of the card balance in the arrears database CDB is the largest is performed. Data of the observation database WDB is used for finding problem cards and vehicles.

[0621] The controller unit 732 of the notification station 730 executes the "Toll collection and movement history collection" CRC shown in Fig. 69 in a fixed cycle when the reception interruption 2 (DRI2) do not start up. When the routine advances to this processing, the unit 732 transmits charge requests via the communication device 731 and the antenna 740 at a toll collection timing that is set either in a fixed cycle (of approximately several minutes) or in a cycle that is not fixed but does have a pitch of approximately several minutes in order to make it more difficult for a fraudulent user to avoid a charge (P61, P62). Furthermore, at a movement history collection timing that is set either in a fixed cycle or in a non-fixed cycle, in the same way as above, movement history data requests are transmitted in sequence to each ID for which ID a control movement history table is generated in the vehicle entry / departure database TDB. The movement history data of each ID is received in sequence and written in the movement history table on the control side at each ID (P64 to P70). Namely, control side movement history tables of each ID are generated in "vehicle entry" date and time sequence in the vehicle entry and departure database TDB. The movement history data request is transmitted to the ID address having the earliest date and time (P64, P65), and the timer Tw is started (P66). A reply (i.e. the history table on the movement side) is then awaited from the ID (P57, P68) until the time on the timer is up. If a reply is received, it is added to the movement history table on the control side in the ID address (P69). Once this is completed, or if time is up on the timer without a reply being received, a movement history data request is transmitted to the ID address having the next earliest writing date and time. (P70, P65). In this way, when data requests and reception (namely, polling)

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has been completed for all IDs in which control side movement history tables are generated in the vehicle entry and departure database TDB, a check is made as to whether or not there are any charge device usage errors in each ID (card ID) (P71), based on the data of the control side movement history tables at each ID in the vehicle entry and departure database TDB.

[0622] Namely, for example, immediately after an ID (charge device 1) has made a "vehicle entry" into a charge area, data (date and time, balance, position and direction) at the time of "vehicle entry", namely, data that has been transmitted to the notification station 730 in step P26 in Fig. 63, is present in (the first column of) the control side movement history table of the ID address until the first movement history collection is performed. Moreover, in the first movement history collection, when the history data shown in Table 20, for example, is collected, that history data is written in the (second column and thereafter of the) control side movement history table. If the balance is negative, the card reader not operating normally, there is no card present or the GPS is not operating normally, that usage error information is written in the control side movement history table. Moreover, a check is made as to whether there are any changes or any lack of changes that do not occur in normal charge processing by a comparative calculation, which corresponds to the type of charge table (Table 17, 18, or 19), of the progress of data of identical items with the data of other items in the order in which they appear (column No.) in the movement history table on the control side. If there are these usage errors, the usage error information is written in the control side movement history table. If there are none of these usage errors, the data of the history table on the movement side just read is left as it is, and the data recorded before that is erased from the movement history table on the control side. If there is usage error information present, it is accumulated by being recorded in the control movement history table each time it is collected without a data erasure such as that above being performed. When the relevant vehicle (card ID) becomes a "vehicle departure", the control movement history table at the ID is transferred to the observation database WDB and is removed from the vehicle entry and departure database. TDB.

[0623] The embodiment described above is a charge system in which charges are levied in area units in a road network, and it is possible to set either a portion or all of a highway road network, or specific areas of a general road network as charge areas and to charge vehicles that transit those areas.. However, the present invention is not limited only to a road network charge system, and may also be implemented in a tourist area, an event area or the like as an entry fee collection system.

Possible Industrial Applications

[0624] As described above, the charge processing device, a charge processing system, and charge processing card of the present invention are preferably used in a device for transferring information such as the receipt of money or the like between a moving body such as a vehicle and the ground, and for performing processing associated with the charge processing relating to the user of the moving body, and may be used, for example, in a device for performing charge processing, a device for leaving charge processing as it is, and a device for charge processing constructed so as to be portable.

Claims

1. A charge processing device comprising:

   detecting means for detecting position information indicating a position where a moving body is located;
   matching means for matching the position information with predetermined map information;
   deciding means for deciding, based on a result of a matching by the matching means, an entry state indicating whether or not the moving body has at least entered into an area in which a charge is applied that corresponds to a predetermined area set in advance in the map information; and
   generating means for generating, based on a result of a deciding by the deciding means, charge information for the moving body.

2. The charge processing device according to claim 1, the charge processing device further comprising location information detecting means for detecting, based on the position information, location information indicating date and time the moving body is located in the area in which a charge is applied, wherein the deciding means decides, based on the result of the matching by the matching means and a result of a detection by the location information detecting means, the entry state including a location state of the moving body within the area in which a charge is applied.

3. The charge processing device according to claim 1 or 2, wherein the generating means decides the entry state including a congestion state caused by moving bodies located in the area in which a charge is applied.

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4. The charge processing device according to any of claim 1 through claim 3, wherein the generating means is further provided with storage means in which predetermined toll data corresponding to the entry state is stored in advance, and the generating means generates the charge information using the toll data in the storage means.

5. A charge processing device comprising:

host position detecting means for detecting a position of a host moving body;
transceiving means for transmitting position information of the host moving body to the ground side, and for receiving charge data relating to a predetermined area in which a charge is applied, using wireless communication; and
charge processing means for performing charge processing relating to the area in which a charge is applied, based on a result of a transmission and reception by the transceiving means, wherein

the host position detecting means, the transceiving means, and the charge processing means are able to be mounted on a moving body.

6. The charge processing device according to claim 5, wherein the charge processing means performs the charge processing using an IC card on which balance information is stored.

7. A charge processing device comprising:

detecting means for detecting position information representing a position where a moving body is located;
charge means for executing charge processing for the moving body when the moving body has entered into a predetermined area in which a charge is applied, based on a result of a detection by the detecting means;
notification means which is mounted on the moving body and which notifies the outside of the moving body of a processing state of the charge processing in a notifying state corresponding to the processing state; and
continuing means for continuing a notification by the notification means during the moving body is located inside the area in which a charge is applied, based on a result of the detection by the detecting means.

8. The charge processing device according to claim 7, wherein the notification means is a radiation means for radiating electromagnetic waves towards the outside of a vehicle.

9. The charge processing device according to claim 7 or 8, wherein the notification means is constructed as a light source disposed on the detecting means, or on a number plate the moving body, or in an area around the number plate of the moving body.

10. The charge processing device according to any of claims 9 through 7, wherein the notification means performs notification in a predetermined operating pattern in which the notification state is altered in the manner of a time series.

11. The charge processing device according to claim 10, wherein the notification means is further provided with receiving means for receiving a pattern signal representing the operating pattern, and notification of the processing state is made to the outside of a vehicle based on the pattern signal.

12. The charge processing device according to any of claims 7 through 11, wherein the notification means is structured from a vehicle exterior notification means for notifying the outside of the vehicle of the processing state, and a vehicle interior notification means for notifying the inside of the vehicle of the processing state, and notification of the processing state is made to the interior and exterior of the vehicle.

13. A charge processing device further comprising observation means for observing a notification from the notification means provided in the charge processing device according to any of claims 7 through 12.

14. The charge processing device according to claim 13, wherein the observation means observes a notification by detecting at least brightness.

15. The charge processing device according to claim 13, wherein the observation means is an image pickup means capable of picking up either one or a plurality of images having at least brightness.

16. The charge processing device according to any of claims 13 through 15, wherein the observation means observes

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a notification by detecting at least brightness in synchronization with the observation pattern determined in advance that is altered in the manner of a time series.

17. The charge processing device according to claim 16, wherein the observation means is further provided with receiving means for receiving a pattern signal indicating the observation pattern, and the observation means observes a notification in synchronization with the observation pattern based on the pattern signal.

18. The charge processing device according to any of claims 13 through 17, wherein the charge processing device is further provided with deciding means for deciding a processing state of the charge processing based on an observation result by the observation means.

19. The charge processing device according to claim 18, wherein the deciding means is provided with comparing means for comparing a notification state of a notification obtained by the observation means with a predetermined notification state, and processing deciding means for deciding a processing state of the charge processing based on a comparison result by the comparing means.

20. A charge processing device comprising in a manner in which each is portable:

receiving means for receiving a pattern signal indicating an observation pattern altered in the manner of a time series in order to observe a notification from a notification means provided in the charge processing device according to any of claims 7 through 12; and

presenting means for presenting notification information corresponding to the observation pattern in synchronization with the observation pattern based on the pattern signal,

21. The charge processing device according to claim 20, wherein the charge processing device according to claim 20, wherein the presenting means presents observation information by at least one of sound and light.

22. A charge processing device comprising:

detecting means for detecting position information indicating a position where a moving body is located;
making means for generating charge information for the moving body in a predetermined area in which a charge is applied, as well as making a charge history of the generated charge information based on a detection result by the detecting means; and
transmitting means for transmitting the charge history of the charge information generated by the generating means to the ground side.

23. The charge processing device according to claim 22, wherein the making means is formed from generating means for generating charge information for each of a plurality of existing areas where a charge is applied, and accumulating means for accumulating in sequence the generated charge information as charge history.

24. The charge processing device according to claim 22 or 23, wherein the detecting means detects the position information using satellite signals from satellites.

25. The charge processing device according to any of claims 22 through 24, wherein the making means is further provided with matching means for matching the position information with predetermined map information, and with deciding means for deciding, based on a matching result by the matching means, a entry state indicating at least whether or not the moving body has entered into a predetermined area in which a charge is applied in the map information, and the charge information is generated based on a result of a decision by the deciding means.

26. A charge processing system comprising:

in-vehicle communication means which is provided with the charge processing device according to any of claims 1 through 4 and in which the transmission means transmits charge history in accordance with an input transmission request: and
on-road communication means having request means for performing the transmission request and processing means for performing charge settlement processing in a predetermined processing area and based on a transmitted charge history.

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27. The charge processing system according to claim 26, wherein the on-road communication means is further provided with altering means for altering the amount of the charge settlement based on a time until an arrival in the processing area.

28. A charge processing device comprising:

detecting means for detecting position information indicating a position where a moving body is located;
storage means capable of being inserted and removed for storing a predetermined area in which a charge is applied; and
generating means for generating charge information for the moving body based on a result of a detection by the detecting means and the area in which a charge is applied stored in the loaded storage means.

29. The charge processing device according to claim 28, wherein the generating means is provided with a reading means for reading a result of a detection by the detecting means and the area in which a charge is applied stored in the storage means, and generates charge information from the read position information and the area in which a charge is applied.

30. The charge processing device according to claim 1 or claim 29, wherein the storage means is a toll card on which is stored the area in which a charge is applied for generating at least charge information.

31. A charge processing card comprising:

a loading portion for loading in an in-vehicle device that detects position information indicating a position where a moving body is located, and generates charge information from the position information and a predetermined area in which a charge is applied;
an area storage portion for storing the area in which a charge is applied; and
a balance storage section for storing balance information.

32. A charge processing device carried by a user or mounted on a moving body comprising:

means for detecting a ground position;
storage means for storing area specifying information and inside-area control information;
notification control means for generating position relation information in a charge processing device for an area indicated by area specifying information, based on the ground position detected by the ground position detecting means and the area specifying information of the storage means; and
notification means for notifying a user as to information expressed by the area specifying information and the inside-area control information and the position relation information.

33. A charge processing device carried by a user or mounted on a moving body comprising:

means for detecting a ground position;
storage means for storing charge area specifying information, inside-area charge information, and credit information;
notification control means for generating position relation information in a charge processing device for a charge area indicated by the charge area specifying information, based on the ground position detected by the ground position detecting means and the charge area specifying information of the storage means, and updating the credit information in the storage means in response to changes outside and inside the ground position relative to the charge area; and
notification means for notifying a user as to information expressed by the charge area specifying information, the inside-area charge information, and the credit information and the position relation information.

34. A charge processing system comprising:

a notification device that is a charge processing device carried by a user or mounted on a moving body and includes

means for detecting a ground position,
communication means for receiving area specifying information,

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storage means for storing received area specifying information,

notification control means for generating position relation information in a charge processing device for art area indicated by the area specifying information based on the ground position detected by the ground position detecting means and the area specifying information of the storage means, and

notification means for notifying a user as to the position relation information; and

a transmitting station comprising

public notification information storage means for storing the area specifying information, and

transmitting means for transmitting the area specifying information of the public notification information storage means.

35. A charge processing system comprising:

a notification device that is a charge processing device carried by a user or mounted on a moving body and includes

means for detecting a ground position,

communication means for receiving charge area specifying information and inside-area charge information,

storage means for storing received charge area specifying information and inside-area charge information, and credit information,

notification control means for generating position relation information in a charge processing device for a charge area, based on the ground position detected by the ground position detecting means and the charge area specifying information of the storage means, and updating the credit information in the storage means in response to changes outside and inside the ground position relative to the charge area, and

notification means for notifying a user as to information expressed by the charge area specifying information, the inside-area charge information, and the credit information and the position relation information; and

a transmitting station comprising.

public notification information storage means for storing area specifying information and the inside-area charge information, and

transmitting means for transmitting the area specifying information and the inside-area charge information of the public notification information storage means.

36. A charge processing device carried by a user or mounted on a moving body comprising:

means for detecting a ground position;

storage means for storing area specifying information and credit information;

relative position determining means for calculating whether the ground position detected by the ground position detecting means is inside or outside an area represented by the area specifying information in the storage means;

interruption instruction means;

time measuring means for measuring a time elapsed inside the area during a period in which there is no interruption instruction from the interruption instruction means; and

charge processing means for updating the credit information based on a value of a time measured by the time measuring means.

37. A charge processing device carried by a user or mounted on a moving body comprising:

means for detecting a ground position;

storage means for storing area specifying information and credit information;

relative position determining means for calculating whether the ground position detected by the ground position detecting means is inside or outside an area represented by the area specifying information in the storage means;

distance measuring means for measuring a distance moved within the area; and

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charge processing means for updating the credit information based on a distance measured by the distance measuring means.

38. The charge device according to claim 36 or 37, wherein the charge device further comprises notification means for notifying a user about information representing the area specifying information and the credit information.

39. The charge processing device according to claim 36 or 37, wherein the charge processing device further comprises: notification control means for generating approach information that the charge processing device is approaching the area represented by the area specifying information based on the ground position detected by the ground position detecting means and the area specifying information of the storage means; and notification means for notifying a user about information representing the approach information, the area specifying information, and the credit information.

40. A charge processing system comprising:

a charge device that is carried by a user or mounted on a moving body and is provided with

means for detecting a ground position,
communication means for receiving area specifying information,
storage means for storing received area specifying information, and credit information,
relative position determining means for calculating whether the ground position detected by the ground position detecting means is inside or outside an area represented by the area specifying information in the storage means;
interruption instruction means,
time measuring means for measuring the time elapsed inside the area during a period in which there is no interruption instruction from the interruption instruction means, and
charge processing means for updating the credit information based on a value of a time measured by the time measuring means; and

a transmitting station that includes

public notification information storage means for the storing area specifying information, and
transmitting means for transmitting the area specifying information of the public notification information storage means.

41. The charge processing device or charge processing system according to claim 36 or claim 40, wherein the charge processing device is mounted on a moving body, and the interruption instruction means performs an interruption instruction interconnectedly with the off operation of an ignition of the moving body.

42. A charge processing system comprising:

a charge processing device that is carried by a user or mounted on a moving body and is provided with

means for detecting a ground position,
communication means for receiving area specifying information,
storage means for storing received area specifying information, and credit information,
relative position determining means for calculating whether the ground position detected by the ground position detecting means is inside or outside an area represented by the area specifying information in the storage means;
distance measuring means for measuring a distance moved inside the area, and
charge processing means for updating the credit information based on a distance measured by the distance measuring means; and

a transmitting station that includes

public notification information storage means for storing the area specifying information, and
transmitting means for the transmitting area specifying information of the public notification information storage means.

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43. A charge processing device comprising:

storage means for storing credit information;
read and write means for reading the credit information from the storage means and writing the credit information to the storage means;
entry detecting means for detecting an entry into a charge area;
charge processing means for updating, in accordance with a charge toll, the credit information in the storage means via the read and write means in response to traffic in the charge area; and
communication means for transmitting charge device state information including whether or not reading and writing of credit information in the storage means is possible while in the charge area.

44. A charge processing device comprising:

means for detecting a ground position;
storage means for storing credit information, charge area, and charge tolls;
charge processing means for detecting whether the ground position detected by the ground position detecting means is within the charge area, and updating, in accordance with the charge toll, credit information in the storage means in response to a traffic in the charge area; and
communication means for transmitting charge device state information including whether or not ground position detection by the ground position detecting means is possible while in the charge area.

45. A charge processing system comprising:

a charge processing device that includes

storage means for storing credit information,
read and write means for reading the credit information from the storage means and writing the credit information to the storage means,
entry detecting means for detecting an entry into a charge area,
charge processing means for updating, in accordance with the charge toll, the credit information in the storage means via the read and write means in response to a traffic in the charge area, and
first communication means for receiving a data request and transmitting charge device state information including whether or not reading and writing of credit information in the storage means is possible while in the charge area; and

a control station that includes

second communication means for transmitting the data request to the charge processing device and receiving the charge processing device state information from the charge processing device, and
serching means for checking for erroneous use of the charge processing device based on received data.

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uncaptured satellites are also displayed by graphic images for discrimination.

The display 2 indicates the current position of the portable terminal. The current latitude, longitude and altitude are displayed by numerals, and the current position is displayed together with a path from the start location of navigation, using simple graphic images. Although not shown in the display 2, a map is actually displayed here, and the holder of the portable terminal can know the region where he/she is.

The display 3 indicates a target position and navigation. A target latitude, longitude, azimuth and distance and a current azimuth and speed are indicated as character information. A graphic image depicted at the lower part of the display 3 is the pattern of a compass so as to facilitate understanding of a target direction and a current proceeding direction. A white-painted arrow denotes the current proceeding direction, while a black-painted arrow denotes the direction of the target location.

Figs. 10A - 10D are views showing examples of the external appearances of the respective portable terminals of the present invention.

Figs. 10A and 10B exemplify the external

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appearance of a terminal of a portable type. Fig. 10A is a front view, while Fig. 10B is a side view.

A display screen 50 for displaying navigation information, a map, etc. is provided on the front of the terminal, and a GPS antenna 51 is attached to the side part thereof. The GPS antenna 51 may be of either a built-in type or of a construction which is attached afterwards using a PC card slot or the like. Further, the GPS antenna 51 should preferably have a structure whose mounting portion can be moved flexibly so as to capture the radio waves from the satellite, and which can be faced upward in any attitude from the terminal. Incidentally, the terminal has the function of communications installed therein so that it can communicate with a central system. Without the communicating function, however, navigation based on the GPS is still possible.

Figs. 10C and 10D exemplify the external appearances of the terminal of a portable telephone type.

Fig. 10C illustrates the state in which a flipper (cover) 54 is closed. A display screen 52 is provided on the front of the terminal. Navigation information and a map are displayed on the display screen 52. A GPS antenna 53 is disposed in the flipper 54, and it

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can capture the radio waves from the satellite so as to offer current position information etc. to the holder of the terminal.

Fig. 10D illustrates the state in which the flipper 54 is opened. When the flipper 54 is opened, input buttons 55 become visible, and they can be used for giving inputs in order to make a telephone call and to receive the services of navigation etc. There is a mouthpiece at the base of the flipper 54. Thus, the flipper 54 reflects the voice of a person so as to transmit the voice to the mouthpiece.

In this manner, a GPS antenna 53 is built into a part, such as flipper 54, including almost no electric circuitry therein, whereby the GPS function can be installed without enlarging the size of the terminal.

According to the present invention, it is possible to provide a position information management system of high serviceability in which the actions of, for example, an old person or a child can be supervised, in which persons holding portable terminals can acquire position information from each other, and in which an abnormal situation of a person holding a portable terminal can be quickly known.

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In the above description, explanation was given of a supervisory process for detecting when a third party remains at the same site unnecessarily long. However, it is also possible to detect when the third party moves from a certain site before a supervisory period has elapsed, in a case where the third party is intended to remain at the site (for example, a hospital or school).

Although the above description refers to supervision of an old person or child, the present invention may also allow tracking of vehicles, valuable goods, and so forth. In this case, the terminal carried by the item to be tracked may be of a simplified design having reduced display and input capabilities.

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CLAIMS

1. A position information management system comprising:

an information terminal (11) for acquiring information from one of a plurality of kinds of positioning systems (12, 13, 23, 24, 33) and for automatically changing any of said positioning systems in an unavailable state, over to an available one of said positioning systems so as to acquire a current position thereof by the use of the positioning system available; and

a central system for processing said acquired information so as to manage information on a position of the information terminal.

2. The position information management system as set forth in claim 1, wherein said information terminal (11) includes a built-in device (20) which detects a moving direction and a moving speed of said information terminal (11), and even when all of said positioning systems (12, 13, 23, 24, 33) have become unavailable, said information terminal (11) independently detects its current position.

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3. The position information management system as set forth in claim 1 or 2,wherein a third party can acquire the position of a holder of said information terminal (11) through the central system (10).

4. The position information management system as set forth in claim 3, wherein the third party is the holder of said information terminal (11).

5. The position information management system as set forth in claim 3 or 4, wherein a movement of the current position of the holder of said information terminal (11) is supervised, and when said holder of said information terminal (11) either has, or, has not, moved from a certain position after a predetermined time period, an alarm is raised upon a judgement that an unusual situation has occurred to said holder.

6. The position information management system as set forth in any preceding claim, wherein said information terminal (11) transmits position information of a destination to the central system (10), thereby to automatically download map data of an appropriate scale from said central system (10) on demand, the map data containing the current position of said

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information terminal (11) and a position of the destination, and to display said map data.

7. The position information management system as set forth in any preceding claim, wherein said information terminal (11) retains minimum map data of a region in which a holder thereof wants to move, in the form of an IC card.

8. The position information management system as set forth in any preceding claim, wherein said information terminal (11) retains map data downloaded from the central system (10) for a certain period of time, and when map data needed before becomes necessary again, it is searched for from within the map data retained in said information terminal (11) and is displayed.

9. The position information management system as set forth in Claim 8, wherein said information terminal (11) sets a time period for retaining map data of higher use frequency, to be longer than a certain period of time.

10. An information terminal which can communicate with a central system for managing

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position information, and which acquires information from a positioning system so as to display information on a position of the information terminal, comprising:

interface means (14, 15, 16, 17) being serviced by a plurality of kinds of positioning systems (12, 13, 23, 24, 33); and

control means (22) for automatically changing any of the positioning systems in an unavailable state, over to an available one of said positioning systems so as to acquire a current position of said information terminal (11) by the use of the positioning system available.

11. The information terminal as set forth in claim 10, further comprising a built-in device (20) which detects a moving direction and a moving speed of said information terminal (11), and wherein even when all of said positioning systems (12, 13, 23, 24, 33) have become unavailable, said information terminal (11) independently determines and displays its current position.

12. The information terminal as set forth in claim 10 or 11, wherein a third party can acquire the position of a holder of said information terminal (11)

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through the central system (10).

13. The information terminal as set forth in claim 12, wherein the third party is the holder of said information terminal (11).

14. The information terminal as set forth in claim 12 or 13, wherein a movement of the current position of the holder of said information terminal (11) is supervised, and when said holder of said information terminal (11) either has, or has not, moved from a certain position after a predetermined time period, an alarm is raised upon a judgement that an unusual situation has occurred to said holder.

15. The information terminal as set forth in any of claims 10 to 14, wherein said information terminal (11) transmits position information of a destination to the central system (10), thereby to automatically download map data of an appropriate scale from said central system (10) on demand, the map data containing the current position of said information terminal (11) and a position of the destination, and to display said map data.

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16. The information terminal as set forth in any of claims 10 to 15, wherein said information terminal (11) retains minimum map data of a region in which a holder thereof wants to move, in the form of an IC card.

17. The information terminal as set forth in any of claims 10 to 15, wherein said information terminal (11) retains map data downloaded from the central system (10) for a certain period of time, and when map data needed before becomes necessary again, it is searched for from within the map data retained in said information terminal (11) and is displayed.

18. The information terminal as set forth in claim 17, wherein said information terminal (11) sets a time period for retaining map data of higher use frequency, to be longer than a certain period of time.

19. The information terminal as set forth in any of claims 10 to 18, wherein said information terminal (11) is a terminal of portable telephone type, in which an antenna (53) for the positioning systems (12, 13) is disposed in a cover (54) for an input button portion of said information terminal (11).

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20. A portable radio terminal, comprising:

position information acquisition means (14, 15, 16, 17) for obtaining current position information; and

means (22) for transmitting the position information obtained by said position information acquisition means (14, 15, 16, 17), to another equipment through a radio channel, in compliance with a request for said position information made through the radio channel by the other equipment.

21. The portable radio terminal as set forth in claim 20, further comprising means (18) for displaying a map which contains a destination, on the basis of position information of the destination.

22. The portable radio terminal as set forth in claim 21, wherein the display means (18) displays a map of an appropriate scale containing the current position of said portable radio terminal (11) and said destination.

23. The portable radio terminal as set forth in claim 20, 21, or 22, further comprising:

means connected to another equipment, for

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acquiring position information of a third party; and

means for outputting the acquired position information of the third party.

24. A portable radio terminal, comprising:

position information acquisition means (14) for obtaining current position information on the basis of electromagnetic waves from a positioning system;

means (15, 16; 22) for connecting said portable radio terminal through a radio channel with a center which manages current position information of a plurality of portable radio telephone terminals;

means (15, 16; 22) for registering the current position information obtained by said position information acquisition means (14), in the center through the connection means (15, 16; 22); and

means (15, 16; 22) for acquiring a current position of the portable radio terminal of a third party from said center through said connection means (15, 16; 22).

25. The portable radio terminal as set forth in claim 24, wherein an antenna (53) for said position information acquisition means (14) is disposed in a cover (54) for an input button portion of said

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portable radio terminal.

26. The portable radio terminal as set forth in claim 24 or 25, further comprising means (52) for displaying a map which contains the acquired current position of said portable radio terminal of the third party.

27. The portable radio terminal as set forth in claim 26, wherein the display means (52) displays a map of an appropriate scale containing a current position of said portable radio terminal itself and said current position of said portable radio terminal of said third party.

28. A position information management system, substantially as hereinbefore described with reference to the accompanying drawings.

29. An information terminal for use in a position information management system, substantially as hereinbefore described with reference to the accompanying drawings.

30. A portable radio terminal for use in a position information management system, substantially as hereinbefore described with reference to the accompanying drawings.

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Patent Office

54

Application No: GB 9716207.7 **Examiner:** Dr E P Plummer
Claims searched: 1 to 19 **Date of search:** 30 October 1997

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): H4D(DAA,DAB,DPBX,DPX), H4L(LDSL,LDDRS)

Int Cl (Ed.6): G01S, H04Q

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB2283873A	TELIA whole document, eg abstract	1,10 at least
X	GB2025185A	SIEMENS whole document, eg abstract	1,10 at least
Y	GB1528180	SPERRY RAND whole document	1,10 at least
Y	EP0601293A2	MOTOROLA whole document, eg abstract	1,10 at least
Y	EP0528090A1	CAE-LINK whole document, eg abstract	1,10 at least
X	EP0006448A1	SIEMENS whole document, eg abstract	1,10 at least
Y	US4806940	HONEYWELL whole document, eg abstract	1,10 at least

X Document indicating lack of novelty or inventive step
Y Document indicating lack of inventive step if combined with one or more other documents of same category.
& Member of the same patent family
A Document indicating technological background and/or state of the art.
P Document published on or after the declared priority date but before the filing date of this invention.
E Patent document published on or after, but with priority date earlier than, the filing date of this application.

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The Patent Office

55

Application No: GB 9716207.7 **Examiner:** Dr E P Plummer
Claims searched: 20 to 23 **Date of search:** 23 April 1998

Patents Act 1977
Further Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): H4D (DAB, DSDX)

Int Cl (Ed.6): G01S

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X Y	EP0766096A2	Shimadzu whole document	20 21-23
Y	WO97/01104A1	Thomson-CSF whole document	21-23
X Y	WO95/27219A1	Motorola whole document	20 21-23
X Y	WO92/13284A1	Song whole document	20 21-23
X Y	WO83/02501A1	Jysk Telefon whole document	20 21-23
X	US5548822	Aisin Seiki whole document	20-23
X Y	US5519403	Motorola column 4 line 53ff	20 21-23
X Y	US5504491	Chapman whole document, nb column 2 lines 1 to 5	20-22 23

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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The Patent Office

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Application No: GB 9716207.7 **Examiner:** Dr E P Plummer
Claims searched: 20 to 23 **Date of search:** 23 April 1998

Category	Identity of document and relevant passage		Relevant to claims
X Y	US5461390	AT&T whole document	20 21-23

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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The Patent Office

Application No: GB 9716207.7 **Examiner:** Dr E P Plummer
Claims searched: 24 at least **Date of search:** 9 April 1998

Patents Act 1977
Further Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): H4D(LDSL,LDSM,LDRRS), H4D(DAA,DAB,DPX,DPBA, DPBC,DPBX,DPDA,DPDD,DPDG,DPDK,DPDN,DPDR,DPDX)

Int Cl (Ed.6): H04Q, G01S

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	WO95/27219A1	MOTOROLA whole document - nb mobile unit 6	24,25
A	WO95/17685A1	TANNER	
X	US5389934	THE BUSINESS EDGE GROUP whole document	24,25
X	US5327144	ASSOCIATED RT whole document, eg abstract, column 8 line 63 to column 9 line 38	24-27

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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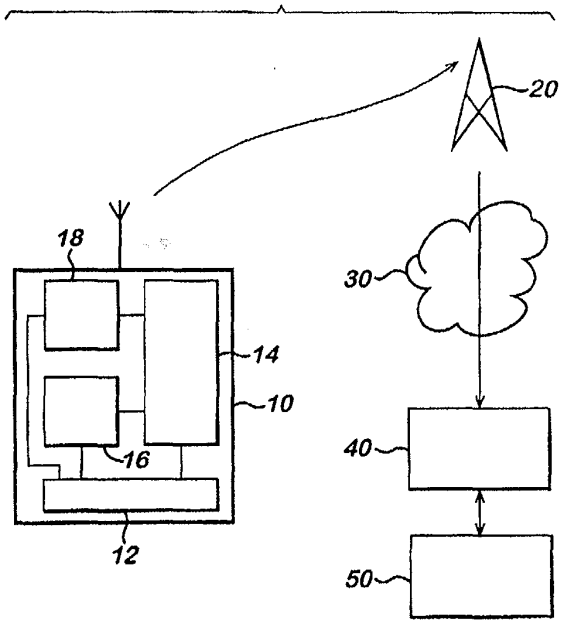
INT CL[7] G06F 17/30 , G08G 1/00 1/01 , H04M 11/00 , H04Q 7/34
Online: EPODOC, JAPIO, WPI, INSPEC

(54) Abstract Title
Location-dependent data collection

(57) A method is described for collecting location-dependent data in a central data collection point. The method comprises the steps of: collecting location dependent data from a data source, in a nearby portable communications device 10; transmitting the collected data to a base station 20 of the portable communications device; and communicating the collected data along with a location identifier to the data collection point 40.

Fig. 1



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1995

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Fig. 1

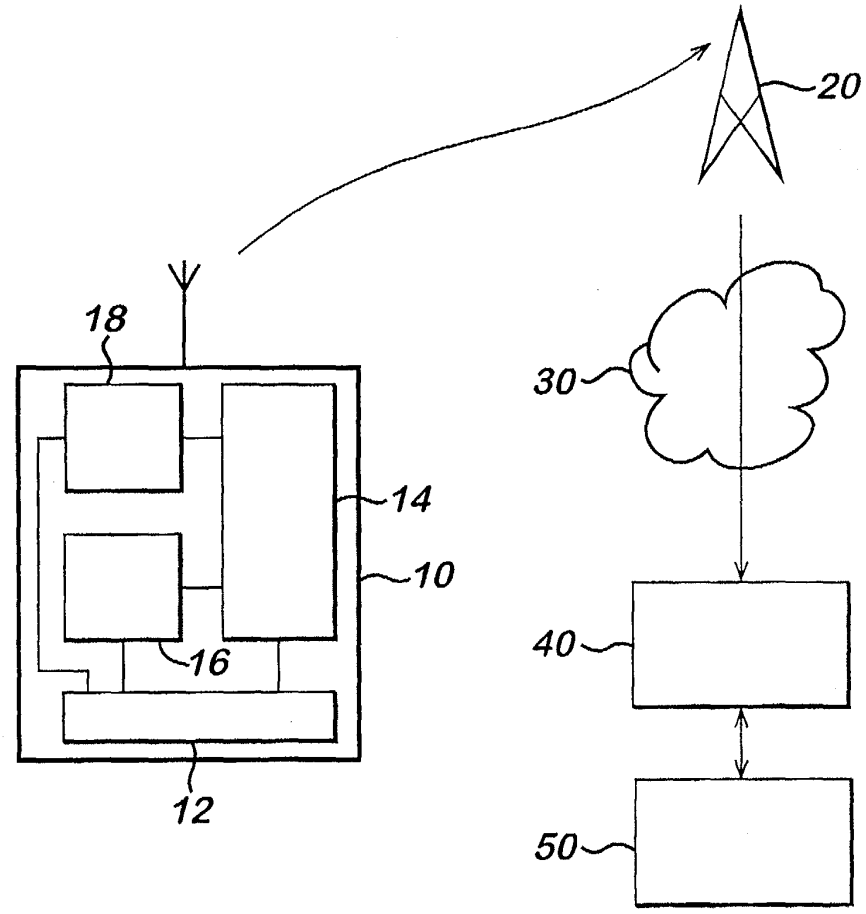


Fig. 2

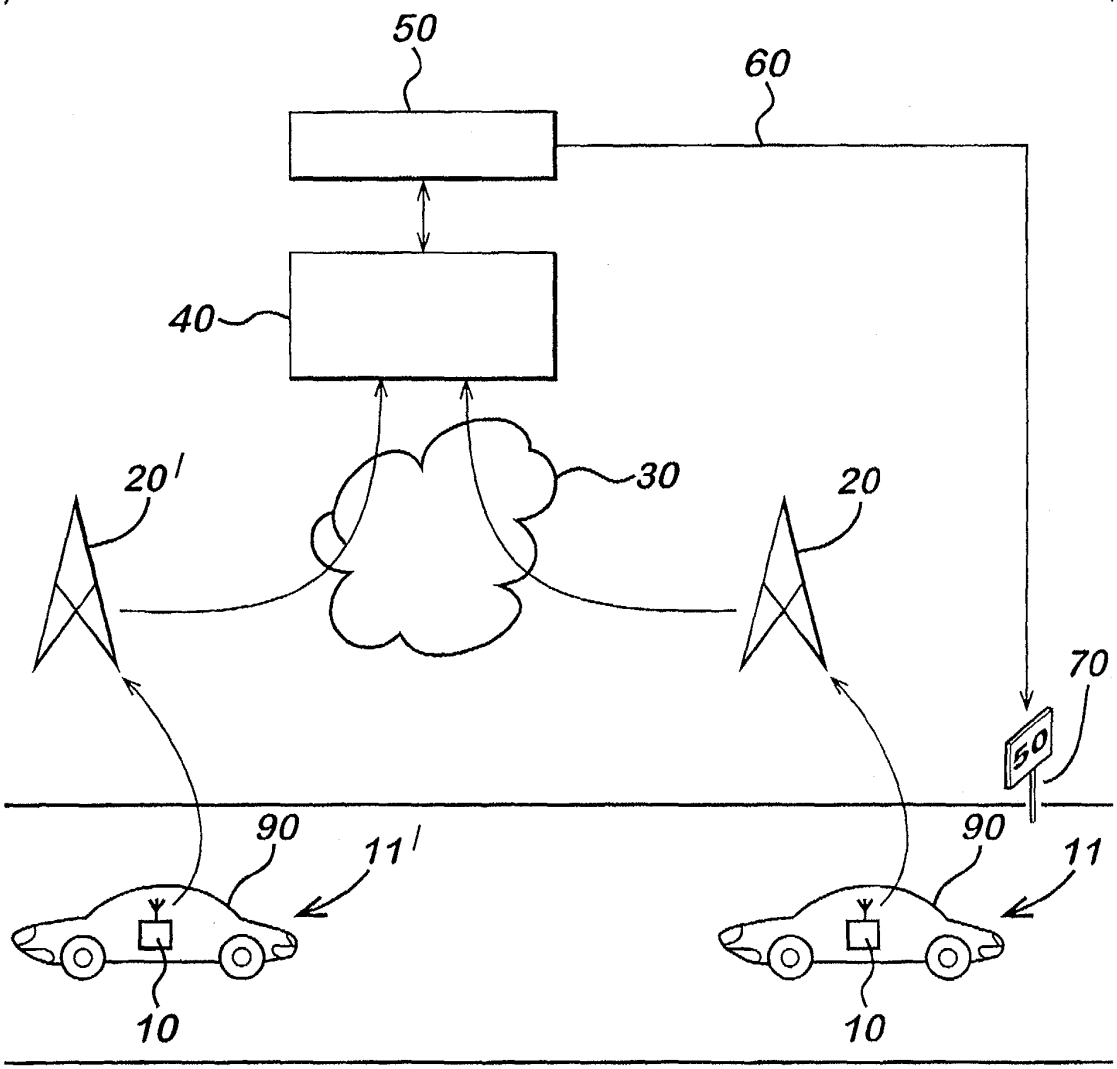


Fig. 3

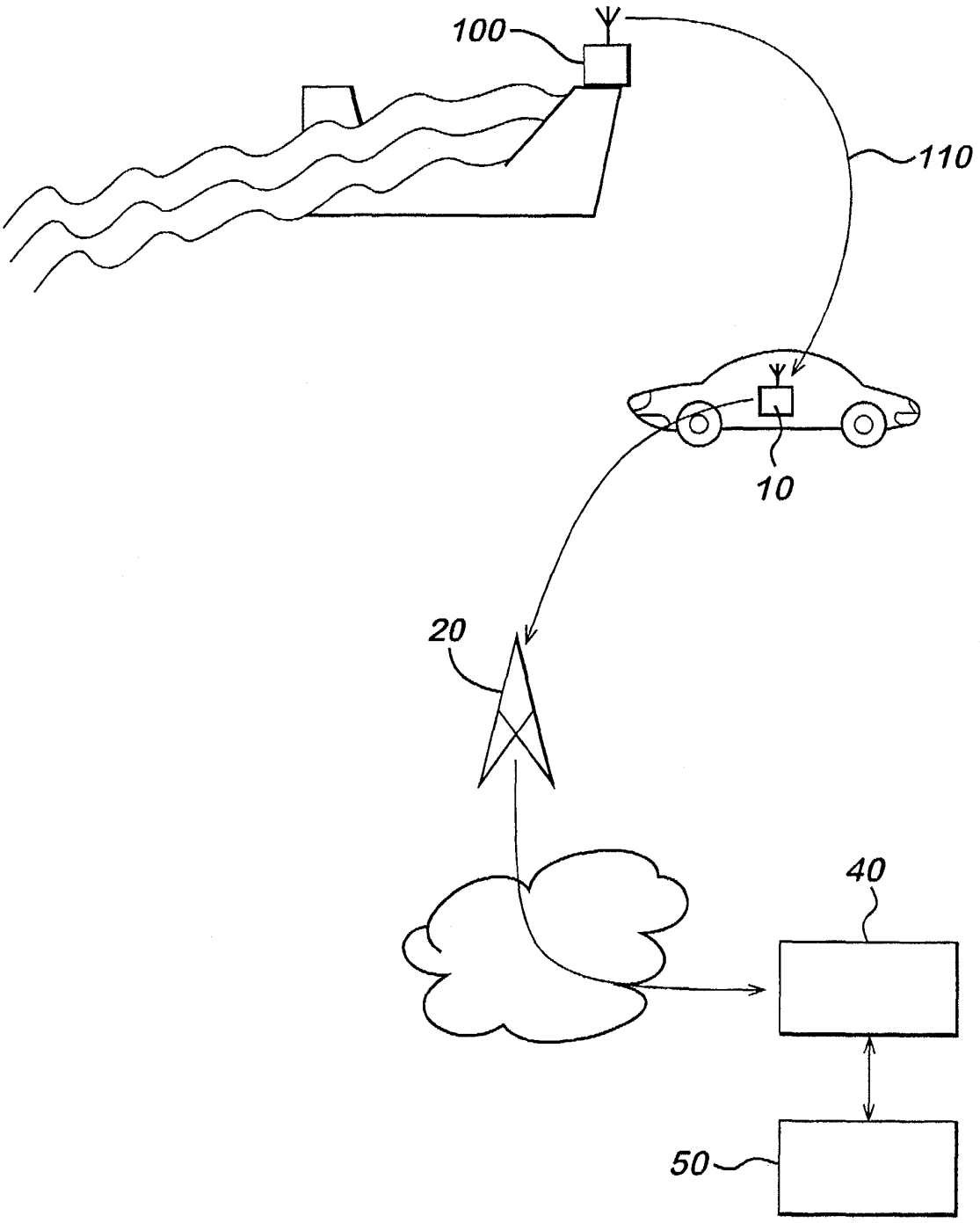
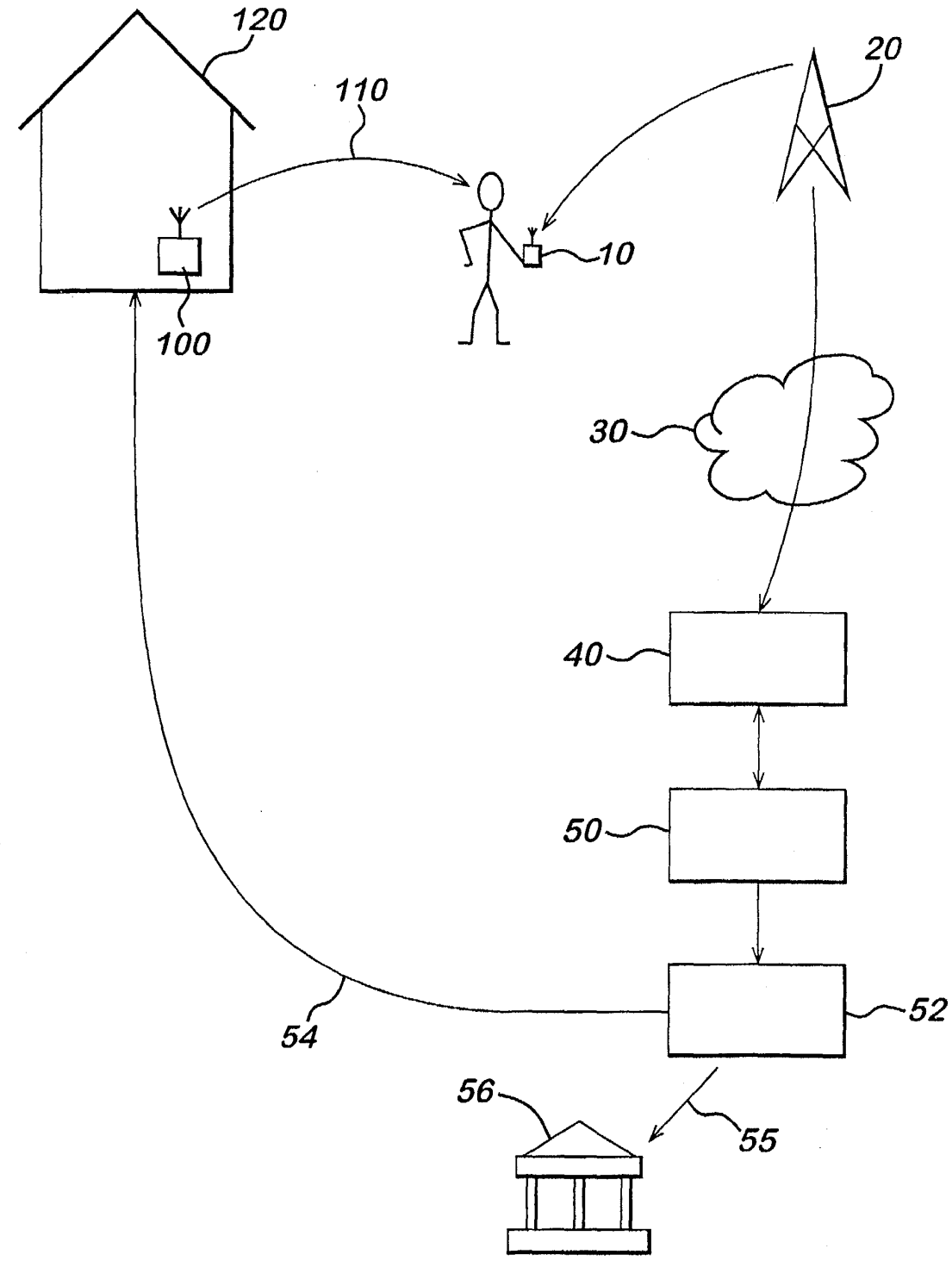


Fig. 4



LOCATION-DEPENDENT DATA COLLECTION

In certain areas of the world, such as many countries of Europe, mobile telephones have become very popular. Large numbers of mobile telephones are carried by people in all walks of life as they go about their daily business. For the vast majority of the time, these telephones are either turned off completely, or are in standby mode, that is, they are powered and registered with a base station but are not actively communicating.

Many applications exist in which location-dependent data needs to be collected. Examples of such applications are weather monitoring, meter reading, evaluation of traffic conditions. Each of these applications will be described in greater detail below, but each requires a large amount of data to be collected from geographically dispersed sites. It would be expensive to install and maintain a dedicated communications system for collecting the required data from each of these various sources.

The present invention provides a method of collecting location dependent data from geographically dispersed sites without the need for a dedicated communications network. In particular, the invention allows portable communications devices such as mobile telephones to collect data relevant to the area in which they happen to be, and to transmit that data over their assigned communications channels to a central data collection point.

Accordingly, the present invention provides a method for collecting location-dependent data in a central data collection point comprising the steps of: collecting location dependent data from a data source, in a nearby portable communications device; transmitting the collected data to a base station of the portable communications device; and communicating the collected data along with a location identifier to the data collection point.

The location identifier may be added to the data by the base station. Alternatively, the location identifier may be included in the data collected from the data source and transmitted to the base station. Alternatively, the location identifier may be supplied by a location-aware component within the portable communications device.

The portable communications device may incorporate a sensor as the data source. Such sensors are referred to herein as "environmental sensor", since they provide information relating to conditions in the immediate locality of the portable communications device. The environmental sensor may provide information representing such conditions as temperature, air pressure, humidity, radiation, air contaminant levels, acoustic noise, magnetic fields, electromagnetic and/or radio signal levels, light levels, pollen count, pheromone levels. The incorporated "environmental sensor" may accordingly detect any one or more of a wide range of conditions in the immediate locality of the portable communications device. The term "environmental data" as used herein is to be interpreted accordingly.

The transmitted data may comprise an identifier identifying the portable communications device, sent with the location identifier. The data may be used to determine the position and speed of motion of the portable communications device. In this case, the portable communications device may be carried in a vehicle, and the collected data may be used to derive location, speed and direction information relating to that vehicle. Similarly, data collected from numerous portable communications devices carried in respective vehicles may be used to derive average speed and direction information relating to traffic in a certain location. The derived speed and direction data may be used to control traffic in the respective location.

An external data source may be used, to wirelessly transmit data to the portable communications device. The external data source may transmit the data by very short range radio transmission. The data transmitted by the very short range radio transmission may comprise information relating to meter readings. The

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transmitted data may incorporate an identifier identifying the transmitter, which may be used as the location identifier.

The portable communications device may be a mobile telephone.

A location aware component may be a GPS receiver built in to the portable communications device.

The data may be communicated to the data collection point over a telephone network.

The present invention also extends to a portable communications device comprising a power source; an environmental sensor for detecting conditions in the locality of the device, and for providing corresponding data to communications circuitry; and communications circuitry for transmitting the data to a base station.

The present invention also extends to a portable communications device comprising a power source; a receiver for receiving data from an external data source, and for providing corresponding data to communications circuitry; and communications circuitry for transmitting the data to a base station.

The above, and further, objects advantages and characteristics of the invention will be described in detail with reference to certain embodiments given by way of examples only, with reference to the accompanying drawings, in which:

Figs 1-4 each schematically represent a respective embodiment of the present invention.

Fig. 1 schematically illustrates a first embodiment of the present invention. A portable communications device 10 (hereinafter referred to as 'mobile phone', although the invention extends to the use of any suitable portable communications device) comprises a power supply 12, communications circuitry 14 and location

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aware circuitry 16 such as a GPS (global positioning by satellite) receiver or other location aware circuitry operating other systems such as multilateration techniques, inertial navigation, UMTS location standards, or 'Galileo'. The device described thus far is known, the location aware circuitry 16 providing details of the mobile phone's present position to the communication circuitry 14 to enable the mobile phone to request information relevant to the present position of the mobile phone. Such applications known at present include the ability to access street maps of the local area, telephone numbers of nearby hotels and restaurants.

According to certain embodiments of the present invention, the mobile phone 10 also includes an environmental sensor 18, which provides information regarding one or more characteristics of the immediate environment of the mobile phone to the communications circuitry 14. For example, the environmental sensor may detect the local temperature, humidity, air pressure, radiation level, air pollution level levels, acoustic noise, magnetic fields, electromagnetic and/or radio signal levels, light levels, pollen count, or pheromone levels. Such portable communications devices are believed to be novel in themselves.

In operation, the environmental sensor 18 provides environmental data and the location aware circuitry 16 provides location data. This data may be stored in a memory device within the mobile phone. At some time thereafter, the mobile phone transmits signals containing the environmental data and the location data to a base station 20. Data recording the time at which the data was provided by the sensor 18 may also be included.

The mobile phone may transmit its data at regular intervals – perhaps every ten minutes or every hour – or may store the data for transmission next time the mobile phone makes or receives a call. In the first instance, it may not be necessary to add time data to the transmitted environmental and location data; a time field could be added by the base station if necessary. In the second case, it is necessary that a time field is transmitted with the data, since it may be several hours before the mobile phone is next used and the data transmitted to the base station.

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Once the transmitted data is received at the base station 20, the environmental, time and location data are transmitted over a telephone network 30 to a central database 40 for access by a user 50.

In this way, it may be possible to obtain a very large set of data relating to environmental conditions over a very wide area. The density of data provided will of course depend on how many suitably enabled mobile phones have passed through the relevant area and transmitted their data in time. For example, this system may enable a weather forecasting service or government statistical office to obtain very accurate measurements of environmental conditions at many separate locations around the country, with a fairly short delay. It is, of course, only possible to employ this embodiment of the invention if mobile phones having the required environmental sensor are in sufficiently widespread use.

The data collected in this way may be corrupted due to particular environmental conditions of the mobile telephones. For example, some may be indoors, some outdoors, some in pockets of clothing. Each of these will affect the environmental data provided by the mobile phone, but suitable software treatment will enable statistical analysis to be performed to extract the required information.

Fig. 2 schematically shows a second embodiment of the present invention. In this embodiment, it is the location of the mobile phone itself that is of interest. For example, a vehicle 90 carries a mobile phone 10 having location aware circuitry 16 in standby mode. Environmental sensor 18 is not necessary in this embodiment. At a certain time, such as at predetermined intervals or when a call is made or received, the mobile phone transmits its location to the base station 20. The location information must be associated with a respective time and identity of the mobile phone. This may be achieved in several ways.

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Most simply, the mobile phone transmits its current location to the base station, and the base station adds the time of reception of the data and the identity of the mobile phone, known from the registration process performed when the mobile phone entered the area covered by the base station.

Alternatively, the mobile phone may record its position at regular intervals, say every few minutes, and store the data in its memory. After a relatively lengthy time, say an hour or so, the mobile phone may transmit a list of locations and times to the base station. Again, the identity of the mobile phone may be added by the base station or may be included in the data transmitted from the mobile phone. In another example, corresponding times and locations may be stored in the mobile phone for an indefinite time, and all this data transferred to the base station the next time a call is made or received by the mobile phone. Another alternative is that the mobile phone only transmits its present position when making or receiving a call, although this may well prove to be insufficient data.

Considering the example shown in Fig. 2, the mobile phone 10 records its position 11 and the corresponding time. It may transmit the data immediately to base station 20, or may store the data for later transmission, as discussed above. Some time later, the mobile phone is at position 11'. It records its new position 11' and the corresponding time. As discussed above, it may transmit this data immediately to base station 20', possibly with the stored data relating to former position 11, or may store the data for later transmission. In any case, the time and location data is transmitted at some time to a base station such as 20 or 20'. Base stations 20, 20' may in fact be the same base station. This data is then communicated over a telephone network 30 to a central database 40. The data may then be operated upon to deduce the speed, direction and location of the vehicle at the relevant times. Furthermore, a collection of data sets from numerous vehicles in the same area may be used to build up a picture of traffic density and average speed in the relevant area. In a further development, the calculated speed and density data may be employed to feed back 60 to traffic control devices 70. For example, if traffic is calculated to be particularly dense, automatic signs 70 may be operated to

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impose a reduced maximum speed limit on the relevant road. If traffic is especially slow, automatic signs 70 may be activated advising drivers to take an alternative route.

Present traffic monitoring systems rely upon sparsely located sites provided with expensive equipment. The present invention would allow effective traffic monitoring across a whole road network with no infrastructure investment required. All that would be necessary would be suitable programming of mobile phones containing location-aware circuitry. It would also require the services of the mobile telephone network providers, and the agreement of mobile telephone users. Users may not wish to have their journey tracked and identifiable to themselves, particularly if that data is to be supplied to a regulatory body such as the police. However, the service provider could easily ensure that data would only be collected and retained as part of a statistical ensemble, and would not be traceable to any particular person.

Fig. 3 schematically shows a third embodiment of the present invention. In this embodiment a data source 100 provides data by wirelessly transmitting 110 to any mobile phones 10 in the vicinity. For example, the data source may transmit data on very short range radio transmission. Any mobile phone 10 which happens to be passing by will receive the transmitted data. This data may be stored for later transmission, as discussed above with respect to first and second embodiments, for example when a call is made or received by the mobile phone 10. Alternatively, the mobile phone may immediately transmit the data. In either case, the data is transmitted to base station 20, and then over a telephone network 30 to a central database 40 for access by a user 50. It will be necessary to identify the data source 100 in some way. For example, this may be by including an identifier in the data transmitted by the data source 100 via the mobile phone 10 to the central database 40, or the mobile phone may add location data (if it has location-aware circuitry) to the received data, and the location data can be used to identify the data source.

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As shown in Fig. 3, such an embodiment may be used to obtain readings from remote monitoring stations such as flow meters on rivers or streams. Similarly, this embodiment may be applied to level monitoring in reservoirs, environmental data recorders placed in remote regions or any remote data sources, whose data output does not need to be immediately received.

A similar, fourth, embodiment is shown in Fig. 4. In this embodiment, the data source 100 is related to a meter recording the use of services such as gas, water or electricity. Data source 100, similar to that discussed in relation to Fig. 3, is provided at the metered premises 120. When required, perhaps at regular billing intervals such as one month, or several months, the data source 100 wirelessly transmits data concerning the latest meter reading to any mobile phones 10 which may happen to be in the vicinity. This transmission may be by very short range radio transmissions 110. As discussed with reference to the first to third embodiments, this data may be stored in the mobile phone, or may be immediately transmitted.

The data provided by data source 100 must at least contain a meter reading. It may also contain an identifier, such as a customer number or a house number and postcode, to identify the metered premises 120. Alternatively, the mobile phone 10 may add location data, if it is provided with location-aware circuitry 16. The time of data collection may be less relevant in this embodiment, although at least the date of the meter reading should be included in the transmission to the central database 40. The date may be added either by the data source 100, the mobile phone 10 or even the base station 20 in embodiments where transmission to the base station will necessarily take place on the same day as the data was collected from the source 100.

The data is sent via base station 20 and telephone network 30 to a central database 40 for access by a user 50, in this case a utility provider. An automated invoicing operation 52 may be performed, using the information from source 100 to calculate the amount owed to the utility provider by the occupier of premises 120.

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The invoicing operation may result in a bill being sent 54 to the occupier, for example by post or by electronic mail. Alternatively, the invoicing operation may provoke a direct debit operation 55 with a bank 56, whereby the required sum of money is automatically debited from the occupier's account in favour of the utility provider, while an advice is sent 54 to the occupier.

In respect of the third and fourth embodiments, it may be important to avoid the same data being collected many times. In this case, the mobile telephone service provider may be required to send an instruction to a particular location, for any phones in that area to pick up data from a defined set of equipment. Once the body of data was collected from that area, the instruction could be narrowed down to requesting smaller remnant sets of data.

The central database should preferably be arranged to detect and eliminate multiple occurrences of the same data.

The present invention therefore provides a method of collecting location-dependent data at negligible cost by using mobile phones in standby mode carried by passing users. The invention is particularly applicable to data which does not need to be immediately transmitted to a user, provided that overall coverage is appropriate to the survey required. Indeed, if any particular data needs to be urgently transmitted, the mobile phone may be caused to call the base station immediately and transfer the data. Such calls would, of course, have to be at the expense of the organisation requiring the data, rather than the user of the mobile phone.

While the present invention has been particularly described with reference to a limited number of particular embodiments, numerous modifications and amendments may be made to the embodiments of the present invention without departing the scope thereof. For example, while the invention has been particularity described with reference to mobile phones, it is equally applicable to any suitable mobile communications device, provided that a sufficient number are in use to

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enable the required level of coverage. Similarly, many different applications of location-dependent data can be envisaged, each of which may be collected by the methods and apparatus of the present invention.

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CLAIMS:

1. A method for collecting location-dependent data in a central data collection point, comprising the steps of:

- collecting location dependent data from a data source, in a nearby portable communications device;

- transmitting the collected data to a base station of the portable communications device; and

- communicating the collected data along with a location identifier to the data collection point.

2. A method according to claim 1 wherein the location identifier is added to the data by the base station.

3. A method according to claim 1 wherein the location identifier is included in the data collected from the data source and transmitted to the base station.

4. A method according to claim 1 in which the location identifier is supplied by a location-aware component within the portable communications device.

5. A method according to any preceding claim wherein the portable communications device incorporates an environmental sensor as the data source, which provides information relating to environmental conditions in the immediate locality of the portable communications device.

6. A method according to claim 5 wherein the environmental sensor provides information representing at least one of: temperature, air pressure, humidity, radiation, air contaminant levels, acoustic noise, magnetic fields, electromagnetic and/or radio signal levels, light levels, pollen count, pheromone levels.

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7. A method according to claim 2 wherein the transmitted data comprises an identifier identifying the portable communications device, sent with the location identifier; and the data is used to determine the position and speed of motion of the portable communications device.

8. A method according to claim 7 wherein the portable communications device is carried in a vehicle, and the collected data is used to derive location, speed and direction information relating to that vehicle.

9. A method according to claim 8 wherein data collected from numerous portable communications device carried in respective vehicles is used to derive average speed and direction information relating to traffic in a certain location.

10. A method according to claim 8 or 9 wherein the derived speed and direction data is used to control traffic in the respective location.

11. A method according to any of claims 1-4 or 7-10 wherein an external data source wirelessly transmits data to the portable communications device.

12. A method according to claim 11 wherein the external data source transmits the data by very short range radio transmission.

13. A method according to claim 12 wherein the data transmitted by the very short range radio transmission comprises information relating to meter readings.

14. A method according to any of claims 11-13 in which the transmitted data incorporates an identifier identifying the transmitter, which is used as the location identifier.

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15. A method according to any preceding claim in which the portable communications device is a mobile telephone.

16. A method according to claim 4 or any claim dependent on claim 4 wherein the location aware component is a GPS receiver built in to the portable communications device.

17. A method according to any preceding claim wherein the data is communicated to the data collection point over a telephone network.

18. A method substantially as described herein, with reference to the accompanying drawings.

19. A portable communications device for use in a method according to claim 5 or any claim dependent on claim 5, comprising:

- a power source;

- an environmental sensor for detecting environmental conditions in the locality of the device, and for providing corresponding data to communications circuitry; and

- communications circuitry for transmitting the data to a base station.

20. A device according to claim 19 wherein the environmental sensor provides information representing at least one of: temperature, air pressure, humidity, radiation, air contaminant levels, acoustic noise, magnetic fields, electromagnetic and/or radio signal levels, light levels, pollen count, pheromone levels.

21. A portable communications device for use in a method according to claim 11 or any claim dependent on claim 11, comprising:

- a power source;

- a receiver for receiving data from an external data source, and for providing corresponding data to communications circuitry; and

- communications circuitry for transmitting the data to a base station.

22. A portable communications device substantially as described herein with reference to the accompanying drawings.

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Application No: GB 0119566.8 **Examiner:** W Euros Morris
Claims searched: All **Date of search:** 15 March 2002

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.T): H4L LDPPX, LRAX, LDPB

Int Cl (Ed.7): H04Q7/34, H04M11/00, G08G1/00, 01, G06F17/30,

Other: Online: EPODOC, JAPIO, WPI, INSPEC

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X, E	GB 2360173 A	(HEWLETT-PACKARD) Whole doc. Relevant, esp fig 7 and page 14 line 1 - 13	1-10, 15-17, 19,20
X, E	EP 1081666 A2	(NAVIGATION TECH CORP) Whole doc relevant, col 7 line 12 - 50 relevant to claims 7-10.	1-4,7-10, 15-17
A	EP 0921 509 A2	(NAVIGATION TECH CORP)	1
X, E	WO 02/03350 A1	(KAPLAN) Whole doc relevant	1-4, 7-10, 15-17
X, E	WO 01/16854 A2	(AIR ADVICE.COM) Whole document relevant	1-6, 15-17, 19,20
X	WO 99/24952 A1	(SWISS-COM) Whole document relevant	1-4,7-10, 15-17
A	WO 99/13426 A	(ABB POWER T & D Co.) Whole document relevant	1, 11,12,13, 14, 21.
X, E	WO 00/65996 A1	(BLANTS et al) Whole document relevant	1-6, 15-17, 19,20

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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connected workstation. In this regard, database 270 and server 260 may act solely as a data collection and reporting device with client workstation 250 generating control signals for the system.

It will be appreciated by those skilled in the art that the information transmitted and received by the wireless transceivers of the present invention may be further integrated with other data transmission protocols for transmission across telecommunications and computer networks other than the Internet. In addition, it should be further appreciated that telecommunications and computer networks other than the Internet can function as a transmission path between the networked wireless transceivers, the local gateways, and the central server.

Reference is now made to FIG. 3A, which is a block diagram that illustrates the functional components of a RF transmitter 320, of a type worn or carried by a person, in more detail. Blocks 327 and 329 represent physical buttons, which a user may actuate to cause the RF transmitter 320 to initiate different signal transmissions. In the illustrated embodiment, these include a "transmit" button 327 and a panic or "emergency" button 329. Of course, additional, fewer, or different buttons may be provided on a given transmitter, depending upon the system or implementation desired. Each of these buttons may be electrically wired to a data interface 321 which is configured to receive electrical signals from buttons 327 and 329, and ultimately convey that information to a data formatter 324. In one embodiment, data interface 321 may simply comprise an addressable port that may be read by the data formatter 324.

For example, each of the signal lines extending between the buttons and the data interface 321 may be pulled up by individual pull up resistors (not shown). Depressing

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any of the individual buttons may ground the electrical signal line interconnecting the respective button and the data interface 321. Data formatter 324 may constantly read from the port defined by data interface 321, and all bit positions should remain high at any given time, if no buttons are depressed. If, however, the data formatter 324 reads a zero in one or more of the bit positions, it then recognizes that one or more of the buttons 327 and 329 have been depressed.

Each transmitter unit may be configured to have a unique identification code (*e.g.*, transmitter identification number) 326, that uniquely identifies the transmitter to the functional blocks of control system 200 (see FIG. 2). This transmitter identification number may be electrically programmable, and implemented in the form of, for example, an EPROM. Alternatively, the transmitter identification number may be set/configured through a series of DIP switches. Additional implementations of the transmitter identification number, whereby the number may be set/configured, may be implemented consistent with the broad concepts of the present invention.

Finally, an additional functional block of the transmitter 320 is a RF transmitter 328. This circuit is used to convert information from digital electronic form into a format, frequency, and voltage level suitable for transmission from antenna 323 via an RF transmission medium.

The data formatter 324 operates to format concise data packets 330 that may be transmitted via RF to a nearby transceiver. From a substantive basis, the information conveyed includes a function code, as well as, a transmitter identification number. As previously mentioned, the transmitter identification number is set for a given transmitter 320. When received by server 260 (see FIG. 2), the transmitter identification number

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may be used to access a look up table that identifies, for example, the person assigned to carry that particular transmitter. Additional information about the person may also be provided within the lookup table, such as, a physical description, and/or any other information that may be deemed appropriate or useful under the circumstances or implementation of the particular system.

In addition, a function code is communicated from RF transmitter 320 to the nearby transceiver. FIG. 3A illustrates a lookup table 325 that may be provided in connection with data formatter 324. Lookup table 325 may be provided to assign a given and unique function code for each button pressed. For example, transmit button 327 may be assigned a first code to identify the party depressing the button. The emergency button 329 may be assigned a second code. Furthermore, additional codes may be provided as necessary to accommodate additional functions or features of a given transmitter 320. Thus, in operation, a user may depress the emergency button 329, which is detected by the data formatter 324. The data formatter 324 may then use the information pertaining to the emergency button 329 to access a look up table 325 to retrieve a code that is uniquely assigned to emergency button 329. The data formatter 324 may also retrieve the pre-configured transmitter identification number 326 in configuring a data packet 330 for communication via RF signals to a nearby transceiver.

Reference is now made briefly to FIG. 3B, which is a block diagram illustrating certain functional blocks of a similar transmitter 340 that may be integrated with sensor 310. For example, sensor 310 in its simplest form could be a two-state device such as a smoke alarm. Alternatively, the sensor 310 may output a continuous range of values to the data interface 321. If the signal output from the sensor 310 is an analog signal, the

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data interface 321 may include an analog-to-digital converter (not shown) to convert signals output to the actuator 340. Alternatively, a digital interface (communicating digital signals) may exist between the data interface 321 and each sensor 310.

As illustrated, many of the components of RF transmitter 340 are similar to that of RF transmitter 320 and need not be repeated herein. The principal difference between the configurations of RF transmitter 320 of FIG. 3A and the RF transmitter 340 of FIG. 3B lies at the input of the data interface 321. Specifically, RF transmitter 320 included user interface buttons 327 and 329. RF transmitter 340, illustrates electrical integration with sensor 310. Unique transmitter identification code 326 coupled with a function code for a smoke alarm on condition is formatted by data controller 324 for transformation into a RF signal by RF transmitter 328 and transmission via antenna 323. In this way, data packet 330 communicated from transmitter 340 will readily distinguish from similar signals generated by other RF transmitters in the system. Of course, additional and/or alternative configurations may also be provided by a similarly configured RF transmitter. For example, a similar configuration may be provided for a transmitter that is integrated into, for example, a carbon monoxide detector, a door position sensor and the like. Alternatively, system parameters that vary across a range of values may be transmitted by RF transmitter 340 as long as data interface 321 and data controller 324 are configured to apply a specific code, consistent with the input from sensor 310. As long as the code was understood by server 260 or workstation 250 (see FIG. 2) the target parameter could be monitored with the present invention.

Reference is now made to FIG. 3C, which is a block diagram similar to that illustrated in FIGs. 3A and 3B, but illustrating a transceiver 360 that is integrated with a

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sensor 310 and an actuator 380. In this illustration, data interface 321 is shown with a single input from sensor 310. It is easy to envision a system that may include multiple sensor inputs. By way of example, a common home heating and cooling system might be integrated with the present invention. The home heating system may include multiple data interface inputs from multiple sensors. A home thermostat control connected with the home heating system could be integrated with a sensor that reports the position of a manually adjusted temperature control (i.e., temperature set value), as well as, a sensor integrated with a thermister to report an ambient temperature. The condition of related parameters can be input to data interface 321 as well, including the condition of the system on / off switch, and the climate control mode selected (i.e., heat, fan, or AC). In addition, depending upon the specific implementation, other system parameters may be provided to data interface 321 as well.

The addition of actuator 380 to the assembly permits data interface 321 to apply control signals to the manual temperature control for the temperature set point, the climate control mode switch, and the system on / off switch. In this way, a remote workstation 250 or laptop 240 with WAN access (see FIG. 2) could control a home heating system from a remote location.

Again, each of these various input sources are routed to data interface 321 which provides the information to a data controller 324. The data controller may utilize a look up table to access unique function codes that are communicated in data packet 330, along with a transceiver identification code 326 via RF, to a local gateway and further onto a WAN. In general, the operation of transceiver 360 will be similar to that described for a transmitter as previously illustrated in FIGs. 3A and 3B. It is significant to note that data

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packet 330 will include a concatenation of the individual function codes selected for each of the aforementioned input parameters. As by way of example, server 260 may provide client workstation 250 with a Web page display that models a common home thermostat. As previously described, either server 260 or workstation 250 may include application software that would permit a user with access to remotely adjust the controls on a home heating system by adjusting related functional controls on a graphical user interface updated with feedback from the aforementioned control system.

Reference is now made to FIG. 3D, which is a block diagram further illustrating the transceiver of FIG. 3C in light of the home heating system described above. Specifically, transceiver 360 is shown with four specific parameters related to four specific function codes as illustrated in look up table 325. In this regard, sensor(s) 310 (one sensor shown for simplicity) inputs a data signal to data interface 321. Data controller receives an input from data interface 321 that it associates with a specific function code as shown in look up table 325. Data controller 324 assembles data packet 332 by concatenating received data packet 330 with its own transceiver identification code 326 and its own specific function codes. Data packet 332 is configured by RF transceiver 350 for transmission via antenna 323 to either a stand-alone transceiver as shown in FIG. 2, or alternatively, to local gateway 210. It will be appreciated by persons skilled in the art that data interface 321 may be uniquely configured to interface with specialized sensor(s) 310. This circuit, therefore, may differ from transceiver to transceiver, depending upon the remote system parameter that is monitored and the related actuator to be controlled. Implementation of data interface 321 will be understood by persons skilled in the art, and need not be described herein.

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Reference is now made to FIG. 3E, which is a block diagram further illustrating the transceiver of FIG. 3C in combination with a GPS receiver. Specifically, GPS receiver 327 replaces data interface 321, sensor 310, and actuator 380 as illustrated in FIG. 3C. In this regard, GPS receiver 327 inputs a data signal containing latitude and longitude coordinates to data controller 324. Data controller 324 assembles data packet 332 by concatenating received data packet 330 with its own transceiver identification code 326 and the coordinates received from GPS receiver 327. Data packet 332 is configured by RF transceiver 350 for transmission via antenna 323 to either a stand-alone transceiver as shown in FIG. 2, or alternatively, to local gateway 210 as previously described.

Having illustrated and described the operation of the various combinations of RF transmitters and transceivers consistent with the present invention, reference is now made to FIG. 4, which is a block diagram illustrating certain principal components and the operation of a local gateway 210 of a control system 100 (see FIG. 2) constructed in accordance with the present invention. The primary physical components that may be provided within local gateway 210 are a transceiver 420, a CPU 422, a memory 424, a network card 426, a DSL modem 428, an ISDN card 430, as well as other components not illustrated in the FIG. 4 that would enable a TCP/IP connection to WAN 230. The transceiver 420 is configured to receive incoming signals consistently formatted in the convention previously described. Local gateway 210 may be configured such that memory 424 includes look up table 425 to assist in identifying the remote and intermediate transceivers used in generating and transmitting the received data transmission. Program code within the memory 424 may also be provided and

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configured for controlling the operation of a CPU 422 to carry out the various functions that are orchestrated and/or controlled by local gateway 210. For example, memory 424 may include program code for controlling the operation of the CPU 422 to evaluate an incoming data packet to determine what action needs to be taken. In this regard, look up tables 425 may also be stored within memory 424 to assist in this process. Furthermore, memory 424 may be configured with program code configured to identify a remote transceiver 427 or identify an intermediate transceiver 429. Function codes, transmitter and or transceiver identification numbers, may all be stored with associated information within look up tables 425.

Thus, one look up table may be provided to associate transceiver identification numbers with a particular user. Another look up table may be used to associate function codes with the interpretation thereof. For example, a unique code may be associated by a look up table to identify functions such as test, temperature, smoke alarm active, security system breach, *etc*. In connection with the lookup tables 425, memory 424 may also include a plurality of code segments that are executed by CPU 422, and which largely control the operation of the computer. For example, a first data packet segment 330 may be provided to access a first lookup table to determine the identity of the transceiver which transmitted the received message. A second code segment may be provided to access a second lookup table to determine the proximate location of the message generating transceiver, by identifying the transceiver that relayed the message. A third code segment may be provided to identify the content of the message transmitted. Namely, is it a fire alarm, a security alarm, an emergency request by a person, a temperature control setting, *etc*. Consistent with the invention, additional, fewer, or

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different code segments may be provided to carryout different functional operations and data signal transfers throughout the transceiver network.

The local gateway 210 may also include one or more mechanisms through which to communicate with remote systems. For example, the gateway may include a network card 426, which would allow the gateway 210 to communicate across a local area network to a network server, which in turn may contain a backup gateway to WAN 230. Alternatively, local gateway 210 may contain a DSL modem 428, which may be configured to provide a direct dial link to a remote system, by way of the PSTN. Alternatively, local gateway 210 may include an ISDN card 430 configured to communicate via an ISDN connection with a remote system. Other communication gateways may be provided as well to serve as primary and or backup links to WAN 230 or to local area networks that might serve to permit local monitoring of gateway health and data packet control.

Reference is now made to FIG. 5, which is a diagram illustrating WAN connectivity in a system constructed in accordance with the invention. In this regard, local gateway 210 is configured to transmit control signals and receive data signals using the open data packet protocol as previously described. Local gateway 210 is preferably interconnected permanently on WAN 230 and configured to translate received data signals for WAN transfer via TCP/IP. A server 530 configured with web applications and client specific applications as required is connected to WAN 230 via router 510 and further protected and buffered by firewall 520. Consistent with the present invention, server 530 is assisted in its task of storing and making available client specific data by database server 540. A workstation 560 configured with a Web browser is connected to

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WAN 230 at client premises by any suitable means known by those of skill in the art. Alternatively, clients may access WAN 230 via remote laptop 550 or other devices configured with a compatible Web browser. In this way, server 530 may provide client specific data upon demand.

Having described the control system of FIG. 2, reference is now made to FIG. 6 which illustrates a specific monitoring embodiment consistent with application of the invention. More specifically, FIG. 6 illustrates a remote utility meter monitoring system 600. Remote utility meter subsystem 610 consists of utility meter 613 and an appropriately integrated sensor 612 wherein the current utility meter operational status and current utility meter usage total is transmitted via functional codes along with a transceiver identification code in a manner previously described by transmitter 614 to stand-alone transceiver 221. Stand-alone transceiver 221 further processes and transmits the encoded data to local gateway 210 which translates the data packet information into TCP/IP format for transfer across WAN 230 to server 260. Server 260 collects and formats the utility meter information for viewing and or retrieval upon client demand in a manner previously described.

Having described a specific client application consistent with the present invention wherein the remote transmitter is permanently integrated with a stationary data input point (a utility meter), reference is now made to FIG. 7 which more fully illustrates the flexibility of the invention. More specifically, FIG. 7 illustrates a remote automotive diagnostics monitoring system 700. Remote automotive diagnostics interface unit 710 consists of sensor 712 integrated with the vehicle diagnostics data bus 711, and transmitter 714 wherein contents of the vehicle diagnostics can be downloaded upon a

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control signal to sensor 712 from a remote location serviced by local gateway 210. In this manner, a vehicle in need of service but still capable of accessing the vehicle diagnostics codes can be remotely diagnosed by uploading the information through remote automotive diagnostics monitoring system 700 and accessing a custom report created by server 260 in a manner previously described. In this regard, server 260 could be configured to perform any of a number of levels of diagnostics and provide service manual instructions, figures, and local authorized service contact information via WAN 230 on a fee basis or per a predetermined level of service plan.

Having described a monitoring system consistent with the present invention wherein the control signal initiates the monitoring process, reference is now made to FIG. 8. FIG. 8 illustrates a client specific control system consistent with both monitoring and control functions of the invention. More specifically, FIG. 8 illustrates a remote irrigation control system 800. For simplicity, controlled area 810 is represented by a single rain gauge 813 and a single related spray head 817. It is easy to see that such a system could be modified and expanded to monitor and control any of a number of irrigation systems integrated with the present invention.

Controlled area 810 is configured with a rain gauge 813 integrated with sensor 811 wherein rainfall and applied water to the adjacent area is transmitted via functional codes by transmitter 812 along with a related transceiver identification code in a manner previously described to stand-alone transceiver 221. Stand-alone transceiver 221 further processes and transmits the encoded data to local gateway 210 which translates the data packet information into TCP/IP format for transfer across WAN 230 to server 260. Server 260 collects and formats the rain gauge data for viewing or retrieval upon client

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demand in a manner previously described. Additionally, server 260 may be configured to communicate data to operate spray head 817 by opening water supply valve 816 integrated with actuator 814 by sending a control signal to transceiver 815, per a client directed water application control schedule. Alternatively, a customer workstation 250 could periodically download and review the rain gauge data and could initiate an automatic control signal appropriate with the customer's watering requirements. In yet another embodiment, a customer technician could initiate a control signal upon review of the rain gauge information and making the determination that more water is required.

Reference is now made to FIG. 9 which illustrates the operation of an automated parking control system 900 consistent with the present invention. Automated parking facility 910 consists of a controlled access area with ingress gate 920 and egress gate 930. Both gates 920 and 930 are further configured with a position sensor, an actuator, and transceiver illustrated as ingress assembly 922 and egress assembly 932, respectively. Parking spaces 940 may be configured with vehicle sensors. Sensor - transceiver assembly 932 may be configured to transmit a function code associated with the condition of parking spaces 1, 2, 3, and 4. It will be appreciated by those skilled in the art that the single row of four appropriately configured parking spaces illustrated can be expanded by adding parking spaces configured with vehicle sensors integrated with control system 900 via multiple sensor - transceiver assemblies. Automated parking control system 900 collects data signals from each sensor - transceiver assembly 932, integrated in the system, and compiles a master schedule consisting of scheduled use for each parking space in the automated parking facility. In this manner, a customer with access to WAN 230 and server 530 may make a reservation and or check the availability

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of parking spaces at the automated parking facility from her home or office (or through any Internet portal). For example, a customer that will be out of town on business for 2 days next week, may access the automated parking control system server 530 by using a Web browser to view parking availability for the target travel dates. The customer may reserve the parking slot by providing a personal transmitter identification code (or other identification code) that the customer intends to use to access and exit the facility the following week. When the customer arrives at the ingress gate 920, the customer may enter the automated parking facility 910 by depressing a button on her personal portable transmitter (see FIG. 3A). Ingress assembly 922 receives and forwards the customer's transmitted identification code to server 530 via gateway 210 and WAN 230 in a manner previously described. Server 530 confirms the customer's reservation, alternatively checks space availability to determine if access should be granted. In addition, server 530 may be further programmed to determine if the particular customer has an established account with the facility owner or whether a credit card payment transaction is in order. Automatic parking facility control system 900 would record the actual use of the reserved parking space for storage on database server 540. Server 530 could retrieve the stored usage information on a periodic basis from database server 540 and generate appropriate bills for each customer.

Alternatively, the customer could reserve the slot by providing billing information via WAN 230 and ingress gate 920 could be further configured with a credit card reader and an alphanumeric keypad interface. Both the credit card reader and the alphanumeric keypad interface could be interconnected to the automated parking facility control system 900 by their own appropriately configured transceiver. Either or both the credit card

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reader and the alphanumeric keypad interface could be used to identify customers with reservations.

The operator of parking facility control system 900, can expand both the level of security of the parking facility and the services provided by adding networked peripherals in a manner previously described and upgrading the software applications on server 530. For example, by adding automated ingress and egress gates configured to allow the entry and exit of parking facility customers and authorized personnel and configuring the egress gate 930 for vehicles such that only identified customers may exit with a vehicle, both customers and their vehicles are protected from thieves.

A further example of expanding the services offered by automated parking facility control system 900 might consist of offering a schedule of vehicle services that could be scheduled and performed on the vehicles of long-term parking customers. By adding the appropriate interface to server 530, parking facility customers could be prompted when making their reservation with a list of potential vehicle services that could be scheduled and performed by vehicle service technicians during the duration of the customer's business trip. A customer interested in having her automobile's oil changed and tires rotated would authorize and schedule the desired services when arranging her parking reservation. Upon leaving the parking facility at the start of her business trip, the customer could leave her vehicle valet key in an appropriately identified lock box. After her trip is complete, the customer returns to the lot. She gains access to the lot by any of the aforementioned methods and retrieves her valet key by similarly identifying herself as the vehicle owner.

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Having illustrated specific applications using the present invention in FIGs. 6 through 9, reference is now made to FIG. 10 which illustrates a system 1000 that monitors and controls remote data points associated with a plurality of systems. In this embodiment, server 530 may be configured with monitor / control remote services 1010 application-specific software. For example, the controlled area 810 of the irrigation control system shown in FIG. 8, the remote utility meter subsystem 610 of FIG. 6, and the automated parking facility 910 of FIG. 9 may be monitored and remotely controlled (where required) by server 530. In a manner previously described herein, server 530 collects and processes data information transferred and sent over WAN 230 by local gateways coupled via RF links to transceivers and transmitters associated with systems 1020, 1030, and 1040. Alternatively, server 530 initiates control signals that may be sent via the gateways to the appropriate transceivers and transmitters as required. For ease of illustration and description, FIG. 10 shows each of the systems serviced by server 530 requiring its own dedicated local gateway. It will be appreciated by those skilled in the art that small-scale systems jointly located within a geographic area served by an array of transceivers and a gateway may be configured to share the transceiver and gateway infrastructure of a previously installed local system.

Having described the physical layer of a system consistent with the present invention, reference is now made to FIG. 11 which describes the data structure of messages sent and received using the invention. In this regard, the standard message consists of : to address; from address; packet number; maximum packet number, packet length; command; data; packet check sum (high byte); and packet check sum (low byte). The "to address" or message destination consists from 1 to 6 bytes. The "from address"

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or message source device is coded in a full 6 byte designator. Bytes 11 through 13 are used by the system to concatenate messages of packet lengths greater than 256 bytes. Bytes 14 is a command byte. Byte 14 works in conjunction with bytes 15 through 30 to communicate information as required by system specific commands. Bytes 31 and 32 are packet check sum bytes. The packet check sum bytes are used by the system to indicate when system messages are received with errors. It is significant to note that bytes 31 and 32 may be shifted in the message to replace bytes 15 and 16 for commands that require only one byte. The order of appearance of specific information within the message protocol of FIG. 11 remains fixed although the byte position number in individual message transmissions may vary due to scalability of the "to address," the command byte, and scalability of the data frame.

Having described the general message structure of a message of the present invention, reference is directed to FIG. 12 which illustrates three sample messages. The first message illustrates the broadcast of an emergency message "FF" from a central server with an address "0012345678" to a personal transceiver with an address of "FF."

The second message illustrated reveals how the first message might be sent to a transceiver that functions as a repeater. In this manner, emergency message "FF" from a central server with address "0012345678" is first sent to transceiver "F0." The second message, further contains additional command data "A000123456" that may be used by the system to identify further transceivers to send the signal through on the way to the destination device.

The third message illustrated on FIG. 12 reveals how the message protocol of the present invention may be used to "ping" a remote transceiver in order to determine

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transceiver health. In this manner, source unit "E112345678" originates a ping request by sending command "08" to a transceiver identified as "A012345678." The response to the ping request can be as simple as reversing the "to address" and the "from address" of the command, such that, a healthy transceiver will send a ping message back to the originating device. The system of the present invention may be configured to expect a return ping within a specific time period. Operators of the present invention could use the delay between the ping request and the ping response to model system loads and to determine if specific system parameters might be adequately monitored and controlled with the expected feedback transmission delay of the system.

Having described the message structure of a message of the present invention, reference is directed to FIG. 13 which illustrates the integration of the system of the present invention with the control system of FIG. 1. Having previously illustrated several variations consistent with the principles of the present invention, it will be appreciated by those skilled in the art that multiple variations of the present invention may be integrated with existing control systems. In this regard, an existing control system with local controller 110 and a plurality of sensor actuators 115 (one shown for simplicity of illustration) are in communication with central controller 130 via PSTN 120 as previously described. In a manner well known in the art of control systems, local controller 110 transmits appropriate status information via PSTN 120 to central controller 130.

Control systems consistent with the design of FIG. 1, as further illustrated in FIG. 13, require the routing of electrical conductors to each sensor and actuator as the application requires. It will be appreciated by those skilled in the art that the system of the present invention can take advantage of the infrastructure of an existing system by

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inserting data translator 140 such that system data is sent to both the central controller 130 in the old configuration, as well as, the data translator 140. Data translator 140 serves to convert system data to function codes as previously described. Once data translator 140 successfully converts the system data stream to the message protocol of the present invention, transceiver 815 further converts the system data stream to a RF signal.

As previously described in connection with FIG. 2, stand-alone transceiver 221 receives and repeats the RF data transmission received from transceiver 815. Local gateway 210 receives the RF data transmission repeated by stand-alone transceiver 221 and converts the RF data transmission into TCP/IP for further transmission across WAN 230 to server 260. In this regard, server 260 may further manage the data for internal storage or alternatively storage in database 270. Customers with WAN 230 access may access the system data from workstation 250 or laptop computer 240.

Having described integration of the system of the present invention with the control system of FIG. 1 in FIG. 13, reference is now directed to FIG. 14 which illustrates integration of the system of the present invention with mobile inventory units. In this regard, system 1060 consists of the system of the present invention as previously illustrated and described in FIGs. 1 and 13. Having previously illustrated several variations consistent with the principles of the present invention, it will be appreciated by those skilled in the art that multiple variations of the present invention may be integrated with mobile inventory units 1070. In this regard, sensor / actuator 115 integrated with transceiver 815 in sensor-transceiver assembly 1065 is further integrated with any of a number of mobile inventory units 1070 (one sensor-transceiver unit 1065 shown for simplicity of illustration). It will be appreciated by those skilled in the art that as long as

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a mobile inventory unit 1070, herein represented by a package, ship, airplane, train, and a taxi are within the radio-frequency transmission and receiving range of stand-alone transceiver 221, the system of the present invention may be used to monitor, store and report information of and relating to mobile inventory unit 1070.

It will be further appreciated by those skilled in the art that the system of the present invention may be used to transfer information to adequately equipped mobile inventory units 1070. In this regard, shipping companies may use the present invention to update a database containing location and status information for each mobile inventory unit 1070 in the company fleet. Shipping companies may also transfer informative messages or other information using the system of the present invention.

In one embodiment, the present invention may be used to store, retrieve, and update maintenance information related to individual mobile inventory units. For example, federally registered airplanes must keep a maintenance log with the craft detailing all inspections, maintenance, and repairs. The system of the present invention could be used by fixed base operators (FBOs) who perform inspections and maintenance on aircraft to retrieve and update the aircraft maintenance log. In this way, FBOs located throughout the world will be able to retrieve and update an electronic version of the maintenance history of an aircraft. In addition, a properly configured system could also contain maintenance directives and other service bulletins related to the particular aircraft.

In yet another embodiment, a properly integrated sensor / actuator 115 with transceiver 815 may be used to monitor mobile inventory unit system parameters. For example, an airplane could be configured to monitor and report engine run time, time

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elapsed since the last recorded inspection of a particular type, and related system information. It will be appreciated by those skilled in the art that the system of the present invention may be integrated with remote units other than those shown. The ship, package, airplane, train, and taxi shown in FIG. 14 are for example only and not meant to limit the scope of the present invention.

It will be appreciated that the foregoing description has illustrated certain fundamental concepts of the invention, but that other additions and/or modifications may be made consistent with the inventive concepts. For example, the one-way transmitters illustrated in FIG. 3A and implemented in a control system as illustrated in FIG. 6 may be adapted to monitor the current status of water, gas, and other utility meters. One-way transmitters might further be used to monitor and report actual operational hours on rental equipment or any other apparatus that must be serviced or monitored on an actual run-time schedule.

The two-way transceivers of the current invention, may be adapted to monitor and apply control signals in an unlimited number of applications. By way of example only, two-way transceivers of the current invention can be adapted for use with pay type publicly located telephones, cable television set converter boxes, as well as, for use with a host of residential appliances and devices to enable a remote controllable home automation and security system.

In a geographic area appropriately networked with permanently located transceivers consistent with the invention, personal transmitters consistent with the invention can be used to monitor and control personnel access and egress from specific rooms or portions thereof within a controlled facility. Personal transmitters can further be

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configured to transfer personal information to public emergency response personnel, personal billing information to vending machines, or to monitor individuals within an assisted living community.

Two-way transceivers consistent with the present invention can be integrated to monitor and control a host of industrial and business applications as well. By way of example only, building automation systems, fire control systems, alarm systems, industrial trash compactors, and building elevators can be monitored and controlled with devices consistent with the present invention. In addition, courier drop boxes, time clock systems, automated teller machines, self-service copy machines, and other self-service devices can be monitored and controlled as appropriate. By way of further example, a number of environment variables that require monitoring can be integrated with the system of the present invention to permit remote monitoring and control. For instance, light levels in the area adjacent to automated teller machines must meet minimum federal standards, the water volume transferred by water treatment plant pumps, smokestack emissions from a coal burning power plant or a coke fueled steel plant oven may also be remotely monitored.

The two-way transceivers of the present invention may be further integrated with a voice-band transmitter and receiver. As a result, when a person presses, for example, the emergency button on his/her transmitter, medical personnel, staff members, or others may respond by communicating via two-way radio with the party in distress. In this regard, each transmitter may be equipped with a microphone and a speaker that would allow the person to communication information such as their present emergency situation, their specific location, *etc.*

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The foregoing description has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Obvious modifications or variations are possible in light of the above teachings. For example, it should be appreciated that, in some implementations, the transceiver identification number is not necessary to identify the location of the transmitter. Indeed, in implementations where the transmitter is permanently integrated into an alarm sensor other stationary device within a system, then the control system server and or local gateway could be configured to identify the transmitter location by the transmitter identification number alone. In will be appreciated that, in embodiments that do not utilize repeating transceivers, the transmitters will be configured to transmit at a higher RF power level, in order to effectively communicate with the control system local gateway.

The embodiment or embodiments discussed were chosen and described illustrate the principles of the invention and its practical application to enable one of ordinary skill in the art to utilize the invention in various embodiments and with various modifications as are suited to the particular use contemplated. All such modifications and variations are within the scope of the invention as determined by the appended claims when interpreted in accordance with the breadth to which they are fairly and legally entitled.

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Electronic Acknowledgement Receipt

EFS ID:	9420389
Application Number:	12350817
International Application Number:	
Confirmation Number:	7586
Title of Invention:	MAPPING IN A MULTI-DIMENSIONAL SPACE
First Named Inventor/Applicant Name:	James Ashley
Customer Number:	33717
Filer:	Charles Berman/Michele Pena
Filer Authorized By:	Charles Berman
Attorney Docket Number:	081221-011500
Receipt Date:	10-FEB-2011
Filing Date:	08-JAN-2009
Time Stamp:	16:24:26
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		WW115.pdf	704915 7002706237f51e3b1ecfc6314c92f62c5dd84349	yes	10

	Multipart Description/PDF files in .zip description			
	Document Description	**Start**	**End**	
	Transmittal Letter	1	3	
	Information Disclosure Statement (IDS) Filed (SB/08)	4	10	
Warnings:				
Information:				
2	Foreign Reference	FR1.pdf	355174 68b1b3986567836c38bfecd52baaadf6344d9f48	no	8
Warnings:				
Information:				
3	Foreign Reference	FR2.pdf	773261 5378c710182d39d595052cc302beac427e21fc92	no	17
Warnings:				
Information:				
4	Foreign Reference	FR3.pdf	721202 157003b1dea402d72b204b28119b50560e19d937	no	16
Warnings:				
Information:				
5	Foreign Reference	FR3a.pdf	1057693 5d36d609786b479c09dc6001500ede2aca52aea0	no	22
Warnings:				
Information:				
6	Foreign Reference	FR3b.pdf	1000999 003cde8995628c73e8fc7fc510464e14e90a7e7a	no	35
Warnings:				
Information:				
7	Foreign Reference	FR4.pdf	241342 bde1c84537e24c77ddec1ede313b3755e7a9f229	no	6
Warnings:				
Information:				
8	Foreign Reference	FR5a.pdf	788149 8704cab34d8f271e8d2595bad230eedeea5953f7	no	20
Warnings:				
Information:				

9	Foreign Reference	FR5b.pdf	2144219 20970cab1b8c0f2aa274e217e590dc2ca094e526	no	21
Warnings:					
Information:					
10	Foreign Reference	FR5c.pdf	578465 f913cef91b16df37104509bb75a13088adf58eac	no	17
Warnings:					
Information:					
11	Foreign Reference	FR6.pdf	2794559 f662a95f52a02704e50fa8fbeac599883cbff4df	no	49
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12	Foreign Reference	FR7.pdf	956850 ab240d49c6a1cc437800ec5ba6ca68fa7c753ad5	no	27
Warnings:					
Information:					
13	Foreign Reference	FR8.pdf	1145486 660c317498caaed15e4388c582573331fb5fb0c0	no	16
Warnings:					
Information:					
14	Foreign Reference	FR9.pdf	673833 dca265b37ce4d168080ef40c24b563690ffb549a	no	8
Warnings:					
Information:					
15	Foreign Reference	FR10.pdf	1169031 236194122444d6a4edf1641601eabe06b3506698	no	27
Warnings:					
Information:					
16	Foreign Reference	FR11.pdf	4075123 faeb21bda9b8338d4d7ddae544becd234a92a29e	no	41
Warnings:					
Information:					
17	Foreign Reference	FR11a.pdf	3891718 b554e68372e3c7affb017f4828a33910bef298f2	no	46
Warnings:					
Information:					

18	Foreign Reference	FR11b.pdf	868044 e8650b45e41220f252ab611054344c44992280ee	no	46
Warnings:					
Information:					
19	Foreign Reference	FR11c.pdf	997228 e226cddb42f6b06daee6a676428459795e37eb15	no	36
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20	Foreign Reference	FR12.pdf	1562597 a9127b5b2ea41b465449fc9e0552606c803b334c	no	32
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21	Foreign Reference	FR5.pdf	1091011 25e7af5b34f0ef62ddb8c1672008e392bd8f8c4e	no	31
Warnings:					
Information:					
22	Foreign Reference	FR13.pdf	2101699 1fefcf591c7be9162f3b01f8eb5227a8e3345342	no	37
Warnings:					
Information:					
23	Foreign Reference	FR14.pdf	1703321 6c4907896198f089b39b4a658ff46921b349b2bb	no	36
Warnings:					
Information:					
24	Foreign Reference	FR14a.pdf	1155683 6172231268a462443afaec01f638e7c689eb0f4d	no	31
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25	Foreign Reference	FR14b.pdf	769813 d73c75846e6b8e132f2764caf8cb1e5462791260	no	26
Warnings:					
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26	Foreign Reference	FR15.pdf	956515 6d757575e293cbde7fe1bd92a103b19550b646bd	no	21
Warnings:					
Information:					

27	Foreign Reference	FR16.pdf	346460 d4a3fc4dfee72d5ed1b059be95cc463670513cf1	no	7
Warnings:					
Information:					
28	Foreign Reference	FR17.pdf	1122501 95dc957fb8d5a5c3f064f3ec91def62369c65471	no	16
Warnings:					
Information:					
29	Foreign Reference	FR18.pdf	733599 72759bc297816fb35c942e94bb3cfbe0f7202973	no	20
Warnings:					
Information:					
30	Foreign Reference	FR19.pdf	920848 decd023dd19b7bf96262f026f3f891ddf76a6741	no	26
Warnings:					
Information:					
31	NPL Documents	NPL1.pdf	1141688 d7b87901bae0826fafc6bc97bd5d12072a73673b	no	23
Warnings:					
Information:					
32	NPL Documents	NPL2.pdf	1635442 fd4f87facd706702ef6f6dfcdf85d127aca7e8cf	no	25
Warnings:					
Information:					
33	NPL Documents	NPL2a.pdf	1420729 6f8b8f9499092cdf541ce4f787dfc0dc31ed5449	no	24
Warnings:					
Information:					
34	NPL Documents	NPL3.pdf	634855 7970a05171b88abaa8b19584e9f21854b9299acf	no	12
Warnings:					
Information:					
35	NPL Documents	NPL4.pdf	2081402 9b75d6fa2968f3aecbd7bd0c3ec7d050fa11051e	no	41
Warnings:					
Information:					

36	NPL Documents	NPL5.pdf	1683858 358e1c2e996b32abc93048c77d03cdf926114f3b	no	21
Warnings:					
Information:					
			Total Files Size (in bytes):	45999312	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12350817	ASHLEY ET AL.
	Examiner	Art Unit
	JIANYE WU	2462

SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
Inventoship search, EAST keyword search, subclass 37/312 with keyword search.	10/1/2011	JY

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

	/JIANYE WU/ Primary Examiner.Art Unit 2462

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/350,817	01/08/2009	James Ashley JR.	081221-011500	7586

33717 7590 10/11/2011

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EXAMINER	
WU, JIANYE	
ART UNIT	**PAPER NUMBER**
2462	

NOTIFICATION DATE	DELIVERY MODE
10/11/2011	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

laipmail@gtlaw.com
clairt@gtlaw.com
cadanoc@gtlaw.com

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Office Action Summary	Application No.	Applicant(s)	
	12/350,817	ASHLEY ET AL.	
	Examiner	Art Unit	
	JIANYE WU	2462	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

5)☒ Claim(s) *1-23* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1-23* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☒ The drawing(s) filed on *08 January 2009* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

12)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *2/10/11*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Double Patenting

1. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

The subject matter claimed in the instant application is fully disclosed in the referenced copending application and would be covered by any patent granted on that

copending application since the referenced copending application and the instant application are claiming common subject matter, as follows.

Furthermore, there is no apparent reason why applicant would be prevented from presenting claims corresponding to those of the instant application in the other copending application. See *In re Schneller*, 397 F.2d 350, 158 USPQ 210 (CCPA 1968). See also MPEP § 804.

2. **Claims 1-23** provisionally rejected on the ground of nonstatutory double patenting over copending Application No. 12/350,828 (hereinafter R828, which appears also double patenting over copending Application No. 12/350,822). This is a provisional double patenting rejection since the conflicting claims have not yet been patented.

For **claim 1**, R828 discloses a system for developing a map of a multi-dimensional space for use by a user, the user being selectively individuals, vehicles, and other entities (claim 1, lines 1-2), comprising:

using a geographical zone, the zone selectively being a preconfigured geographical zone, the zone including a plurality of spaced apart nodes (claim 1, line 3), wherein the nodes are arranged in a multi-dimensional sense (claim 1, line 7);

sending data communications between one or more of the nodes, one or more users, and one or more control stations (claim 1, lines 4-5); and

affecting multi-dimensional mapping according to the placement of the nodes and the communications between the nodes and the control stations (claim 1, last line).

For **claim 17**, R828 discloses a system for mapping a geographical space (claim 1, lines 1-3), comprising:

communicating data between communication nodes and a selected mobile communication device (claim 1, lines 4-5);

arranging an array of communication nodes about a three-dimensional geographical space (claim 5);

enabling one or more different mobile communication devices to be in communication with different communication nodes when the devices are within range of one or more selected nodes (claim 1, lines 4-5); and

associating the mobile device with the respective nodes such that the mobile device is locatable in the three-dimensional space (claim 1 and claim 5).

For **claim 19**, R828 discloses a system for developing a map of a multi-dimensional space (claim 1, lines 1-3) comprising:

defining a geographical space in multi-dimensions, the space including a plurality of spaced apart nodes (claim 1, line 3), wherein the nodes are arranged about the multi-dimensional space (claim 1, line 7);

sending data communications wirelessly between one or more of the nodes, and by wire or wirelessly to one or more control stations, the wireless communication protocol in part being at least by a Bluetooth.TM. protocol (claims 1 and 6); and

affecting mapping according to the placement of nodes and the communications between the nodes and the control stations (claim 25, lines 5-7).

For **claim 22**, R828 discloses a map of a multi dimensional space (claim 25, lines 4-5) comprising:

a geographical space in multi-dimensions, the space including a plurality of spaced apart nodes and the nodes being arranged about the multi-dimensional space (claim 25, lines 5-7);

the map having being affected by communications wirelessly between one or more of the nodes, and by wire or wirelessly to one or more control stations, the wireless communication protocol in part being at least by a Bluetooth.TM. protocol (claims 25 and 27).

Dependent claims are rejected because they depend on independent claims above.

Priority

Applicant claims priority of US application 12/044840 files on Mar. 7, 2008 and US application 11/848,178 filed on Aug. 30, 2007, which further claims priority of the provisional application 60/625,467 filed Nov. 5, 2004. However, none of these applications disclose the essential claim limitation of “map of multi-dimensional space”. Therefore, the claimed priority is inproper. Examiner considers the priority of the application as the filing date of this application.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. **Claims 1-23** are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Independent **Claims 1, 17, 19** are rejected because the structure of the apparatus(system) are not clearly identified. The body of the claims include only step-like limitations such as “communicating …”, “enabling …” and “sending …”. There are no structure elements in the body of claim language.

Claims 3-4, 7, 19 and **21-22** contains the trademark/trade name “Bluetooth.TM”. Where a trademark or trade name is used in a claim as a limitation to identify or describe a particular material or product, the claim does not comply with the requirements of 35 U.S.C. 112, second paragraph. See *Ex parte Simpson*, 218 USPQ 1020 (Bd. App. 1982). The claim scope is uncertain since the trademark or trade name cannot be used properly to identify any particular material or product. A trademark or trade name is used to identify a source of goods, and not the goods themselves. Thus, a trademark or trade name does not identify or describe the goods associated with the trademark or trade name. In the present case, the trademark/trade name is used to identify/describe the product and, accordingly, the identification/description is indefinite. Furthermore, Bluetooth has many different versions and may have many further versions as technology advances. It is not clear which version of Bluetooth the claim language refers to and it inlcudes features in the future versions that do not exist currently.

Other dependent claims are rejected because they depend on independent claims that have been all rejected.

Claim Rejections - 35 USC § 101

5. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

6. **Claims 22-23** are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.

Regarding **claim 22**, it recites "A map of multi dimensional space comprising: …". A map does not belong to any one of process, machine, manufacture, or composition of matter.

Claim 23 is rejected because they have the same problems explained above.

Correction is required.

Claim Rejections - 35 USC § 102

7. The following is a quotation of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

8. **Claims 1-5, 14, 17-23** are rejected under 35 U.S.C. 35 U.S.C. 102(e) as being anticipated by Bathory et al. (US 20050090978 A1, hereinafter Bathory).

For **claim 1**, Bathory discloses a system for developing a map of a multi-dimensional space ("displaying various geographic and flight maps", [0127]) for use by a user, the user being selectively individuals, vehicles, and other entities (see FIG. 1 for vehicles 2 such as airplane and ships), comprising:

using a geographical zone (the space shown in FIG. 1), the zone selectively being a preconfigured geographical zone, the zone including a plurality of spaced apart nodes (Satellite, radar and camera shown in FIG. 1), wherein the nodes are arranged in a multi-dimensional sense ("the co-ordinate and speed data forecasts and their normal projections on the 3D map", [0154] in view of FIG. 1);

sending data communications between one or more of the nodes, one or more users (see FIG. 1 for communications between plane & ship with satellite), and one or more control stations ("the space-information unit 17b" which stores "the space-information database", [0151]); and

affecting multi-dimensional mapping according to the placement of the nodes and the communications between the nodes and the control stations (suggested by "the co-ordinate and speed data forecasts and their normal projections on the 3D map", [0154] in view of FIG. 1).

For **claim 17**, Bathory discloses a system for mapping a geographical space (see FIG. 1) comprising:

communicating data between communication nodes (Satellite, radar and camera shown in FIG. 1) and a selected mobile communication device (plane 2);

arranging an array of communication nodes about a three-dimensional geographical space ("the co-ordinate and speed data forecasts and their normal projections on the 3D map", [0154] in view of FIG. 1);

enabling one or more different mobile communication devices to be in communication with different communication nodes when the devices are within range

of one or more selected nodes (FIG. 1 shows plane 2 communicates with different nodes such as satellites 6, 7a, 7b and other nodes); and

associating the mobile device with the respective nodes such that the mobile device is locatable in the three-dimensional space (FIG. 1 shows plane is locatable in the three-dimensional space).

For **claims 19** and **22**, Bathory discloses a system for developing a map of a multi-dimensional space ("the co-ordinate and speed data forecasts and their normal projections on the 3D map", [0154] in view of FIG. 1) comprising:

defining a geographical space in multi-dimensions (the space shown in FIG. 1, which is a 3D space), the space including a plurality of spaced apart nodes (Satellite, radar and camera shown in FIG. 1), wherein the nodes are arranged about the multi-dimensional space (FIG. 1 shows plane is locatable in the three-dimensional space);

sending data communications wirelessly between one or more of the nodes, and by wire or wirelessly to one or more control stations ("In case the GSM communication and/or GPS communication of the object centre 2 of the consignment is interrupted, it attempts to take up communication automatically by wire or even radio technology", [0098]), the wireless communication protocol in part being at least by a Bluetooth.TM. protocol ("if necessary by bluetooth technology, with the object centre 2 of the consignment-carrier container or wagon playing a master role.", [0098]); and

affecting mapping according to the placement of nodes and the communications between the nodes and the control stations (suggested by "the co-ordinate and speed data forecasts and their normal projections on the 3D map", [0154] in view of FIG. 1).

As to **claims 2, 18, 20** and **23,** Bathory discloses claims 1, 17 and 22, Bathory further discloses the mapping is affected in a three-dimensional sense, selectively being the three-dimensional sense in the x, y, and z axes or coordinates (suggested by "the co-ordinate and speed data forecasts and their normal projections on the 3D map", [0154] in view of FIG. 1; note 3D is normally shown in the x, y, and z axes, it can also shown in other 3D coordinates).

As to **claim claims 3** and **21,** Bathory discloses claim 1, Bathory further discloses the nodes are enabled selectively to communicate with GPS ("in the traffic control system a GPS-based time adjustment prevails with a number one priority", [0450]) and with Bluetooth.TM. protocols ("if necessary by bluetooth technology, with the object centre 2 of the consignment-carrier container or wagon playing a master role.", [0098]), and wherein the nodes are selectively part of a mesh network or other suitable network configuration (see FIG. 1 for suitable configuration).

As to **claim 4,** Bathory discloses claim 1, Bathory further discloses the nodes are enabled with a Bluetooth.TM. protocol to effect communications between nodes and users of the mapping, the users of the mapping have mobile devices being at least Bluetooth.TM. protocol enabled ("if necessary by bluetooth technology, with the object centre 2 of the consignment-carrier container or wagon playing a master role.", [0098]).

As to **claim 5,** Bathory discloses claim 1, Bathory further discloses the nodes are selectively part of a mesh network or other suitable network configuration (see FIG. 1 for suitable configuration).

As to **claim 14,** Bathory discloses claim 1, Bathory further discloses a multi-dimensional shape of a geographical area is the shape of a non-regular geometrical shape (see FIG. 1, where the space is a non-regular geometrical shape).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. **Claims 6-10, 12-13-16 and 15** are rejected under 35 U.S.C. 103(a) as being unpatentable over Bathory et al. (US 20050090978 A1, hereinafter Bathory) in view of Yoshihashi et al. (US 20040225436 A1).

As to **claim 6,** Bathory discloses claim 1, but is silent on the nodes selectively communicate with users having a selected subscriber device, the device being selectively a cell phone, PDA, or computer device.

Yoshihashi discloses the users having a selected subscriber device, the device being selectively a cell phone, PDA, or computer device ("The terminal unit 400 may be, for example, a mobile phone, a PHS (Personal Handyphone System), a PDA (Personal Digital Assistant), a portable personal computer, an in-vehicle navigation device installed on a vehicle as a movable body, and a portable navigation device", [0044]).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to apply the teaching of Yoshihashi to the system disclosed by

Bathory to include a cell phone, PDA, or computer device as a user for the benefit of extending the range of the system services.

As to **claim 7,** Bathory in view of Yoshihashi discloses claim 6, Bathory further discloses the communication is through a Bluetooth.TM. protocol ("if necessary by bluetooth technology, with the object centre 2 of the consignment-carrier container or wagon playing a master role.", [0098]), and wherein the nodes are selectively part of a mesh network or other suitable network configuration (see FIG. 1 for suitable configuration).

As to **claim 8,** Bathory discloses claim 1, but does not explicitly disclose the ability to effect fine resolution determination of a location as part of a multi-dimensional map of a location containing the nodes.

Yoshihashi discloses the ability to effect fine resolution determination of a location as part of a multi-dimensional map of a location containing the nodes ("the display area VS generally displays the map with 100 to 140 pixels in the short horizontal dimension when the map is displayed on the terminal display 440", [0078]; note the number of fixels effects fine resolution determination of a location).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to apply the teaching of Yoshihashi to the system disclosed by Bathory for the benefit of having better display ([0078] of Yoshihashi).

As to **claim 9,** Bathory discloses claim 1, including defining a geographical zone, the zone being multi-dimensional (as disclosed by the parent claim), but is silent on the

nodes selectively communicate with users having a selected subscriber device, the device being selectively a cell phone, PDA, or computer device.

Yoshihashi discloses nodes selectively communicate with users having a selected subscriber device, the device being selectively a cell phone, PDA, or computer device ("The terminal unit 400 may be, for example, a mobile phone, a PHS (Personal Handyphone System), a PDA (Personal Digital Assistant), a portable personal computer, an in-vehicle navigation device installed on a vehicle as a movable body, and a portable navigation device", [0044]).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to apply the teaching of Yoshihashi to the system disclosed by Bathory to include a cell phone, PDA, or computer device as a user for the benefit of extending the range of the system services.

As to **claim 10,** Bathory discloses claim 1, but is silent on loading from a computing device to memory in a transponder or subscriber device a plurality of coordinates; mapping the coordinates on a pixilated image wherein the pixilated image is configurable; and forming a contiguous array of pixels that enclose a shape in the pixilated image to form the geographic space.

Yoshihashi discloses loading from a computing device to memory in a transponder or subscriber device a plurality of coordinates (mapping the coordinates on a pixilated image wherein the pixilated image is configurable; and forming a contiguous array of pixels that enclose a shape in the pixilated image to form the geographic space ("the display area VS generally displays the map with 100 to 140 pixels in the short

horizontal dimension when the map is displayed on the terminal display 440", [0078]; note the number of pixels effects fine resolution determination of a location).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to apply the teaching of Yoshihashi to the system disclosed by Bathory the benefit of having better display ([0078] of Yoshihashi).

As to **claim 12,** Bathory in view of Yoshihashi discloses claim 10, wherein the plurality of coordinates are entered by a user of a computer device, and transmitted to the transponder or subscriber device (see FIG. 1 of Yoshihashi).

As to **claim 13,** Bathory in view of Yoshihashi discloses claim 10, wherein a user enters the plurality of coordinates by the user selecting points in a map in a computer by clicking on the map; and calculating geographical coordinates of each selected point in the map (see FIGs 1 and 4 of Yoshihashi).

As to **claim 15,** Bathory discloses claim 1, but is silent on loading from a computing device to memory in a transponder or subscriber device a plurality of coordinates, wherein the plurality of coordinates identify a multi-dimensional area; dividing the multi-dimensional area into a grid, allowing at least one user to select at least one section from within the grid in order to define a multi-dimensional geographical region; and associating the at least one section with at least one pixel in a pixilated computer image of the multi-dimensional area such that the pixels selected by the at least one user are identified as being located in the multi-dimensional geographical region.

Yoshihashi discloses loading from a computing device to memory in a transponder or subscriber device a plurality of coordinates ("The terminal unit 400, therefore, only needs to display the map, so that the processing load that displays the map information M", [0112]), wherein the plurality of coordinates identify a multi-dimensional area (see FIG. 4); dividing the multi-dimensional area into a grid (see FIG. 4), allowing at least one user to select at least one section from within the grid in order to define a multi-dimensional geographical region (see FIG. 4); and associating the at least one section with at least one pixel in a pixilated computer image of the multi-dimensional area such that the pixels selected by the at least one user are identified as being located in the multi-dimensional geographical region ("the display area VS generally displays the map with 100 to 140 pixels in the short horizontal dimension when the map is displayed on the terminal display 440", [0078] in view of FIG. 4).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to apply the teaching of Yoshihashi to the system disclosed by Bathory the benefit of having better display ([0078] of Yoshihashi).

As to **claim 16,** Bathory in view of Yoshihashi discloses claim 15, wherein the multi-dimensional area is divided into a grid of three-dimensional squares or rectangles, and wherein the three-dimensional squares or rectangles of the grid have at least one depth.

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to apply the teaching of Yoshihashi to the system disclosed by Bathory the benefit of having better display ([0078] of Yoshihashi).

11. **Claim 11** is rejected under 35 U.S.C. 103(a) as being unpatentable over Bathory et al. (US 20050090978 A1, hereinafter Bathory) in view of Yoshihashi et al. (US 20040225436 A1), further in view of Gibson (US 6,198,431 B1).

As to **claim 11,** Bathory in view of Yoshihashi discloses claim 10, but is silent on a user enters the plurality of coordinates by entering on a computer the longitude, latitude, and elevation.

Gibson discloses the plurality of coordinates by entering on a computer the longitude, latitude, and elevation ("the users location by latitude, longitude and elevation and converts if from what would be a floating way point when attempted to be placed onto a 3-D topographical model or picture map to an accurate display of location", col. 2, lines 64-67).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to apply the teaching of Gibson to the system disclosed by Bathory in view of Yoshihashi the benefit of displaying accurate location (col. 2, line 67 of Gibson).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jianye Wu whose telephone number is (571)270-1665. The examiner can normally be reached on Monday to Thursday, 8am to 7pm. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Seema Rao can be reached on (571)272-3174. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jianye Wu/
Primary Examiner, Art Unit 2462

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CONFIRMATION NO. 7586

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12/350,817	01/08/2009 RULE	370	2462	081221-011500

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**** CONTINUING DATA ***************************

This application is a CIP of 11/848,178 08/30/2007

**** FOREIGN APPLICATIONS ***************************

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED **** ** SMALL ENTITY **
01/21/2009

Foreign Priority claimed	☐ Yes ☑ No	☐ Met after Allowance	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
35 USC 119(a-d) conditions met	☐ Yes ☑ No		CA	24	23	4
Verified and Acknowledged	/JIANYE WU/ Examiner's Signature	Initials				

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UNITED STATES

TITLE

MAPPING IN A MULTI-DIMENSIONAL SPACE

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715	FEES: Authority has been given in Paper No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

BIB (Rev. 05/07).

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	7	Map$5 with pix$7 with (dimension $5) (geographical near2 zone) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2011/10/01 15:07
L2	3555	Map$5 with pix$7 with (dimension $5) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2011/10/01 15:09
L3	31	Map$5 with pix$7 with (dimension $5) (PDA with ((cell OR mobile) adj phone) with computer) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2011/10/01 15:10
L4	1496	Map$5 (longitude with latitude with elevation) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2011/10/01 17:23
L5	242	Map$5 with (longitude with latitude with elevation) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2011/10/01 17:23

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L6	39	Map$5 with (longitude with latitude with elevation) ((cell OR mobile) adj phone) with computer (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2011/10/01 17:24
L7	0	Map$5 with pix$7 with (longitude with latitude with elevation) ((cell OR mobile) adj phone) with computer (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2011/10/01 17:25
L8	9	Map$5 with pix$7 Map$5 with (longitude with latitude with elevation) ((cell OR mobile) adj phone) with computer (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2011/10/01 17:25
L9	5	Map$5 with pix$7 user with (longitude with latitude with elevation) ((cell OR mobile) adj phone) with computer (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2011/10/01 17:35
L10	1721	(370/312).CCLS.	US-PGPUB; USPAT; DERWENT	OR	OFF	2011/10/01 18:19
L11	0	10 Map$5 with pix $7 with (dimension $5) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2011/10/01 18:21

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S1	3	(geographical adj zone) same2 (map near4 (multi $1dimension$5)) (user with vehicle) (node with user with (control adj station))	US-PGPUB; USPAT; DERWENT	AND	ON	2011/09/26 06:17
S2	0	(geographical adj zone) same2 (map near4 (multi $1dimension$5)) (user with vehicle) (node with user with (control adj station)) (@ad< "20041105" OR @rlad< "20041105")	US-PGPUB; USPAT; DERWENT	AND	ON	2011/09/26 06:18
S5	38	Map$5 with (dimension$5) (geographical near2 zone) (user OR device) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2011/09/29 23:08
S6	0	Map$5 with (dimension$5) (geographical near2 zone) (user OR device) bluetooth (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2011/09/29 23:08
S7	1439	Map$5 with (dimension$5) (user OR device) bluetooth (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2011/09/29 23:09
S8	638	Map$5 with (dimension$5) (device) with bluetooth (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2011/09/29 23:10

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S9	421	Map$5 with (dimension$5) (device) with bluetooth GPS (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2011/09/29 23:12
S10	102	Map$5 with (dimension$5) (device) with bluetooth with GPS (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2011/09/29 23:12
S11	0	Map$5 with (dimension$5) (device) with bluetooth with GPS PDS with (mobile OR cell$5) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2011/09/29 23:14
S12	0	Map$5 with (dimension$5) (device) with bluetooth with GPS PDS (mobile OR cell $5) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2011/09/29 23:14
S13	102	Map$5 with (dimension$5) (device) with bluetooth with GPS (mobile OR cell$5) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2011/09/29 23:14
S15	0	Map$5 with (dimension$5) (device) with bluetooth with GPS (mobile OR cell$5) (pixilated adj2 image) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2011/09/29 23:16

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S16	63	Map$5 with (dimension$5) (device) with bluetooth with GPS (mobile OR cell$5) (pix$7 with image) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2011/09/29 23:17
S17	40	Map$5 near2 (dimension$5) (device) with bluetooth with GPS (mobile OR cell$5) (pix$7 with image) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2011/09/29 23:17
S18	38	Map$5 near2 (dimension$5) (device) with bluetooth near4 GPS (mobile OR cell $5) (pix$7 with image) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2011/09/29 23:17
S19	59	(device) with bluetooth near4 GPS (mobile OR cell $5) (pix$7 with image) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2011/09/29 23:24

EAST Search History (Interference)

< This search history is empty>

10/ 1/ 2011 6:29:00 PM
C:\ Documents and Settings\ jwu2\ My Documents\ EAST\ Workspaces\ 12350817.wsp

Google Exhibit 1004, Page 960 of 1125

Notice of References Cited	Application/Control No. 12/350,817	Applicant(s)/Patent Under Reexamination ASHLEY ET AL.	
	Examiner JIANYE WU	Art Unit 2462	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-6,198,431 B1	03-2001	Gibson, James M.	342/357.57
*	B	US-2004/0225436 A1	11-2004	Yoshihashi, Makoto	701/208
*	C	US-2005/0090978 A1	04-2005	Bathory et al.	701/213
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Sheet 1 of 7

Complete if Known	
Application Number	12/350,817
Filing Date	January 8, 2009
First Named Inventor	James Ashley Jr.
Art Unit	2473
Examiner Name	Kwang Bin Yao
Attorney Docket Number	081221-011500/US

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Grant/Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US- 2007-0244633A1	10-18-2007	Phillips et al.	
		US- 7,848,765B2	12-07-2010	Phillips et al.	
		US- 7,539,742B2	05-26-2009	Spector	
		US- 6,970,922B1	11-29-2005	Spector	
		US- 7,870,229B2	01-11-2011	Spector	
		US- 2002-0072356A1	06-13-2002	Yamashita et al.	
		US- 2002-0059434A1	05-16-2002	Karaoguz et al.	
		US- 6,014,089	01-11-2000	Tracy et al.	
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		US- 2001-048755A1	12-06-2001	Weins et al.	
		US- 7,323,982	01-29-2003	Staton	
		US- 7,286,929	07-23-2007	Staton	
		US- 7,138,916	11-21-2006	Schwartz	
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		US- 6,531,924	03-2003	Aparin	
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		US- 5,917,405	06-1999	Joao	

Examiner Signature	/Jianye Wu/	Date Considered	09/26/2011

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Sheet 2 of 7

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		US- 6,043,748	03-2000	Touchton et al.	
		US- 6,236,358	05-2001	Durst et al.	
		US- 6,421,001	07-2002	Durst et al.	
		US- 6,509,830	01-2003	Elliot et al.	
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		US- 6,597,365	07-2003	Baecke et al.	
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		US- 2003-0149526	08-2003	Zhou et al.	
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		US- 6,009,330	12-1999	Kennedy, III et al.	
		US- 6,055,426	04-2000	Beasley	
		US- 6,617,969	09-2003	Mi et al.	
		US- 6,717,513	04-2004	Shprecher et al.	
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		US- 2006-0109107	05-2006	Staton et al.	
		US- 4,819,860	04-1989	Hargrove et al.	

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		US- 4,958,645	09-1990	Cadell et al.	
		US- 6,243,039	06-2001	Elliot	
		US- 5,389,934	02-1995	Kass	
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		US- 6,853,911	02-2005	Sakarya	
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		US- 6,868,074	03-2005	Hanson	

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Sheet 4 of 7

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Application Number	12/350,817
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First Named Inventor	James Ashley Jr.
Art Unit	2473
Examiner Name	Kwang Bin Yao
Attorney Docket Number	081221-011500/US

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		US- 6,868,410	03-2005	Fortin et al.	
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		US- 2001-0027378	10-2001	Tennison et al.	
		US- 2001-0032236	10-2001	Lin	
		US- 2002-0059434	05-2002	Karaoguz et al.	
		US- 2003-0013462	01-2003	Adachi	
		US- 2002-0068544	06-2002	Barzilay et al.	
		US- 2004-0075553	04-2004	Ono	
		US- 2004-0152460	08-2004	La et al.	
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		US- 2005-0275549	12-2005	Barclay et al.	
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		US- 5,235,633	08-1993	Dennison et al.	
		US- 5,388,147	02-1995	Grimes	
		US- 5,546,445	08-1996	Dennison et al.	
		US- 5,617,944	04-1997	McTaggart	
		US- 5,621,785	04-1997	Norimatsu	
		US- 5,835,907	11-1998	Newman	
		US- 5,918,180	06-1999	Dimino	
		US- 5,938,721	08-1999	Dussell et al.	
		US- 5,946,611	08-1999	Dennison et al.	
		US- 6,073,013	06-2000	Agre et al.	
		US- 6,198.914	03-2001	Saegusa	
		US- 6,265,978	07-2001	Atlas	

Examiner Signature	/Jianye Wu/	Date Considered	09/26/2011

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Sheet 5 of 7

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Examiner Name	Kwang Bin Yao
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		US- 6,300,875	10-2001	Schafer	
		US- 6,317,605	11-2001	Sakuma	
		US- 6,324,404	11-2001	Dennison et al.	
		US- 6,330,446	12-2001	Mori	
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		US- 2004-0043774	03-2004	Lee	
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		US- 2004-0249560	12-2004	Kim et al.	
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		US- 5,479,482	12-1995	Grimes	
		US- 7,016,478	03-2006	Potorny et al.	
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		US- 2006-0009240	01-2006	Katz	
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		US- 6,574,484	06-2003	Carley	

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	1	WO2003-049060A	06-12-2003	Lahaye et al.		
	2	WO2001-46926A	01-28-2001	Osterhuber et al.		
	3	WO2001-35190A	05-17-2001	StatSignal Systems		
	4	DE19960219	06-05-2001	Eisenlohr et al.		
	5	GB2322248A	08-19-1998	Fujitsu Ltd.		
	6	WO2001-63318A	08-31-2001	Advanced B Science		
	7	WO2000-41428A	06-13-2000	Erickson, Inc.		
	8	EP1345148A	08-17-2003	Nokia Corp.		

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Examiner Name	Kwang Bin Yao
Attorney Docket Number	081221-011500/US

	9	DE4028214A1	03-12-1992	Nuclear Cargo Inc.		
	10	WO2003-042926	05-22-2003	Vodafone AG		
	11	EP1050853A1	11-08-2000	Toyota Motor Co.		
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	13	WO2000-01065	01-2000	Qualcomm Inc.		
	14	WO2002-063768	08-2000	Columbia U.		
	15	WO2003-079587	09-2003	Motorola Inc.		
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	17	EP1345148	09-2003	Nokia Corp.		
	18	GB2369966	06-2002	Roke Manor		
	19	WO0041428	07-13-2000	Ericsson, Inc.		

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include the name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published	T[2]
	1	Wirelesswerx TrakWERK II SMS/Satellite Dual Mode Tracking Unit, Manual, November 17, 2003, pages 1-20.	
	2	Wirelesswerx Training Outline, Manual, October 29, 2004, pages 1-44.	
	3	Wirelesswerx System Description Tucson01, Manual, February 8, 2006, pages 1-10.	
	4	Wirelesswerx Requirements Specification Tucson01, Manual, February 27, 2006, pages 1-35.	
	5	Wirelesswerx Technical Overview, Manual, September 10, 2003, pages 1-19.	

Examiner Signature	/Jianye Wu/	Date Considered	09/26/2011

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.
[1] Applicant's unique citation designation number (optional). [2] Applicant is to place a check mark here if English language Translation is attached.
This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /JY/

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AMENDMENTS TO THE CLAIMS

Claim 1 (currently amended): A ~~system~~ method for developing a map ~~of a multi-dimensional space~~ for use by a user, the user being selectively individuals, vehicles, and other entities, comprising:

using a geographical zone, the zone selectively being a preconfigured geographical zone,

the zone including a plurality of spaced apart nodes, wherein the nodes are arranged in a multi-dimensional sense, the location of the nodes in the multidimensional sense being affixed and installed to a structure attached to the ground;

sending data communications between one or more of the nodes, one or more users, and one or more control stations; and

affecting multi-dimensional mapping according to the placement of the nodes and the communications between the nodes and the control stations.

Claim 2 (currently amended): The ~~system~~ method of claim 1, wherein the mapping is affected in a three-dimensional sense, selectively being the three-dimensional sense in the x, y, and z axes or coordinates.

Claim 3 (currently amended): The ~~system~~ method of claim 1, wherein the nodes are enabled selectively to communicate with GPS and with ~~Bluetooth™~~ bluetooth protocols.

Claim 4 (currently amended): The ~~system~~ method of claim 1, wherein the nodes are enabled with a ~~Bluetooth™~~ bluetooth protocol to effect communications between nodes and users of the mapping, the users of the mapping have mobile devices being at least ~~Bluetooth™~~ bluetooth protocol enabled.

Claim 5 (currently amended): The ~~system~~ method of claim 1, wherein the nodes are selectively part of a mesh network or other suitable network configuration.

Claim 6 (currently amended): The ~~system~~ method of claim 1, wherein the nodes selectively communicate with users having a selected subscriber device, the device being selectively a cell phone, PDA, or computer device.

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Claim 7 (currently amended): The ~~system~~ method of claim 6, wherein the communication is through a ~~Bluetooth™~~ bluetooth protocol.

Claim 8 (currently amended): The ~~system~~ method of claim 1, including the ability to effect fine resolution determination of a location as part of a multi-dimensional map of a location containing the nodes.

Claim 9 (currently amended): The ~~system~~ method of claim 1, including defining a geographical zone, the zone being multi-dimensional, and regulating a user being a movable entity that has a transponder or subscriber device, the device being selectively a cell phone, PDA pager, computer, or device configured to be in wireless communication with other devices and nodes through a wireless communication network.

Claim 10 (currently amended): The ~~system~~ method of claim 1, including loading from a computing device to memory in a transponder or subscriber device a plurality of coordinates; mapping the coordinates on a pixilated image wherein the pixilated image is configurable; and forming a contiguous array of pixels that enclose a shape in the pixilated image to form the geographic space.

Claim 11 (currently amended): The ~~system~~ method of claim 10, wherein a user enters the plurality of coordinates by entering on a computer the longitude, latitude, and elevation.

Claim 12 (currently amended): The ~~system~~ method of claim 10, wherein the plurality of coordinates are entered by a user of a computer device, and transmitted to the transponder or subscriber device.

Claim 13 (currently amended): The ~~system~~ method of claim 10, wherein a user enters the plurality of coordinates by the user selecting points in a map in a computer by clicking on the map; and calculating geographical coordinates of each selected point in the map.

Claim 14 (currently amended): The ~~system~~ method of claim 1, wherein a multi-dimensional shape of a geographical area is the shape of a non-regular geometrical shape.

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Claim 15 (currently amended): The ~~system~~ method of claim 1, including loading from a computing device to memory in a transponder or subscriber device a plurality of coordinates, wherein the plurality of coordinates identify a multi-dimensional area; dividing the multi-dimensional area into a grid, allowing at least one user to select at least one section from within the grid in order to define a multi-dimensional geographical region; and associating the at least one section with at least one pixel in a pixilated computer image of the multi-dimensional area such that the pixels selected by the at least one user are identified as being located in the multi-dimensional geographical region.

Claim 16 (currently amended): The ~~system~~ method of claim 15, wherein the multi-dimensional area is divided into a grid of three-dimensional squares or rectangles, and wherein the three-dimensional squares or rectangles of the grid have at least one depth.

Claim 17 (currently amended): A ~~system~~ method for mapping a geographical space comprising:

communicating data between communication nodes and a selected mobile communication device;

arranging an array of communication nodes about a three-dimensional geographical space, and the location of the nodes in the multidimensional sense being affixed and installed to a structure attached to the ground;

enabling one or more different mobile communication devices to be in communication with different communication nodes when the devices are within range of one or more selected nodes; and

associating the mobile device with the respective nodes such that the mobile device is locatable in the three-dimensional space.

Claim 18 (currently amended): The ~~system~~ method of claim 17 wherein the nodes are arranged in a three-dimensional sense, selectively being the three-dimensional sense in the x, y, and z axes or coordinates; and affecting three-dimensional mapping according to the placement of nodes in a three-dimensional sense.

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Claim 19 (currently amended): A ~~system~~ method for developing a map of a multi-dimensional space comprising:

defining a geographical space in multi-dimensions,

the space including a plurality of spaced apart nodes, wherein the nodes are arranged about the multi-dimensional space, and the location of the nodes in the multidimensional sense being affixed and installed to a structure attached to the ground;

sending data communications wirelessly between one or more of the nodes, and by wire or wirelessly to one or more control stations, the wireless communication protocol in part being at least by a Bluetooth™ protocol; and

affecting mapping according to the placement of nodes and the communications between the nodes and the control stations.

Claim 20 (currently amended): The ~~system~~ method of claim 19, wherein the mapping is affected in a three-dimensional sense, selectively being a three-dimensional sense in the x, y, and z axes or coordinates.

Claim 21 (currently amended): The ~~system~~ method of claim 19, wherein the nodes are enabled selectively to communicate with GPS and with ~~Bluetooth™~~ bluetooth protocols, and wherein the nodes are selectively part of a mesh network or other suitable network configuration.

Claim 22 (currently amended): A device incorporating a map ~~of a multi-dimensional space comprising~~ wherein the map comprises:

a geographical space in multi-dimensions,

the space including a plurality of spaced apart nodes and the nodes being arranged about the multi-dimensional space, and the location of the nodes in the multidimensional sense being affixed and installed to a structure attached to the ground;

the map having being affected by communications wirelessly between one or more of the nodes, and by wire or wirelessly to one or more control stations, the wireless communication protocol in part being at least by a ~~Bluetooth™~~ bluetooth protocol, and

the device includes the map uploaded onto the device.

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Claim 23 (currently amended): The ~~map~~ device of claim 22, wherein the geographical space is in three-dimensions.

Claim 24 (new): The method of claim 1, wherein the mapping is affected in a three-dimensional sense, selectively being a three-dimensional sense in the x, y, and z axes or coordinates and the structure is a building, the building having different floors and there are nodes on different floors whereby there are nodes at multiple different altitude levels.

Claim 25 (new): The method of claim 1, wherein the mapping is affected in a three-dimensional sense, selectively being a three-dimensional sense in the x, y, and z axes or coordinates and the structure is a building, the building having at least three different floors and there are nodes on the three different floors whereby there are nodes on at least three different altitude levels.

Claim 26 (new): The method of claim 1, wherein the mapping is affected in a three-dimensional sense, selectively being a three-dimensional sense in the x, y, and z axes or coordinates and the structure is a building, the nodes being contained in the building structure at different floors and there are nodes on the different floors whereby there are nodes on at least different altitude levels.

Claim 27 (new): The method of claim 1, wherein the mapping is affected in a three-dimensional sense, selectively being a three-dimensional sense in the x, y, and z axes or coordinates and the structure is a building, the nodes are fixed and non-movable relative to the ground and the nodes are on at least two different altitude levels.

Claim 28 (new): The method of claim 1, wherein the mapping is affected in a three-dimensional sense, selectively being a three-dimensional sense in the x, y, and z axes or coordinates and the structure is a building, the building having different floors and there are nodes on different floors whereby there are nodes at multiple different altitude levels, and the multi-dimensional mapping is effected internally in the building.

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REMARKS

The office action issued by the Examiner and the citations referred to in the office action have been carefully considered.

Double Patenting

Terminal Disclaimers are included in relation to co-pending Application No. 12/350,828 and Application No. 12/350,822. Thus this rejection is overcome.

Priority

Claims 1 and 22 delete "map of multiple-dimensional space". Thus the priority from provisional 60/625,467 filed November 5, 2004 is applicable.

35 U.S.C. § 112

Claims 1-23 are rejected as being indefinite for failing to particularly point out and distinctly claim the subject matter which application regards as the invention.

All the claims have been changed appropriately.

Claims 1, 17 and 19 have been amended to overcome the rejection is here. Also Claims 3-4, 19 and 21-22 have been amended in regard to the use of the term "Bluetooth", which in and of itself is not a trademark.

It is submitted that the term blue tooth is clearly understood in the art. Please see the Wikipedia definition. Minor changes have been used to the terminology as used in the claims.

> **Bluetooth** is a proprietary open wireless technology standard for exchanging data over short distances (using short wavelength radio transmissions in the ISM band from 2400-2480 MHz) from fixed and mobile devices, creating personal area networks (PANs) with high levels of security. Created by telecoms vendor Ericsson in 1994,[1] it was originally conceived as a wireless alternative to RS-232 data cables. It can connect several devices, overcoming problems of synchronization. http://en.wikipedia.org/wiki/Bluetooth

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It is submitted that this rejection is overcome.

New claims 24 to 28 define the location of the nodes in an altitude sense in different manners:

- where the structure is a building, the building having different floors and there are nodes on different floors whereby there are nodes at multiple different altitude levels. (Claim 24)
- where the structure is a building, the building having at least three different floors and there are nodes on the three different floors whereby there are nodes on at least three different altitude levels. (Claim 25)
- structure is a building, the nodes being contained in the building structure at different floors and there are nodes on the different floors whereby there are nodes on at least different altitude levels. (Claim 26)
- the structure is a building, the nodes are fixed and non-movable relative to the ground and the nodes are on at least two different altitude levels. (Claim 27)
- the structure is a building, the building having different floors and there are nodes on different floors whereby there are nodes at multiple different altitude levels, and the multi-dimensional mapping is effected internally in the building. (Claim 28)

35 U.S.C. § 101

Claims 22-23 have been amended to cover a device and hence the rejection for non-statutory matter is overcome.

Rejections over Prior Art

Claims 1-5, 14, 17-23 are rejected as being anticipated by Bathory et al. (2005/0090978).

Claims 6-10, 12,13 and 15-16 are rejected as being unpatentable over Bathory et al. in view of Yoshihashi et al. (2004/0225436).

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Claim 11 is rejected as being unpatentable over Bathory et al. in view of Yoshihashi et al., further in view of Gibson (6,198,431).

The independent claims 1, 17, 19 and 22 have been amended to define the location of the nodes relative to the ground. Thus, the location of the nodes in the multidimensional sense is affixed and installed to a structure attached to the ground.

This is fundamentally different to Bathory, and none of the other references deal with multidimensional nodes set up in the manner as claimed. Indeed no reference deals with nodes used for mapping a structure. Accordingly it is unnecessary to discuss the cited art and rejections in further detail.

A review of the appropriate legal standards for obviousness should be helpful.

In *ex parte Stephen R. Rohrer And Joseph M. Endter*, Appeal 2009-001292 Application 11/070,488 Decided: February 5, 2010 the BPAI stated the principles in regard to obviousness as follows:

Principles of Law

> Rejections based on 35 U.S.C. § 103 must rest on a factual basis. In making such a rejection, the Examiner has the initial duty of supplying the requisite factual basis and may not, because of doubts that the invention is patentable, resort to speculation, unfounded assumptions or hindsight reconstruction to supply deficiencies in the factual basis. See *In re Warner*, 379 F.2d 1011, 1017 (CCPA 1967). Further, in rejecting claims as unpatentable on the basis of obviousness, the Examiner must provide "some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *KSR Int'l. Co. v. Teleflex, Inc.*, 550 U.S. 398, 418 (2007).
>
> In other words, it is improper to base a conclusion of obviousness upon facts gleaned only through hindsight. "To draw on hindsight knowledge of the patented invention, when the prior art does not contain or suggest that knowledge, is to use the invention as a template for its own reconstruction—an illogical and inappropriate process by which to determine patentability." *Sensonics, Inc. v. Aerosonic Corp.*, 81 F.3d 1566, 1570 (Fed. Cir. 1996) (citing *W.L. Gore & Assoc. v. Garlock, Inc.*, 721 F.2d 1540, 1553 (Fed. Cir. 1983)). "The invention must be viewed not after the blueprint has been drawn by the inventor, but as it would have been perceived in the state of the art that existed at the time the invention

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> was made." *Id.* (citing *Interconnect Planning Corp. v. Feil*, 774 F.2d 1132, 1138 (Fed. Cir. 1985)).
>
> To support a conclusion that a claim is directed to obvious subject matter, prior art references must suggest expressly or impliedly the claimed invention or an Examiner must present a "convincing line of reasoning' as to why one of ordinary skill in the art would have found the claimed invention to have been obvious. *Ex parte Clapp*, 227 USPQ 972, 973 (BPAI 1985). When determining whether a rejection based on design choice is appropriate, the Examiner must review the Specification and ascertain *if the limitation in question* is disclosed as serving any advantage or particular purpose, or whether it solves a stated problem. The Examiner also should explain the reasoning used to determine that the prior art would have performed equally as well as the claimed invention. These two steps help present the aforementioned "convincing line of reasoning." *Ex parte Clapp*, 227 USPQ at 973. [emphasis added]

The prior art references do not suggest expressly or impliedly the claimed invention and based on that the Examiner cannot present a "convincing line of reasoning" as to why one of ordinary skill in the art would have found the claimed invention to have been obvious.

Respectfully the Examiner needs to consider each of these specific requirements of the claims. With this in mind there is no basis for making a rejection of the pending claims without any supportable art or suggestion in the art.

To conclude otherwise, the Examiner would incorrectly apply a hindsight reconstruction in consideration of the claims. Since the prior art in any combination does not support any different conclusion, the Examiner's position and conclusion of obviousness is wrong in fact and contrary to the law.

More so, even with the cited art there are steps in the claims which are not taught disclosed or suggested.

The appropriate KSR standard and its progeny cases apply in dealing with the obviousness standard. Although the teaching, suggestion, motivation test is still recognized under *KSR*, the test is largely subsumed by the more general principles laid out in *KSR*. Indeed, in any given application, the combination of elements "must do more than yield a predictable

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result." *Id.* at 1740. Nevertheless, combining elements "in an unexpected and fruitful manner" is sufficient to render an invention non-obvious. *Id.*

More importantly, "a patent composed of several elements **is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art.**" KSR *Id.* (emphasis added).

In *KSR*, the Supreme Court addressed such logic in obviousness-type rejections. Importantly, *KSR* specifically forbids obviousness rejections simply because each element was independently known in the prior art. The art cited against the instant application falls into this rubric because they are nothing more than a string of references showing some of the claimed elements with tenuous logic to support their combination.

As stated In *ex parte Stephen R. Rohrer And Joseph M. Endter*, supra:

> a patent [claim] composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art. Although common sense directs one to look with care at a patent application that claims as innovation the combination of two known devices according to their established functions, it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does.

KSR Int'l., 550 U.S. at 418.

In this case, the Examiner cannot provide a cogent reason. The Applicants submit that a person of ordinary skill in the art would not reasonably infer or deduce anything from the prior art in the sense of allowing the features to be considered an obvious choice.

The Examiner cannot meet the KSR threshold tests, since there would be a necessity to combine other references for the missing elements (and no such other references exist) and for the Examiner to show that there is a teaching, suggestion, or motivation to combine them and thereby attain the invention as claimed. Since the prior art is silent as to the claimed features, the

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Applicants submit that the prior art applied by the Examiner does not show or render obvious the submitted claims.

At the time of the invention, it was the inventors insights and willingness to confront and overcome the obstacles which led to the invention as claimed. The invention as claimed is more than a mere design choice.

It is respectfully submitted that all of the Examiner's objections have been successfully traversed and that the application is now in order for allowance. Accordingly, reconsideration of the application and allowance thereof is courteously solicited.

The Director is authorized to charge any additional fee(s) or any underpayment of fee(s), or to credit any overpayments to **Deposit Account Number 50-2638**. Please ensure that Attorney Docket Number 081221-011500 is referred to when charging any payments or credits for this case.

Respectfully submitted,

Date: January 10, 2012

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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	James Ashley, Jr. et al.	Examiner:	Jianye Wu
Serial No.	12/350,817	Group Art Unit:	2462
Filed:	January 8, 2009	Docket No.	081221-011500
Customer No.:	33717	Confirmation No.:	7586
Title:	MAPPING IN A MULTI-DIMENSIONAL SPACE		

CERTIFICATE OF TRANSMISSION

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Name: Rosemary D. Payton

AMENDMENT

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Post Office Box 1450
Alexandria, Virginia 22313-1450

Sir/Madam:

In response to the Non-Final Office Action mailed October 11, 2011, kindly enter the following amendments:

Amendments to the Claims begin on page 2.

Remarks/Argument begin on page 7.

Terminal Disclaimers follow page 12.

Google Exhibit 1004, Page 980 of 1125

Electronic Acknowledgement Receipt	
EFS ID:	11803793
Application Number:	12350817
International Application Number:	
Confirmation Number:	7586
Title of Invention:	MAPPING IN A MULTI-DIMENSIONAL SPACE
First Named Inventor/Applicant Name:	James Ashley
Customer Number:	33717
Filer:	Charles Berman/Rosemary Payton
Filer Authorized By:	Charles Berman
Attorney Docket Number:	081221-011500
Receipt Date:	10-JAN-2012
Filing Date:	08-JAN-2009
Time Stamp:	17:00:59
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$490
RAM confirmation Number	3838
Deposit Account	502638
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		Amendment.pdf	1554273 fd7938df7bdd9cf5b08c150832a8758b5b3873a3	yes	14

Multipart Description/PDF files in .zip description

Document Description	Start	End
Amendment/Req. Reconsideration-After Non-Final Reject	1	1
Claims	2	6
Applicant Arguments/Remarks Made in an Amendment	7	12
Terminal Disclaimer Filed	13	14

Warnings:

Information:

2		IDS.pdf	454114 2bc04f06add63a3c223b4be430ec3f2ecc42f497	yes	4

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Document Description	Start	End
Transmittal Letter	1	3
Information Disclosure Statement (IDS) Form (SB08)	4	4

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Information:

3	Fee Worksheet (SB06)	fee-info.pdf	33413 ec5c3f0544bf7d15553decc1880d7db559c93647	no	2

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 1

Complete if Known	
Application Number	12/350,817
Filing Date	January 8, 2009
First Named Inventor	James Ashley, Jr.
Art Unit	2462
Examiner Name	Jianye Wu
Attorney Docket Number	081221-011500

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
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FOREIGN PATENT DOCUMENTS

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LA 130058107v1

Examiner Signature		Date Considered	

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Electronic Patent Application Fee Transmittal

Application Number:	12350817
Filing Date:	08-Jan-2009
Title of Invention:	MAPPING IN A MULTI-DIMENSIONAL SPACE
First Named Inventor/Applicant Name:	James Ashley
Filer:	Charles Berman/Rosemary Payton
Attorney Docket Number:	081221-011500

Filed as Small Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Claims in excess of 20	2202	5	30	150
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
Statutory or terminal disclaimer	2814	2	80	160
		Total in USD ($)		**490**

PATENT

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Name: Rosemary D. Payton

INFORMATION DISCLOSURE STATEMENT [37 C.F.R. § 1.56]

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Alexandria, Virginia 22313-1450

Sir/Madam:

Pursuant to 37 C.F.R. §§ 1.56, 1.97 and 1.98, applicant brings the references listed on the attached Form SB-08 to the examiner's attention. 37 C.F.R. § 1.56. Do not construe the filing of this information disclosure statement as a representation that applicant has made a search (37 C.F.R. § 1.97(g)), or as an admission that the information cited is, or is considered to be, material to patentability, or that no other material information exists. We enclose copies of any cited foreign documents. Copies of the U.S. references are not enclosed.

This Information Disclosure Statement is being submitted:

☐ 1. Within three months of the filing date of a national application other than a continued prosecution application under 37 C.F.R. § 1.53(d), or within three months of the date of entry of the national stage as set forth in 37 C.F.R. § 1.491 in an international application; or **before the mailing date of a first**

Google Exhibit 1004, Page 987 of 1125

office action on the merits, and therefore, Applicant believes no fee is required;

☒ 2. After the period specified in paragraph (1) above of this section, but before the mailing date of either a final action under 37 C.F.R. § 1.113, or a notice of allowance under 37 C.F.R. § 1.311, whichever occurs first, and is accompanied by either:

☐ a. A statement that:

(i) Each item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application not more than three months before the filing of the information disclosure statement; or

(ii) No item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the statement after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months before the filing of the information disclosure statement;

☒ b. The fee for filing an Information Disclosure Statement under 37 C.F.R. § 1.17(p) is $180.00.

☐ 3. After the period specified in paragraph (2) of this section, but on or before payment of the issue fee and is accompanied by:

☐ a. A statement that:

(i) Each item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application not more than three months before the filing of the information disclosure statement; or

Google Exhibit 1004, Page 988 of 1125

(ii) No item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the statement after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months before the filing of the information disclosure statement; and

☐ b. The fee set forth in 37 C.F.R. § 1.17(p).

Applicant would appreciate the examiner initialing and signing a copy of attached Form PTO-1449 indicating that he or she considered the information and made the information of record.

If the transmittal letter is separated from this document and the PTO determines that an extension or other relief is required, applicant petitions for any required relief including extensions of time and authorizes the Commissioner to charge the cost of such petitions and/or other fees due in connection with the filing of this document to Deposit Account No. 50-2638.

Authorization is hereby given to charge any fees due, or credit any overpayment of fees, to Deposit Account No. 50-2638.

Respectfully submitted,

Date: January 10, 2012

/charles berman/
Charles Berman
Reg. No. 29,249

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Google Exhibit 1004, Page 989 of 1125

PTO/SB/25 (08-11)
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TERMINAL DISCLAIMER TO OBVIATE A PROVISIONAL DOUBLE PATENTING REJECTION OVER A PENDING "REFERENCE" APPLICATION	Docket Number (Optional) 081221-011500

In re Application of: James Ashley, Jr. et al.

Application No.: 12/350,817

Filed: January 8, 2009

For: MAPPING IN A MULTI-DIMENSIONAL SPACE

The owner*, WIRELESSWERX INTERNATIONAL, INC., of 100 percent interest in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of any patent granted on pending **reference** Application Number 12/350,822, filed January 8, 2009, as the term of any patent granted on said **reference** application may be shortened by any terminal disclaimer filed prior to the grant of any patent on the pending **reference** application. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and any patent granted on the **reference** application are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the owner does not disclaim the terminal part of any patent granted on the instant application that would extend to the expiration date of the full statutory term of any patent granted on said **reference** application, "as the term of any patent granted on said **reference** application may be shortened by any terminal disclaimer filed prior to the grant of any patent on the pending **reference** application," in the event that: any such patent: granted on the pending **reference** application: expires for failure to pay a maintenance fee, is held unenforceable, is found invalid by a court of competent jurisdiction, is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321, has all claims canceled by a reexamination certificate, is reissued, or is in any manner terminated prior to the expiration of its full statutory term as shortened by any terminal disclaimer filed prior to its grant.

Check either box 1 or 2 below, if appropriate.

1. ☐ For submissions on behalf of a business/organization (e.g., corporation, partnership, university, government agency, etc.), the undersigned is empowered to act on behalf of the business/organization.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

2. ☑ The undersigned is an attorney or agent of record. Reg. No. 29249

/charles berman/ — Signature
January 10, 2012 — Date

Charles Berman — Typed or printed name

(310) 586-7770 — Telephone Number

☑ Terminal disclaimer fee under 37 CFR 1.20(d) is included.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).
Form PTO/SB/96 may be used for making this statement. See MPEP § 324.

This collection of information is required by 37 CFR 1.321. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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TERMINAL DISCLAIMER TO OBVIATE A PROVISIONAL DOUBLE PATENTING REJECTION OVER A PENDING "REFERENCE" APPLICATION	Docket Number (Optional) 081221-011500

In re Application of: James Ashley, Jr. et al.

Application No.: 12/350,817

Filed: January 8, 2009

For: MAPPING IN A MULTI-DIMENSIONAL SPACE

The owner*, WIRELESSWERX INTERNATIONAL, INC., of 100 percent interest in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of any patent granted on pending **reference** Application Number 12/350,828, filed January 8, 2009, as the term of any patent granted on said **reference** application may be shortened by any terminal disclaimer filed prior to the grant of any patent on the pending **reference** application. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and any patent granted on the **reference** application are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the owner does not disclaim the terminal part of any patent granted on the instant application that would extend to the expiration date of the full statutory term of any patent granted on said **reference** application, "as the term of any patent granted on said **reference** application may be shortened by any terminal disclaimer filed prior to the grant of any patent on the pending **reference** application," in the event that: any such patent: granted on the pending **reference** application: expires for failure to pay a maintenance fee, is held unenforceable, is found invalid by a court of competent jurisdiction, is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321, has all claims canceled by a reexamination certificate, is reissued, or is in any manner terminated prior to the expiration of its full statutory term as shortened by any terminal disclaimer filed prior to its grant.

Check either box 1 or 2 below, if appropriate.

1. ☐ For submissions on behalf of a business/organization (e.g., corporation, partnership, university, government agency, etc.), the undersigned is empowered to act on behalf of the business/organization.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

2. ☑ The undersigned is an attorney or agent of record. Reg. No. 29249

/charles berman/ — Signature
January 10, 2012 — Date

Charles Berman — Typed or printed name

(310) 586-7770 — Telephone Number

☑ Terminal disclaimer fee under 37 CFR 1.20(d) is included.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

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This collection of information is required by 37 CFR 1.321. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
12/350,817	01/08/2009	

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)	SMALL ENTITY ☒		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT	01/10/2012	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 28	Minus	** 23	= 5	X $30 =	150	OR	X $ =	
	Independent (37 CFR 1.16(h))	* 4	Minus	***4	= 0	X $125 =	0	OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE	150	OR	TOTAL ADD'L FEE	

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/LINDA 18 WISE/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Substitute for form 1449B/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 1

Complete if Known	
Application Number	12/350,817
Filing Date	January 8, 2009
First Named Inventor	James Ashley, Jr.
Art Unit	2462
Examiner Name	Jianye Wu
Attorney Docket Number	081221-011500

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US- 2007/0276270 A1	11-29-2007	Tran	
		US-			
		US-			

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3] Number[4] Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[5]

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include the name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published	T[2]

LA 130058107v1

Examiner Signature	/Jianye Wu/	Date Considered	01/23/2012

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.
[1] Applicant's unique citation designation number (optional). [2] Applicant is to place a check mark here if English language Translation is attached.
This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /J.Y

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United States Patent and Trademark Office
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P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/350,817	01/08/2009	James Ashley JR.	081221-011500	7586

33717 7590 01/30/2012

GREENBERG TRAURIG LLP (LA)
c/o: Greenberg Traurig LLP Chicago Office
77 West Wacker Drive, Suite 3100
INTELLECTUAL PROPERTY DEPARTMENT
Chicago, IL 60601

EXAMINER	
WU, JIANYE	
ART UNIT	**PAPER NUMBER**
2462	

NOTIFICATION DATE	DELIVERY MODE
01/30/2012	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

laipmail@gtlaw.com
clairt@gtlaw.com
cadanoc@gtlaw.com

Google Exhibit 1004, Page 994 of 1125

Office Action Summary	Application No.	Applicant(s)	
	12/350,817	ASHLEY ET AL.	
	Examiner	Art Unit	
	JIANYE WU	2462	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10 January 2012*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

5)☒ Claim(s) *1-28* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1-28* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

12)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *1/10/12*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Double Patenting

1. The terminal disclaimer filed on 1/10/2012 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of Application #12/350,822 and #12/350,828 has been reviewed and is accepted. The terminal disclaimer has been recorded.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. **Claims 1-23** are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Independent **Claims 1, 17, 19** recite a newly added limitation “the location of the node in the multidimensional sense being affixed and installed to a structure attached to the ground”. There is insufficient support in the specification for this limitation in the claim. Applicant did not provide any information regarding the evidences in the specification for supporting the newly added claim limitation.

The dependent claims are rejected because they depend on independent claims that have been all rejected.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. **Claims 1-23** are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Independent **Claims 1, 17, 19** recite a newly added limitation "the location of the node in the multidimensional sense being affixed and installed to a structure attached to the ground". This limitation needs clarity. Particularly, it is unclear what dose it meant by "the node in the multidimensional sense being affixed".

The dependent claims are rejected because they depend on independent claims that have been all rejected.

For examination on the merits, the claims will be interpreted as the best understood.

Claim Rejections - 35 USC § 102

The following is a quotation of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. **Claims 1-5, 14, 17-23** are rejected under 35 U.S.C. 35 U.S.C. 102(e) as being anticipated by Bathory et al. (US 20050090978 A1, hereinafter Bathory).

For **claim 1**, Bathory discloses a method for developing a map of a multi-dimensional space ("displaying various geographic and flight *maps*", [0127]) for use by a user, the user being selectively individuals, vehicles, and other entities (see FIG. 1 for vehicles 2 such as airplane and ships), comprising:

using a geographical zone (the space shown in FIG. 1), the zone selectively being a preconfigured geographical zone (the space shown in FIG. 1 is a preconfigured geographical zone), the zone including a plurality of spaced apart nodes (Satellite, radar and camera shown in FIG. 1), wherein the nodes are arranged in a multi-dimensional sense ("the co-ordinate and speed data forecasts and their normal projections on the 3D map", [0154] in view of FIG. 1), the location of the node in the multidimensional sense being affixed and installed to a structure attached to the ground (some nodes such as ship 44, or tower 11a and etc. are nodes being affixed and installed to a structure attached to the ground);

sending data communications between one or more of the nodes, one or more users (see FIG. 1 for communications between plane & ship with satellite), and one or more control stations ("the space-information unit 17b" which stores "the space-information database", [0151]); and

affecting multi-dimensional mapping according to the placement of the nodes and the communications between the nodes and the control stations (suggested by "the co-

ordinate and speed data forecasts and their normal projections on the 3D map", [0154] in view of FIG. 1).

For **claim 17**, Bathory discloses a system for mapping a geographical space (see FIG. 1) comprising:

communicating data between communication nodes (Satellite, radar and camera shown in FIG. 1) and a selected mobile communication device (plane 2);

arranging an array of communication nodes about a three-dimensional geographical space ("the co-ordinate and speed data forecasts and their normal projections on the 3D map", [0154] in view of FIG. 1);

enabling one or more different mobile communication devices to be in communication with different communication nodes when the devices are within range of one or more selected nodes (FIG. 1 shows plane 2 communicates with different nodes such as satellites 6, 7a, 7b and other nodes); and

associating the mobile device with the respective nodes such that the mobile device is locatable in the three-dimensional space (FIG. 1 shows plane is locatable in the three-dimensional space).

For **claims 19** and **22**, Bathory discloses a system for developing a map of a multi-dimensional space ("the co-ordinate and speed data forecasts and their normal projections on the 3D map", [0154] in view of FIG. 1) comprising:

defining a geographical space in multi-dimensions (the space shown in FIG. 1, which is a 3D space), the space including a plurality of spaced apart nodes (Satellite,

radar and camera shown in FIG. 1), wherein the nodes are arranged about the multi-dimensional space (FIG. 1 shows plane is locatable in the three-dimensional space);

sending data communications wirelessly between one or more of the nodes, and by wire or wirelessly to one or more control stations ("In case the GSM communication and/or GPS communication of the object centre 2 of the consignment is interrupted, it attempts to take up communication automatically by wire or even radio technology", [0098]), the wireless communication protocol in part being at least by a bluetooth protocol ("if necessary by *bluetooth* technology, with the object centre 2 of the consignment-carrier container or wagon playing a master role.", [0098]); and

affecting mapping according to the placement of nodes and the communications between the nodes and the control stations (suggested by "the co-ordinate and speed data forecasts and their normal projections on the 3D map", [0154] in view of FIG. 1).

As to **claims 2, 18, 20** and **23,** Bathory discloses claims 1, 17 and 22, Bathory further discloses the mapping is affected in a three-dimensional sense, selectively being the three-dimensional sense in the x, y, and z axes or coordinates (suggested by "the co-ordinate and speed data forecasts and their normal projections on the 3D map", [0154] in view of FIG. 1; note 3D is normally shown in the x, y, and z axes, it can also shown in other 3D coordinates).

As to **claim claims 3** and **21,** Bathory discloses claim 1, Bathory further discloses the nodes are enabled selectively to communicate with GPS ("in the traffic control system a GPS-based time adjustment prevails with a number one priority", [0450]) and with bluetooth protocols ("if necessary by *bluetooth* technology, with the

object centre 2 of the consignment-carrier container or wagon playing a master role.", [0098]), and wherein the nodes are selectively part of a mesh network or other suitable network configuration (see FIG. 1 for suitable configuration).

As to **claim 4,** Bathory discloses claim 1, Bathory further discloses the nodes are enabled with a Bluetooth protocol to effect communications between nodes and users of the mapping, the users of the mapping have mobile devices being at least Bluetooth protocol enabled ("if necessary by bluetooth technology, with the object centre 2 of the consignment-carrier container or wagon playing a master role.", [0098]).

As to **claim 5,** Bathory discloses claim 1, Bathory further discloses the nodes are selectively part of a mesh network or other suitable network configuration (see FIG. 1 for suitable configuration).

As to **claim 14,** Bathory discloses claim 1, Bathory further discloses a multi-dimensional shape of a geographical area is the shape of a non-regular geometrical shape (see FIG. 1, where the space is a non-regular geometrical shape).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. **Claims 6-10, 12-13-16 and 15** are rejected under 35 U.S.C. 103(a) as being unpatentable over Bathory et al. (US 20050090978 A1, hereinafter Bathory) in view of Yoshihashi et al. (US 20040225436 A1).

As to **claim 6,** Bathory discloses claim 1, but is silent on the nodes selectively communicate with users having a selected subscriber device, the device being selectively a cell phone, PDA, or computer device.

Yoshihashi discloses the users having a selected subscriber device, the device being selectively a cell phone, PDA, or computer device ("The terminal unit 400 may be, for example, a mobile phone, a PHS (Personal Handyphone System), a PDA (Personal Digital Assistant), a portable personal computer, an in-vehicle navigation device installed on a vehicle as a movable body, and a portable navigation device", [0044]).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to apply the teaching of Yoshihashi to the system disclosed by Bathory to include a cell phone, PDA, or computer device as a user for the benefit of extending the range of the system services.

As to **claim 7,** Bathory in view of Yoshihashi discloses claim 6, Bathory further discloses the communication is through a Bluetooth protocol ("if necessary by bluetooth technology, with the object centre 2 of the consignment-carrier container or wagon playing a master role.", [0098]), and wherein the nodes are selectively part of a mesh network or other suitable network configuration (see FIG. 1 for suitable configuration).

As to **claim 8,** Bathory discloses claim 1, but does not explicitly disclose the ability to effect fine resolution determination of a location as part of a multi-dimensional map of a location containing the nodes.

Yoshihashi discloses the ability to effect fine resolution determination of a location as part of a multi-dimensional map of a location containing the nodes ("the

display area VS generally displays the map with 100 to 140 pixels in the short horizontal dimension when the map is displayed on the terminal display 440", [0078]; note the number of fixels effects fine resolution determination of a location).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to apply the teaching of Yoshihashi to the system disclosed by Bathory for the benefit of having better display ([0078] of Yoshihashi).

As to **claim 9,** Bathory discloses claim 1, including defining a geographical zone, the zone being multi-dimensional (as disclosed by the parent claim), but is silent on the nodes selectively communicate with users having a selected subscriber device, the device being selectively a cell phone, PDA, or computer device.

Yoshihashi discloses nodes selectively communicate with users having a selected subscriber device, the device being selectively a cell phone, PDA, or computer device ("The terminal unit 400 may be, for example, a mobile phone, a PHS (Personal Handyphone System), a PDA (Personal Digital Assistant), a portable personal computer, an in-vehicle navigation device installed on a vehicle as a movable body, and a portable navigation device", [0044]).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to apply the teaching of Yoshihashi to the system disclosed by Bathory to include a cell phone, PDA, or computer device as a user for the benefit of extending the range of the system services.

As to **claim 10,** Bathory discloses claim 1, but is silent on loading from a computing device to memory in a transponder or subscriber device a plurality of

coordinates; mapping the coordinates on a pixilated image wherein the pixilated image is configurable; and forming a contiguous array of pixels that enclose a shape in the pixilated image to form the geographic space.

Yoshihashi discloses loading from a computing device to memory in a transponder or subscriber device a plurality of coordinates (mapping the coordinates on a pixilated image wherein the pixilated image is configurable; and forming a contiguous array of pixels that enclose a shape in the pixilated image to form the geographic space ("the display area VS generally displays the map with 100 to 140 pixels in the short horizontal dimension when the map is displayed on the terminal display 440", [0078]; note the number of pixels effects fine resolution determination of a location).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to apply the teaching of Yoshihashi to the system disclosed by Bathory the benefit of having better display ([0078] of Yoshihashi).

As to **claim 12,** Bathory in view of Yoshihashi discloses claim 10, wherein the plurality of coordinates are entered by a user of a computer device, and transmitted to the transponder or subscriber device (see FIG. 1 of Yoshihashi).

As to **claim 13,** Bathory in view of Yoshihashi discloses claim 10, wherein a user enters the plurality of coordinates by the user selecting points in a map in a computer by clicking on the map; and calculating geographical coordinates of each selected point in the map (see FIGs 1 and 4 of Yoshihashi).

As to **claim 15,** Bathory discloses claim 1, but is silent on loading from a computing device to memory in a transponder or subscriber device a plurality of

coordinates, wherein the plurality of coordinates identify a multi-dimensional area; dividing the multi-dimensional area into a grid, allowing at least one user to select at least one section from within the grid in order to define a multi-dimensional geographical region; and associating the at least one section with at least one pixel in a pixilated computer image of the multi-dimensional area such that the pixels selected by the at least one user are identified as being located in the multi-dimensional geographical region.

Yoshihashi discloses loading from a computing device to memory in a transponder or subscriber device a plurality of coordinates ("The terminal unit 400, therefore, only needs to display the map, so that the processing load that displays the map information M", [0112]), wherein the plurality of coordinates identify a multi-dimensional area (see FIG. 4); dividing the multi-dimensional area into a grid (see FIG. 4), allowing at least one user to select at least one section from within the grid in order to define a multi-dimensional geographical region (see FIG. 4); and associating the at least one section with at least one pixel in a pixilated computer image of the multi-dimensional area such that the pixels selected by the at least one user are identified as being located in the multi-dimensional geographical region ("the display area VS generally displays the map with 100 to 140 pixels in the short horizontal dimension when the map is displayed on the terminal display 440", [0078] in view of FIG. 4).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to apply the teaching of Yoshihashi to the system disclosed by Bathory the benefit of having better display ([0078] of Yoshihashi).

As to **claim 16,** Bathory in view of Yoshihashi discloses claim 15, wherein the multi-dimensional area is divided into a grid of three-dimensional squares or rectangles, and wherein the three-dimensional squares or rectangles of the grid have at least one depth.

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to apply the teaching of Yoshihashi to the system disclosed by Bathory the benefit of having better display ([0078] of Yoshihashi).

7. **Claim 11** is rejected under 35 U.S.C. 103(a) as being unpatentable over Bathory et al. (US 20050090978 A1, hereinafter Bathory) in view of Yoshihashi et al. (US 20040225436 A1), further in view of Gibson (US 6,198,431 B1).

As to **claim 11,** Bathory in view of Yoshihashi discloses claim 10, but is silent on a user enters the plurality of coordinates by entering on a computer the longitude, latitude, and elevation.

Gibson discloses the plurality of coordinates by entering on a computer the longitude, latitude, and elevation (“the users location by latitude, longitude and elevation and converts if from what would be a floating way point when attempted to be placed onto a 3-D topographical model or picture map to an accurate display of location”, col. 2, lines 64-67).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to apply the teaching of Gibson to the system disclosed by Bathory in view of Yoshihashi the benefit of displaying accurate location (col. 2, line 67 of Gibson).

Response to Applicant's Arguments/Amendments

Applicant's arguments and amendments filed on 1/10/12 have been considered, but are moot due to the fact that all independent claims have been amended, to which new ground rejections have been made.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jianye Wu whose telephone number is (571)270-1665. The examiner can normally be reached on Monday to Thursday, 8am to 7pm. If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Seema Rao can be reached on (571)272-3174. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jianye Wu/
Primary Examiner, Art Unit 2462

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	3	(geographical adj zone) same2 (map near4 (multi $1dimension$5)) (user with vehicle) (node with user with (control adj station))	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
L2	0	(geographical adj zone) same2 (map near4 (multi $1dimension$5)) (user with vehicle) (node with user with (control adj station)) (@ad< "20041105" OR @rlad< "20041105")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
L3	40	Map$5 with (dimension$5) (geographical near2 zone) (user OR device) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
L4	0	Map$5 with (dimension$5) (geographical near2 zone) (user OR device) bluetooth (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
L5	1515	Map$5 with (dimension$5) (user OR device) bluetooth (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
L6	684	Map$5 with (dimension$5) (device) with bluetooth (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42

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L7	460	Map$5 with (dimension$5) (device) with bluetooth GPS (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
L8	107	Map$5 with (dimension$5) (device) with bluetooth with GPS (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
L9	0	Map$5 with (dimension$5) (device) with bluetooth with GPS PDS with (mobile OR cell$5) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
L10	0	Map$5 with (dimension$5) (device) with bluetooth with GPS PDS (mobile OR cell $5) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
L11	107	Map$5 with (dimension$5) (device) with bluetooth with GPS (mobile OR cell$5) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
L12	0	Map$5 with (dimension$5) (device) with bluetooth with GPS (mobile OR cell$5) (pixilated adj2 image) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42

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L13	66	Map$5 with (dimension$5) (device) with bluetooth with GPS (mobile OR cell$5) (pix $7 with image) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
L14	42	Map$5 near2 (dimension$5) (device) with bluetooth with GPS (mobile OR cell$5) (pix $7 with image) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
L15	40	Map$5 near2 (dimension$5) (device) with bluetooth near4 GPS (mobile OR cell$5) (pix $7 with image) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
L16	61	(device) with bluetooth near4 GPS (mobile OR cell$5) (pix $7 with image) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
L17	7	Map$5 with pix$7 with (dimension$5) (geographical near2 zone) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
L18	3621	Map$5 with pix$7 with (dimension$5) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
L19	31	Map$5 with pix$7 with (dimension$5) (PDA with ((cell OR mobile) adj phone) with computer) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42

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L20	1650	Map$5 (longitude with latitude with elevation) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
L21	253	Map$5 with (longitude with latitude with elevation) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
L22	39	Map$5 with (longitude with latitude with elevation) ((cell OR mobile) adj phone) with computer (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
L23	0	Map$5 with pix$7 with (longitude with latitude with elevation) ((cell OR mobile) adj phone) with computer (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
L24	9	Map$5 with pix$7 Map $5 with (longitude with latitude with elevation) ((cell OR mobile) adj phone) with computer (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
L25	5	Map$5 with pix$7 user with (longitude with latitude with elevation) ((cell OR mobile) adj phone) with computer (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
L26	1877	(370/312).CCLS.	US-PGPUB; USPAT; DERWENT	OR	OFF	2012/01/24 22:42
L27	0	L26 Map$5 with pix$7 with (dimension$5) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42

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L28	3	"20070276270"	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2012/01/24 22:42

EAST Search History (Interference)

< This search history is empty>

1/ 24/ 2012 10:50:17 PM
C:\ Documents and Settings\ jwu2\ My Documents\ EAST\ Workspaces\ 12350817.wsp

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Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12350817	ASHLEY ET AL.
	Examiner	Art Unit
	JIANYE WU	2462

SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
Inventoship search, EAST keyword search, subclass 37/312 with keyword search.	10/1/2011	JY
Inventoship search update, EAST keyword search, subclass 37/312 with keyword search update.	1/23/2012	JY

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

	/JIANYE WU/ Primary Examiner.Art Unit 2462

Application Number	Application/Control No.	Applicant(s)/Patent under Reexamination	
	12/350,817	ASHLEY ET AL.	

Document Code - DISQ	Internal Document – DO NOT MAIL

TERMINAL DISCLAIMER	☒ APPROVED	☐ DISAPPROVED
Date Filed : 01/10/12	This patent is subject to a Terminal Disclaimer	

Approved/Disapproved by:
Lawana Hixon

U.S. Patent and Trademark Office

DETAILED ACTION

This office action vacates the final office action that was issued on 1/30/2012 to correct some typographic errors in section 2 (Claim Rejections under 35 U.S.C. 103). Additional rejections for claims 24-28 under 35 U.S.C. 103(a) are also added.

Double Patenting

1. The terminal disclaimer filed on 1/10/2012 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of Application #12/350,822 and #12/350,828 has been reviewed and is accepted. The terminal disclaimer has been recorded.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. **Claims 1-28** are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Independent **Claims 1, 17, 19** recite a newly added limitation “the location of the node in the multidimensional sense being affixed and installed to a structure attached to the ground”. There is insufficient support in the specification for this limitation in the

claim. Applicant did not provide any information regarding the evidences in the specification for supporting the newly added claim limitation.

The dependent claims are rejected because they depend on independent claims that have been all rejected.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. **Claims 1-28** are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Independent **Claims 1, 17, 19** recite a newly added limitation “the location of the node in the multidimensional sense being affixed and installed to a structure attached to the ground”. This limitation needs clarity. Particularly, it is unclear what dose it meant by “the node in the multidimensional sense being affixed”.

The dependent claims are rejected because they depend on independent claims that have been all rejected.

For examination on the merits, the claims will be interpreted as the best understood.

Claim Rejections - 35 USC § 102

The following is a quotation of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –

> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. **Claims 1-5, 14, 17-23** are rejected under 35 U.S.C. 35 U.S.C. 102(e) as being anticipated by Bathory et al. (US 20050090978 A1, hereinafter Bathory).

For **claim 1**, Bathory discloses a method for developing a map of a multi-dimensional space ("displaying various geographic and flight *maps*", [0127]) for use by a user, the user being selectively individuals, vehicles, and other entities (see FIG. 1 for vehicles 2 such as airplane and ships), comprising:

using a geographical zone (the space shown in FIG. 1), the zone selectively being a preconfigured geographical zone (the space shown in FIG. 1 is a preconfigured geographical zone), the zone including a plurality of spaced apart nodes (Satellite, radar and camera shown in FIG. 1), wherein the nodes are arranged in a multi-dimensional sense ("the co-ordinate and speed data forecasts and their normal projections on the 3D map", [0154] in view of FIG. 1), the location of the node in the multidimensional sense being affixed and installed to a structure attached to the ground (some nodes such as ship 44, or tower 11a and etc. are nodes being affixed and installed to a structure attached to the ground);

sending data communications between one or more of the nodes, one or more users (see FIG. 1 for communications between plane & ship with satellite), and one or more control stations ("the space-information unit 17b" which stores "the space-information database", [0151]); and

affecting multi-dimensional mapping according to the placement of the nodes and the communications between the nodes and the control stations (suggested by "the co-ordinate and speed data forecasts and their normal projections on the 3D map", [0154] in view of FIG. 1).

For **claim 17**, Bathory discloses a system for mapping a geographical space (see FIG. 1) comprising:

communicating data between communication nodes (Satellite, radar and camera shown in FIG. 1) and a selected mobile communication device (plane 2);

arranging an array of communication nodes about a three-dimensional geographical space ("the co-ordinate and speed data forecasts and their normal projections on the 3D map", [0154] in view of FIG. 1);

enabling one or more different mobile communication devices to be in communication with different communication nodes when the devices are within range of one or more selected nodes (FIG. 1 shows plane 2 communicates with different nodes such as satellites 6, 7a, 7b and other nodes); and

associating the mobile device with the respective nodes such that the mobile device is locatable in the three-dimensional space (FIG. 1 shows plane is locatable in the three-dimensional space).

For **claims 19** and **22**, Bathory discloses a system for developing a map of a multi-dimensional space ("the co-ordinate and speed data forecasts and their normal projections on the 3D map", [0154] in view of FIG. 1) comprising:

defining a geographical space in multi-dimensions (the space shown in FIG. 1, which is a 3D space), the space including a plurality of spaced apart nodes (Satellite, radar and camera shown in FIG. 1), wherein the nodes are arranged about the multi-dimensional space (FIG. 1 shows plane is locatable in the three-dimensional space);

sending data communications wirelessly between one or more of the nodes, and by wire or wirelessly to one or more control stations ("In case the GSM communication and/or GPS communication of the object centre 2 of the consignment is interrupted, it attempts to take up communication automatically by wire or even radio technology", [0098]), the wireless communication protocol in part being at least by a bluetooth protocol ("if necessary by *bluetooth* technology, with the object centre 2 of the consignment-carrier container or wagon playing a master role.", [0098]); and

affecting mapping according to the placement of nodes and the communications between the nodes and the control stations (suggested by "the co-ordinate and speed data forecasts and their normal projections on the 3D map", [0154] in view of FIG. 1).

As to **claims 2, 18, 20** and **23,** Bathory discloses claims 1, 17 and 22, Bathory further discloses the mapping is affected in a three-dimensional sense, selectively being the three-dimensional sense in the x, y, and z axes or coordinates (suggested by "the co-ordinate and speed data forecasts and their normal projections on the 3D map", [0154] in view of FIG. 1; note 3D is normally shown in the x, y, and z axes, it can also shown in other 3D coordinates).

As to **claim claims 3** and **21,** Bathory discloses claim 1, Bathory further discloses the nodes are enabled selectively to communicate with GPS ("in the traffic

control system a GPS-based time adjustment prevails with a number one priority", [0450]) and with bluetooth protocols ("if necessary by *bluetooth* technology, with the object centre 2 of the consignment-carrier container or wagon playing a master role.", [0098]), and wherein the nodes are selectively part of a mesh network or other suitable network configuration (see FIG. 1 for suitable configuration).

As to **claim 4,** Bathory discloses claim 1, Bathory further discloses the nodes are enabled with a Bluetooth protocol to effect communications between nodes and users of the mapping, the users of the mapping have mobile devices being at least Bluetooth protocol enabled ("if necessary by bluetooth technology, with the object centre 2 of the consignment-carrier container or wagon playing a master role.", [0098]).

As to **claim 5,** Bathory discloses claim 1, Bathory further discloses the nodes are selectively part of a mesh network or other suitable network configuration (see FIG. 1 for suitable configuration).

As to **claim 14,** Bathory discloses claim 1, Bathory further discloses a multi-dimensional shape of a geographical area is the shape of a non-regular geometrical shape (see FIG. 1, where the space is a non-regular geometrical shape).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. **Claims 6-10, 12-13-16 and 15** are rejected under 35 U.S.C. 103(a) as being unpatentable over Bathory et al. (US 20050090978 A1, hereinafter Bathory) in view of Yoshihashi et al. (US 20040225436 A1).

As to **claim 6,** Bathory discloses claim 1, but is silent on the nodes selectively communicate with users having a selected subscriber device, the device being selectively a cell phone, PDA, or computer device.

Yoshihashi discloses the users having a selected subscriber device, the device being selectively a cell phone, PDA, or computer device ("The terminal unit 400 may be, for example, a mobile phone, a PHS (Personal Handyphone System), a PDA (Personal Digital Assistant), a portable personal computer, an in-vehicle navigation device installed on a vehicle as a movable body, and a portable navigation device", [0044]).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to apply the teaching of Yoshihashi to the system disclosed by Bathory to include a cell phone, PDA, or computer device as a user for the benefit of extending the range of the system services.

As to **claim 7,** Bathory in view of Yoshihashi discloses claim 6, Bathory further discloses the communication is through a Bluetooth protocol ("if necessary by bluetooth technology, with the object centre 2 of the consignment-carrier container or wagon playing a master role.", [0098]), and wherein the nodes are selectively part of a mesh network or other suitable network configuration (see FIG. 1 for suitable configuration).

As to **claim 8,** Bathory discloses claim 1, but does not explicitly disclose the ability to effect fine resolution determination of a location as part of a multi-dimensional map of a location containing the nodes.

Yoshihashi discloses the ability to effect fine resolution determination of a location as part of a multi-dimensional map of a location containing the nodes ("the display area VS generally displays the map with 100 to 140 pixels in the short horizontal dimension when the map is displayed on the terminal display 440", [0078]; note the number of fixels effects fine resolution determination of a location).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to apply the teaching of Yoshihashi to the system disclosed by Bathory for the benefit of having better display ([0078] of Yoshihashi).

As to **claim 9,** Bathory discloses claim 1, including defining a geographical zone, the zone being multi-dimensional (as disclosed by the parent claim), but is silent on the nodes selectively communicate with users having a selected subscriber device, the device being selectively a cell phone, PDA, or computer device.

Yoshihashi discloses nodes selectively communicate with users having a selected subscriber device, the device being selectively a cell phone, PDA, or computer device ("The terminal unit 400 may be, for example, a mobile phone, a PHS (Personal Handyphone System), a PDA (Personal Digital Assistant), a portable personal computer, an in-vehicle navigation device installed on a vehicle as a movable body, and a portable navigation device", [0044]).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to apply the teaching of Yoshihashi to the system disclosed by Bathory to include a cell phone, PDA, or computer device as a user for the benefit of extending the range of the system services.

As to **claim 10,** Bathory discloses claim 1, but is silent on loading from a computing device to memory in a transponder or subscriber device a plurality of coordinates; mapping the coordinates on a pixilated image wherein the pixilated image is configurable; and forming a contiguous array of pixels that enclose a shape in the pixilated image to form the geographic space.

Yoshihashi discloses loading from a computing device to memory in a transponder or subscriber device a plurality of coordinates (mapping the coordinates on a pixilated image wherein the pixilated image is configurable; and forming a contiguous array of pixels that enclose a shape in the pixilated image to form the geographic space ("the display area VS generally displays the map with 100 to 140 pixels in the short horizontal dimension when the map is displayed on the terminal display 440", [0078]; note the number of pixels effects fine resolution determination of a location).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to apply the teaching of Yoshihashi to the system disclosed by Bathory the benefit of having better display ([0078] of Yoshihashi).

As to **claim 12,** Bathory in view of Yoshihashi discloses claim 10, wherein the plurality of coordinates are entered by a user of a computer device, and transmitted to the transponder or subscriber device (see FIG. 1 of Yoshihashi).

As to **claim 13,** Bathory in view of Yoshihashi discloses claim 10, wherein a user enters the plurality of coordinates by the user selecting points in a map in a computer by clicking on the map; and calculating geographical coordinates of each selected point in the map (see FIGs 1 and 4 of Yoshihashi).

As to **claim 15,** Bathory discloses claim 1, but is silent on loading from a computing device to memory in a transponder or subscriber device a plurality of coordinates, wherein the plurality of coordinates identify a multi-dimensional area; dividing the multi-dimensional area into a grid, allowing at least one user to select at least one section from within the grid in order to define a multi-dimensional geographical region; and associating the at least one section with at least one pixel in a pixilated computer image of the multi-dimensional area such that the pixels selected by the at least one user are identified as being located in the multi-dimensional geographical region.

Yoshihashi discloses loading from a computing device to memory in a transponder or subscriber device a plurality of coordinates ("The terminal unit 400, therefore, only needs to display the map, so that the processing load that displays the map information M", [0112]), wherein the plurality of coordinates identify a multi-dimensional area (see FIG. 4); dividing the multi-dimensional area into a grid (see FIG. 4), allowing at least one user to select at least one section from within the grid in order to define a multi-dimensional geographical region (see FIG. 4); and associating the at least one section with at least one pixel in a pixilated computer image of the multi-dimensional area such that the pixels selected by the at least one user are identified as

being located in the multi-dimensional geographical region ("the display area VS generally displays the map with 100 to 140 pixels in the short horizontal dimension when the map is displayed on the terminal display 440", [0078] in view of FIG. 4).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to apply the teaching of Yoshihashi to the system disclosed by Bathory the benefit of having better display ([0078] of Yoshihashi).

As to **claim 16,** Bathory in view of Yoshihashi discloses claim 15, wherein the multi-dimensional area is divided into a grid of three-dimensional squares or rectangles, and wherein the three-dimensional squares or rectangles of the grid have at least one depth.

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to apply the teaching of Yoshihashi to the system disclosed by Bathory the benefit of having better display ([0078] of Yoshihashi).

7. **Claim 11** is rejected under 35 U.S.C. 103(a) as being unpatentable over Bathory et al. (US 20050090978 A1, hereinafter Bathory) in view of Yoshihashi et al. (US 20040225436 A1), further in view of Gibson (US 6,198,431 B1).

As to **claim 11,** Bathory in view of Yoshihashi discloses claim 10, but is silent on a user enters the plurality of coordinates by entering on a computer the longitude, latitude, and elevation.

Gibson discloses the plurality of coordinates by entering on a computer the longitude, latitude, and elevation ("the users location by latitude, longitude and elevation and converts if from what would be a floating way point when attempted to be placed

onto a 3-D topographical model or picture map to an accurate display of location", col. 2, lines 64-67).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to apply the teaching of Gibson to the system disclosed by Bathory in view of Yoshihashi the benefit of displaying accurate location (col. 2, line 67 of Gibson).

8. **Claims 24-28** are rejected under 35 U.S.C. 103(a) as being unpatentable over Bathory et al. (US 20050090978 A1, hereinafter Bathory) in view of Laired et al. (US 20050085257 A1), further in view of Gibson (US 6,198,431 B1).

As to **claim 24,** Bathory discloses claim 1, Bathory further discloses the mapping is affected in a three-dimensional sense, selectively being a three-dimensional sense in the x, y, and z axes or coordinates (suggested by "the co-ordinate and speed data forecasts and their normal projections on the 3D map", [0154] in view of FIG. 1).

Bathory is silent on but Laired discloses the structure is a building, the building having different floors and there are nodes on different floors whereby there are nodes at multiple different altitude levels ("one or more *floors* of an office *building*", [0031]).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to apply the teaching of Bathory to the three-dimensional zone as disclosed by Laired because a multi-floor building is just one kind of three-dimensional zone.

As to **claim 25,** Bathory discloses claim 1, Bathory further discloses the mapping is affected in a three-dimensional sense, selectively being a three-dimensional sense in

the x, y, and z axes or coordinates (suggested by "the co-ordinate and speed data forecasts and their normal projections on the 3D map", [0154] in view of FIG. 1).

Bathory is silent on but Laired discloses the structure is a building, the building having at least three different floors and there are nodes on the three different floors whereby there are nodes on at least three different altitude levels ("one or more *floors* of an office *building*", [0031]).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to apply the teaching of Bathory to the three-dimensional zone as disclosed by Laired because a multi-floor building is just one kind of three-dimensional zone.

As to **claim 26,** Bathory discloses claim 1, Bathory further discloses the mapping is affected in a three-dimensional sense, selectively being a three-dimensional sense in the x, y, and z axes or coordinates (suggested by "the co-ordinate and speed data forecasts and their normal projections on the 3D map", [0154] in view of FIG. 1).

Bathory is silent on but Laired discloses the structure is a building, the nodes being contained in the building structure at different floors and there are nodes on the different floors whereby there are nodes on at least different altitude levels ("For example, a travel box can allow a user to traverse halls or rooms of a multi-story *building* by specifying the altitude(s) of the *floor(s)* on which the user is allowed to travel", [0137]).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to apply the teaching of Bathory to the three-dimensional zone

as disclosed by Laired because a multi-floor building is just one kind of three-dimensional zone.

As to **claim 27,** Bathory discloses claim 1, Bathory further discloses the mapping is affected in a three-dimensional sense, selectively being a three-dimensional sense in the x, y, and z axes or coordinates (suggested by "the co-ordinate and speed data forecasts and their normal projections on the 3D map", [0154] in view of FIG. 1).

Bathory is silent on but Laired discloses the structure is a building, the nodes are fixed and non-movable relative to the ground and the nodes are on at least two different altitude levels ("campus WLAN 119, Bluetooth, etc., to send the check-in message", [0150]; the Aps for WLAN or Bluetooth servers placed in different floors are nodes that are fixed relative to the ground).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to apply the teaching of Bathory to the three-dimensional zone as disclosed by Laired because a multi-floor building is just one kind of three-dimensional zone.

As to **claim 28,** Bathory discloses claim 1, Bathory further discloses the mapping is affected in a three-dimensional sense, selectively being a three-dimensional sense in the x, y, and z axes or coordinates (suggested by "the co-ordinate and speed data forecasts and their normal projections on the *3D map*", [0154] in view of FIG. 1).

Bathory is silent on but Laired discloses the structure is a building, the building having different floors and there are nodes on different floors whereby there are nodes

at multiple different altitude levels, and the multi-dimensional mapping is effected internally in the building ("one or more *floors* of an office *building*", [0031]).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to apply the teaching of Bathory to the three-dimensional zone as disclosed by Laired because a multi-floor building is just one kind of three-dimensional zone.

Response to Applicant's Arguments/Amendments

Applicant's arguments and amendments filed on 1/10/12 have been considered, but are moot due to the fact that all independent claims have been amended, to which new ground rejections have been made.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jianye Wu whose telephone number is (571)270-1665. The examiner can normally be reached on Monday to Thursday, 8am to 7pm. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Seema Rao can be reached on (571)272-3174. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jianye Wu/
Primary Examiner, Art Unit 2462

Notice of References Cited	Application/Control No. 12/350,817	Applicant(s)/Patent Under Reexamination ASHLEY ET AL.	
	Examiner JIANYE WU	Art Unit 2462	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-6,198,431 B1	03-2001	Gibson, James M.	342/357.57
*	B	US-2004/0225436 A1	11-2004	Yoshihashi, Makoto	701/208
*	C	US-2005/0090978 A1	04-2005	Bathory et al.	701/213
*	D	US-2005/0085257 A1	04-2005	Laird et al.	455/550.1
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12350817	ASHLEY ET AL.
	Examiner	Art Unit
	JIANYE WU	2462

SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
Inventoship search, EAST keyword search, subclass 37/312 with keyword search.	10/1/2011	JY
Inventoship search update, EAST keyword search, subclass 37/312 with keyword search update.	1/23/2012	JY
Inventoship search update, EAST keyword search, subclass 37/312 with keyword search update.	3/8/2012	JY

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

	/JIANYE WU/ Primary Examiner.Art Unit 2462

Applicant-Initiated Interview Summary	Application No.	Applicant(s)	
	12/350,817	ASHLEY ET AL.	
	Examiner	Art Unit	
	JIANYE WU	2462	

All participants (applicant, applicant's representative, PTO personnel):

(1) *JIANYE WU*. (3)_____.

(2) *Charles Berman*. (4)_____.

Date of Interview: *03 March 2012*.

Type: ☒ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☐112 ☐102 ☒103 ☐Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: *24-28*.

Identification of prior art discussed: _____.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

Applicant pointed out that newly added claims 24-28 were not considered. Examiner noticed that in 112 rejection that 112 rejection there were typos in that 23 should be 28 and claim 24-28 are rejected because the claims are all dependent claims. Applicant suggested sending a new claim proposal for Examiner to review for a possible conclusion. Examiner expressed willingness to consider to a proposal, giving Examiner's point of view to the proposal after quick search. However, for a quick resolution, Examiner would consider proposal only once.

Applicant sent a proposal on 3/7/12, Examiner's did the search and informed Applicant that new references appeared to read on the newly added claim limitation and the claim amendment proposal was not in a form for allowance .

Applicant recordation instructions: The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

/Jianye Wu/ Primary Examiner, Art Unit 2462	

Google Exhibit 1004, Page 1034 of 1125

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews
Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.
All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:
- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:
1) A brief description of the nature of any exhibit shown or any demonstration conducted,
2) an identification of the claims discussed,
3) an identification of the specific prior art discussed,
4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
5) a brief identification of the general thrust of the principal arguments presented to the examiner,
   (The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
6) a general indication of any other pertinent matters discussed, and
7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

UNITED STATES DEPARTMENT OF COMMERCE
U.S. Patent and Trademark Office
Address : COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450

APPLICATION NO./ CONTROL NO.	FILING DATE	FIRST NAMED INVENTOR / PATENT IN REEXAMINATION	ATTORNEY DOCKET NO.
12/350,817	08 January, 2009	ASHLEY ET AL.	081221-011500

GREENBERG TRAURIG LLP (LA)
c/o: Greenberg Traurig LLP Chicago Office
77 West Wacker Drive, Suite 3100
INTELLECTUAL PROPERTY DEPARTMENT
Chicago, IL 60601

EXAMINER	
JIANYE WU	
ART UNIT	PAPER
2462	20120308

DATE MAILED:

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner for Patents

This this the final office action that would replace the final office action issued on 1/30/2012 to correct a typo that claim 1-28 are rejected instead of claim 1-23.

/Jianye Wu/
Primary Examiner, Art Unit 2462

PTO-90C (Rev.04-03)

UNITED STATES PATENT AND TRADEMARK OFFICE

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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/350,817	01/08/2009	James Ashley JR.	081221-011500	7586

33717 7590 03/21/2012

GREENBERG TRAURIG LLP (LA)
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77 West Wacker Drive, Suite 3100
INTELLECTUAL PROPERTY DEPARTMENT
Chicago, IL 60601

EXAMINER	
WU, JIANYE	
ART UNIT	**PAPER NUMBER**
2462	

NOTIFICATION DATE	DELIVERY MODE
03/21/2012	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

clairt@gtlaw.com
laipmail@gtlaw.com
rupickd@gtlaw.com

Google Exhibit 1004, Page 1037 of 1125

Office Action Summary	Application No.	Applicant(s)	
	12/350,817	ASHLEY ET AL.	
	Examiner	Art Unit	
	JIANYE WU	2462	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10 January 2012*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

5)☒ Claim(s) *1-28* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1-28* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

12)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☒ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S32	3	(geographical adj zone) same2 (map near4 (multi$1dimension$5)) (user with vehicle) (node with user with (control adj station))	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
S33	0	(geographical adj zone) same2 (map near4 (multi$1dimension$5)) (user with vehicle) (node with user with (control adj station)) (@ad< "20041105" OR @rlad< "20041105")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
S34	40	Map$5 with (dimension$5) (geographical near2 zone) (user OR device) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
S35	0	Map$5 with (dimension$5) (geographical near2 zone) (user OR device) bluetooth (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
S39	107	Map$5 with (dimension$5) (device) with bluetooth with GPS (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
S41	0	Map$5 with (dimension$5) (device) with bluetooth with GPS PDS (mobile OR cell$5) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
S42	107	Map$5 with (dimension$5) (device) with bluetooth with GPS (mobile OR cell$5) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
S43	0	Map$5 with (dimension$5) (device) with bluetooth with GPS (mobile OR cell$5) (pixilated adj2 image) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
S46	40	Map$5 near2 (dimension$5) (device) with bluetooth near4 GPS (mobile OR cell$5) (pix$7 with image) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
S47	61	(device) with bluetooth near4 GPS (mobile OR cell$5) (pix$7 with image) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
S48	7	Map$5 with pix$7 with (dimension$5) (geographical near2 zone) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
S50	31	Map$5 with pix$7 with (dimension$5) (PDA with ((cell OR mobile) adj phone) with computer) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
S53	39	Map$5 with (longitude with latitude with	US-PGPUB;	AND	ON	2012/01/24

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		elevation) ((cell OR mobile) adj phone) with computer (@ad< "20090108" OR @rlad< "20090108")	USPAT; DERWENT			22:42
S54	0	Map$5 with pix$7 with (longitude with latitude with elevation) ((cell OR mobile) adj phone) with computer (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
S55	9	Map$5 with pix$7 Map$5 with (longitude with latitude with elevation) ((cell OR mobile) adj phone) with computer (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
S56	5	Map$5 with pix$7 user with (longitude with latitude with elevation) ((cell OR mobile) adj phone) with computer (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
S57	1877	(370/312).OCLS.	US-PGPUB; USPAT; DERWENT	OR	OFF	2012/01/24 22:42
S58	0	S57 Map$5 with pix$7 with (dimension$5) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/01/24 22:42
S69	4	AICH with E$AICH with differen$5	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2012/01/27 17:41
S70	4	AICH with E$1AICH with differen$5	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2012/01/27 17:42
S79	1	(second adj preamble) with synchroni$7 with (one near4 receiv$5) with (other near4 transmi$7)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2012/01/27 21:42
S80	23	(second adj preamble) with synchroni$7 with receiv$5 with transmi$7	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2012/01/27 21:47
S81	30	(OFDM near2 symbol) near4 (sub$1carrier near2 band)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2012/01/27 22:00
S82	1	(second adj preamble) with synchroni$7 with (one near4 receiv$5) with (other near4 transmi$7) sub$1channel$9	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2012/01/27 22:01
S84	2	"20050090978"	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2012/03/06 16:49
S85	513	((three OR "3")$1dimension$5) with location with (device)) (bluetooth OR WiFi OR "802.11"$5 building with floor (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/03/08 20:50
S86	21	((three OR "3")$1dimension$5 with location with (device OR user OR object	US-PGPUB; USPAT;	AND	ON	2012/03/08 20:52

Google Exhibit 1004, Page 1040 of 1125

		OR node)) location with (bluetooth OR WiFi OR "802.11"$5) building with floor (@ad< "20090108" OR @rlad< "20090108")	DERWENT			

EAST Search History (Interference)

< This search history is empty>

3/ 9/ 2012 1:41:51 PM
C:\ Users\ jwu2\ Documents\ EAST\ Workspaces\ 12350817.wsp

Google Exhibit 1004, Page 1041 of 1125

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	James Ashley, Jr. et al.	Examiner:	Jianye Wu
Serial No.:	12/350,817	Group Art Unit:	2462
Filed:	January 8, 2009	Docket No.:	081221-011500
Customer No.:	33717	Confirmation No.:	7586
Title:	MAPPING IN A MULTI-DIMENSIONAL SPACE		

CERTIFICATE OF TRANSMISSION

I hereby certify that this document is being transmitted electronically to the United States Patent and Trademark Office via the EFS Web e-Filing system on April 12, 2012.

Name: Rosemary D. Payton

INFORMATION DISCLOSURE STATEMENT [37 C.F.R. § 1.56]

MAIL STOP: AMENDMENT
Commissioner for Patents
Post Office Box 1450
Alexandria, Virginia 22313-1450

Sir/Madam:

Pursuant to 37 C.F.R. §§ 1.56, 1.97 and 1.98, applicant brings the references listed on the attached Form SB-08 to the examiner's attention. 37 C.F.R. § 1.56. Do not construe the filing of this information disclosure statement as a representation that applicant has made a search (37 C.F.R. § 1.97(g)), or as an admission that the information cited is, or is considered to be, material to patentability, or that no other material information exists. We enclose copies of any cited foreign documents. Copies of the U.S. references are not enclosed.

This Information Disclosure Statement is being submitted:

☐ 1. Within three months of the filing date of a national application other than a continued prosecution application under 37 C.F.R. § 1.53(d), or within three months of the date of entry of the national stage as set forth in 37 C.F.R. § 1.491 in an international application; or **before the mailing date of a first**

Google Exhibit 1004, Page 1042 of 1125

office action on the merits, and therefore, Applicant believes no fee is required;

☐ 2. After the period specified in paragraph (1) above of this section, but before the mailing date of either a final action under 37 C.F.R. § 1.113, or a notice of allowance under 37 C.F.R. § 1.311, whichever occurs first, and is accompanied by either:

☐ a. A statement that:

(i) Each item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application not more than three months before the filing of the information disclosure statement; or

(ii) No item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the statement after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months before the filing of the information disclosure statement;

☐ b. The fee for filing an Information Disclosure Statement under 37 C.F.R. § 1.17(p) is $180.00.

☒ 3. After the period specified in paragraph (2) of this section, but on or before payment of the issue fee and is accompanied by:

☒ a. A statement that:

(i) Each item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application not more than three months before the filing of the information disclosure statement; or

Google Exhibit 1004, Page 1043 of 1125

(ii) No item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the statement after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months before the filing of the information disclosure statement; and

☒ b. The fee set forth in 37 C.F.R. § 1.17(p).

Applicant would appreciate the examiner initialing and signing a copy of attached Form PTO-1449 indicating that he or she considered the information and made the information of record.

If the transmittal letter is separated from this document and the PTO determines that an extension or other relief is required, applicant petitions for any required relief including extensions of time and authorizes the Commissioner to charge the cost of such petitions and/or other fees due in connection with the filing of this document to Deposit Account No. 50-2638.

Authorization is hereby given to charge any fees due, or credit any overpayment of fees, to Deposit Account No. 50-2638.

Respectfully submitted,

Date: April 12, 2012

/charles berman/
Charles Berman
Reg. No. 29,249

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Google Exhibit 1004, Page 1044 of 1125

PTO/SB/08A (07-09)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Substitute for form 1449B/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 1

Complete if Known	
Application Number	12/350,817
Filing Date	January 8, 2009
First Named Inventor	James Ashley, Jr.
Art Unit	2462
Examiner Name	Jianye Wu
Attorney Docket Number	081221-011500

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	1	US- 6,531,963 B1	03-11-2003	Nyfelt	
	2	US- 2003/0137435 A1	07-24-2003	Haddad et al.	
	3	US- 2003/0141962 A1	07-31-2003	Barink	
	4	US- 2003/0158635 A1	08-21-2003	Pillar et al.	
	5	US- 2004/0203944 A1	10-14-2004	Huomo et al.	
	6	US- 2004/0215750 A1	10-28-2004	Stilp	
	7	US- 2005/0151654 A1	07-14-2005	Curwen	
		US-			

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3] Number[4] Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[5]

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include the name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published	T[2]

LA 130223164v1

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.
[1] Applicant's unique citation designation number (optional). [2] Applicant is to place a check mark here if English language Translation is attached.
This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Electronic Acknowledgement Receipt	
EFS ID:	12530733
Application Number:	12350817
International Application Number:	
Confirmation Number:	7586
Title of Invention:	MAPPING IN A MULTI-DIMENSIONAL SPACE
First Named Inventor/Applicant Name:	James Ashley
Customer Number:	33717
Filer:	Charles Berman/Rosemary Payton
Filer Authorized By:	Charles Berman
Attorney Docket Number:	081221-011500
Receipt Date:	12-APR-2012
Filing Date:	08-JAN-2009
Time Stamp:	17:03:53
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$180
RAM confirmation Number	3846
Deposit Account	502638
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		081221-011500-IDS.pdf	451346 372a38cc1881961cce7ac4d9dcbaf2e11103f4a1	yes	4

Multipart Description/PDF files in .zip description		
Document Description	**Start**	**End**
Transmittal Letter	1	3
Information Disclosure Statement (IDS) Form (SB08)	4	4

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	30288 87f477b42d7514d2496abf7e2e2afb25ae1ff7fc	no	2

Warnings:

Information:

Total Files Size (in bytes):	481634

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Electronic Patent Application Fee Transmittal	
Application Number:	12350817
Filing Date:	08-Jan-2009
Title of Invention:	MAPPING IN A MULTI-DIMENSIONAL SPACE
First Named Inventor/Applicant Name:	James Ashley
Filer:	Charles Berman/Rosemary Payton
Attorney Docket Number:	081221-011500
Filed as Large Entity	

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Doc code: RCEX
Doc description: Request for Continued Examination (RCE)

PTO/SB/30EFS (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	12350817	Filing Date	2009-01-08	Docket Number (if applicable)	081221-011500	Art Unit	2462
First Named Inventor	James Ashley Jr.			Examiner Name	Jianye Wu		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

- ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____
- ☐ Other _____

☒ Enclosed

- ☒ Amendment/Reply
- ☐ Information Disclosure Statement (IDS)
- ☐ Affidavit(s)/ Declaration(s)
- ☐ Other _____

MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____ (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other _____

FEES

☒ **The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.**
The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No 502638

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature

☐ Applicant Signature

Google Exhibit 1004, Page 1050 of 1125

PTO/SB/30EFS (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Signature of Registered U.S. Patent Practitioner			
Signature	/charles berman/	Date (YYYY-MM-DD)	2012-06-22
Name	Charles Berman	Registration Number	29249

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

REMARKS

The office action issued by the Examiner and the citations referred to in the office action have been carefully considered. A Request for Continued Examination is being filed with this response, and reconsideration is requested.

Claims 1-23 have been cancelled.

Claim 24 is amended and new claims 29 to 53 have been added. No new matter is added by this amendment.

Claim 24 is for

- a communication node for communication with a receiver and transmitter.
- communication between a plurality of nodes.
- nodes at multiple different levels
- a plurality of nodes in the multidimensional sense being placed with a structure attached to the ground
- the structure is a building, the building having different floors
- nodes on different floors whereby there are nodes at multiple different levels
- the system narrows the plurality of nodes for use by the user to the most practically near node to a user, such that a node on one floor, even though physically closer to a user is excluded as being a node the most practically near to that user, and a different node on a different floor is the most practically near to that user

New Claim 29 has been added. It covers the features of:

- using a preconfigured geographical zone, wherein the zone includes a plurality of spaced apart communication transponders; the transponders including a

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transmitter and receiver and wherein at least one of the transponders permits communication with a mobile device of a user;

- sending data communication between pluralities of the transponders in a network communication protocol with each other, applying the plurality of transponders in the network with each other to define the multi dimensional zone,
- communicating between at least one transponder to the mobile user and between at least one transponder; the communication between the mobile device of the user and the least one transponder being effected by at least one of a bluetooth or a wi fi protocol thereby to determine the location of the user in the zone through such communication;
- arranging the transponders at locations in the zone, and the respective locations of the plurality of transponders in the zone being placed within a building structure;
- obtaining and analyzing data related to the location of the mobile user according to the placement of the transponders in the zone;
- enabling selected mobile communication devices to be in communication with at least one selected communication transponder when the devices are within range of the selected transponder;
- the mobile user receiving selection parameter data from multiple transponders, and utilizing the selection parameters, such that the system narrows the plurality of transponders to the most practically near transponder, such most practically near transponder not necessarily being the transponder physically closest to the mobile user;
- associating respective users of respective mobile devices with a respective profile of the respective user of the respective mobile device;
- sending a targeted message to a selected mobile device of a selected user from the selected communication transponder when the selected mobile device is in range; and
- tailoring the targeted message to the profile of the user associated with the mobile device.

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Further the invention as now claimed in new claims 29 to 51 are directed to

- enabling selected mobile communication devices to be in communication with at least one selected communication transponder when the devices are within range of the selected transponder;
- associating respective users of the respective mobile devices with a profile of the user of the respective mobile device;
- sending a targeted message to the mobile device from the selected communication transponder when the selected mobile device is in range; and
- tailoring a targeted message to the profile of the user associated with the mobile device.

The Applicants further add new claim 52 directed to:

- effecting a location transponder selection by a general wireless communication of multiple location transponder located within communication range in the zone, obtaining unique location transponder radio addresses, searching for wireless devices of at least one subclass, the subclasses being selected to include specific types of wireless communication devices, selectively cell phones, pagers, PDAs, and laptop computers, or by searching for at least one specific wireless device operating in a specific mode

Support for this claim is in paragraph [0175] of the application.

The Applicants further add new claim 53 directed to:

- arranging the transponders in a multi-dimensional sense about the zone, the transponders being distributed in separate mesh networks, and the mesh networks being in different specific zones, and wherein different mesh networks of transponders are associated with a dedicated base station

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Support for this claim is in paragraph [0215] of the application.

In view of the amendments, the rejection of claims 1-23 is moot.

Claims 24-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bathory et al. (US 20050090978 Al, hereinafter Bathory) in view of Laired et al. (US 20050085257 Al), further in view of Gibson (US 6,198,431 B1).

This invention as defined in claim 24 is fundamentally different to Bathory. Also no other reference deals with multidimensional nodes set up in the manner as claimed. The reference of Laired is not relevant because there is nothing remotely dealing with a system that narrows the plurality of nodes for use by the user to the most practically near node to a user, such that a node on one floor, even though physically closer to a user is excluded as being a node the most practically near to that user, and a different node on a different floor is the most practically near to that user.

Laired, as identified by the Examiner relates only to a multifloor campus and communications due to emergency.

There is nothing indicating how mapping can be affected; nor whether the transponders (nodes) are transmitters and receivers, it relates to emergency communications only, and has nothing to do with the other characteristics of the present invention as claimed in the different claims.

For instance different uses and applications of the present invention are claimed in claims 46-51, and this is not remotely disclosed, taught or suggested in this art.

Further, and in particular, and by way of example only, there is nothing remotely concerned with:

- the mobile user receiving selection parameter data from multiple transponders, and utilizing the selection parameters, such that the system narrows the plurality of transponders to the most practically near transponder, such most practically

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near transponder not necessarily being the transponder physically closest to the mobile user;

- associating respective users of respective mobile devices with a respective profile of the respective user of the respective mobile device;
- sending a targeted message to a selected mobile device of a selected user from the selected communication transponder when the selected mobile device is in range; and
- tailoring the targeted message to the profile of the user associated with the mobile device.

Indeed no reference deals with nodes used for mapping a structure. Accordingly it is unnecessary to discuss the cited art and rejections in further detail.

A review of the appropriate legal standards for obviousness should be helpful.

In *ex parte Stephen R. Rohrer And Joseph M. Endter*, Appeal 2009-001292 Application 11/070,488 Decided: February 5, 2010 the BPAI stated the principles in regard to obviousness as follows:

Principles of Law

> Rejections based on 35 U.S.C. § 103 must rest on a factual basis. In making such a rejection, the Examiner has the initial duty of supplying the requisite factual basis and may not, because of doubts that the invention is patentable, resort to speculation, unfounded assumptions or hindsight reconstruction to supply deficiencies in the factual basis. See *In re Warner*, 379 F.2d 1011, 1017 (CCPA 1967). Further, in rejecting claims as unpatentable on the basis of obviousness, the Examiner must provide "some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *KSR Int'l. Co. v. Teleflex, Inc.*, 550 U.S. 398, 418 (2007).
>
> In other words, it is improper to base a conclusion of obviousness upon facts gleaned only through hindsight. "To draw on hindsight knowledge of the patented invention, when the prior art does not contain or suggest that knowledge, is to use the invention as a template for its own reconstruction—an illogical and inappropriate process by which to determine patentability." *Sensonics, Inc. v. Aerosonic Corp.*, 81 F.3d 1566, 1570 (Fed. Cir. 1996) (citing *W.L. Gore & Assoc. v. Garlock, Inc.*, 721 F.2d 1540, 1553 (Fed. Cir. 1983)). "The invention must be

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> viewed not after the blueprint has been drawn by the inventor, but as it would have been perceived in the state of the art that existed at the time the invention was made." *Id.* (citing *Interconnect Planning Corp. v. Feil*, 774 F.2d 1132, 1138 (Fed. Cir. 1985)).
>
> To support a conclusion that a claim is directed to obvious subject matter, prior art references must suggest expressly or impliedly the claimed invention or an Examiner must present a "convincing line of reasoning' as to why one of ordinary skill in the art would have found the claimed invention to have been obvious. *Ex parte Clapp*, 227 USPQ 972, 973 (BPAI 1985). When determining whether a rejection based on design choice is appropriate, the Examiner must review the Specification and ascertain *if the limitation in question* is disclosed as serving any advantage or particular purpose, or whether it solves a stated problem. The Examiner also should explain the reasoning used to determine that the prior art would have performed equally as well as the claimed invention. These two steps help present the aforementioned "convincing line of reasoning." *Ex parte Clapp*, 227 USPQ at 973. [emphasis added]

The prior art references do not suggest expressly or impliedly the claimed invention and based on that the Examiner cannot present a "convincing line of reasoning" as to why one of ordinary skill in the art would have found the claimed invention to have been obvious.

Respectfully the Examiner needs to consider each of these specific requirements of the claims. With this in mind there is no basis for making a rejection of the pending claims without any supportable art or suggestion in the art.

To conclude otherwise, the Examiner would incorrectly apply a hindsight reconstruction in consideration of the claims. Since the prior art in any combination does not support any different conclusion, the Examiner's position and conclusion of obviousness is wrong in fact and contrary to the law.

More so, even with the cited art there are steps in the claims which are not taught disclosed or suggested.

The appropriate KSR standard and its progeny cases apply in dealing with the obviousness standard. Although the teaching, suggestion, motivation test is still recognized under *KSR*, the test is largely subsumed by the more general principles laid out in *KSR*. Indeed,

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in any given application, the combination of elements "must do more than yield a predictable result." *Id.* at 1740. Nevertheless, combining elements "in an unexpected and fruitful manner" is sufficient to render an invention non-obvious. *Id.*

More importantly, "a patent composed of several elements **is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art.**" KSR *Id.* (emphasis added).

In *KSR*, the Supreme Court addressed such logic in obviousness-type rejections. Importantly, *KSR* specifically forbids obviousness rejections simply because each element was independently known in the prior art. The art cited against the instant application falls into this rubric because they are nothing more than a string of references showing some of the claimed elements with tenuous logic to support their combination.

As stated In *ex parte Stephen R. Rohrer And Joseph M. Endter*, supra:

> a patent [claim] composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art. Although common sense directs one to look with care at a patent application that claims as innovation the combination of two known devices according to their established functions, it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does.

KSR Int'l., 550 U.S. at 418.

In this case, the Examiner cannot provide a cogent reason. The Applicants submit that a person of ordinary skill in the art would not reasonably infer or deduce anything from the prior art in the sense of allowing the features to be considered an obvious choice.

The Examiner cannot meet the KSR threshold tests, since there would be a necessity to combine other references for the missing elements (and no such other references exist) and for the Examiner to show that there is a teaching, suggestion, or motivation to combine them and thereby attain the invention as claimed. Since the prior art is silent as to the claimed features, the

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Applicants submit that the prior art applied by the Examiner does not show or render obvious the submitted claims.

At the time of the invention, it was the inventor's insights and willingness to confront and overcome the obstacles which led to the invention as claimed. The invention as claimed is more than a mere design choice.

It is respectfully submitted that all of the Examiner's objections have been successfully traversed and that the application is now in order for allowance. Accordingly, reconsideration of the application and allowance thereof is courteously solicited.

A Request for Continued Examination follows this paper.

The Director is authorized to charge any additional fee(s) or any underpayment of fee(s), or to credit any overpayments to **Deposit Account Number 50-2638**. Please ensure that Attorney Docket Number 081221-011500 is referred to when charging any payments or credits for this case.

Respectfully submitted,

Date: June 22, 2012

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AMENDMENTS TO THE CLAIMS

Claims 1 to 23 (cancel)

Claim 24 (currently amended): A method for developing a map for use by a user, the user being selectively individuals, vehicles, and other entities, comprising:

using a geographical zone, the zone selectively being a preconfigured geographical zone,

the zone including a plurality of spaced apart nodes, wherein the nodes are arranged in a multi-dimensional sense, the location of the plurality of nodes in the multidimensional sense being placed with a structure attached to the ground;

sending data communications between one or more of the nodes, one or more users, and one or more control stations; and

affecting multi-dimensional mapping according to the placement of the nodes and the communications between the nodes and the control stations, ~~The method of claim 1,~~ wherein the mapping is affected in a three-dimensional sense, selectively being a three-dimensional sense in the x, y, and z axes or coordinates and the structure is a building, the building having different floors and there are nodes on different floors whereby there are nodes at multiple different ~~altitude~~ levels, and wherein the system narrows the plurality of nodes for use by the user to the most practically near node to a user, such that a node on one floor, even though physically closer to a user is excluded as being a node the most practically near to that user, and a different node on a different floor is the most practically near to that user.

Claim 25 (currently amended): The method of claim ~~1~~ 24, wherein the mapping is affected in a three-dimensional sense, selectively being a three-dimensional sense in the x, y, and z axes or coordinates and the structure is a building, the building having at least three different floors and there are nodes on the three different floors whereby there are nodes on at least three different ~~altitude~~ levels.

Claim 26 (currently amended): The method of claim ~~1~~ 24, wherein the mapping is affected in a three-dimensional sense, selectively being a three-dimensional sense in the x, y, and z axes or coordinates and the structure is a building, the nodes being contained in the building structure at

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different floors and there are nodes on the different floors whereby there are nodes on at least different ~~altitude~~ levels.

Claim 27 (currently amended): The method of claim ~~1~~ 24,, wherein the mapping is affected in a three-dimensional sense, selectively being a three-dimensional sense in the x, y, and z axes or coordinates and the structure is a building, the nodes are fixed and non-movable relative to the ground and the nodes are on at least two different ~~altitude~~ levels.

Claim 28 (currently amended): The method of claim ~~1~~ 24, wherein the mapping is affected in a three-dimensional sense, selectively being a three-dimensional sense in the x, y, and z axes or coordinates and the structure is a building, the building having different floors and there are nodes on different floors whereby there are nodes at multiple different ~~altitude~~ levels, and the multi-dimensional mapping is effected internally in the building.

Claim 29 (new): A method of communicating data between at least one selected communication transponder and at least one selected mobile communication device comprising:

using a geographical zone, wherein the zone includes a plurality of spaced apart communication transponders; the transponders including a transmitter and receiver and wherein at least one of the transponders permits communication with a mobile device of a user;

sending data communication between pluralities of the transponders in a network communication protocol with each other, applying the plurality of transponders in the network with each other to define the zone,

communicating between at least one transponder to the mobile user and between at least one transponder; the communication between the mobile device of the user and the least one transponder being effected by at least one of a bluetooth or a wi fi protocol thereby to determine the location of the user in the zone through such communication;

arranging the transponders at locations in the zone, and the respective locations of the plurality of transponders in the zone being placed within a building structure;

obtaining and analyzing data related to the location of the mobile user according to the placement of the transponders in the zone;

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enabling selected mobile communication devices to be in communication with at least one selected communication transponder when the devices are within range of the selected transponder;

the mobile user receiving selection parameter data from multiple transponders, and utilizing the selection parameters, such that the system narrows the plurality of transponders to the most practically near transponder, such most practically near transponder not necessarily being the transponder physically closest to the mobile user;

associating respective users of respective mobile devices with a respective profile of the respective user of the respective mobile device;

sending a targeted message to a selected mobile device of a selected user from the selected communication transponder when the selected mobile device is in range; and

tailoring the targeted message to the profile of the user associated with the mobile device.

Claim 30 (new): The method of claim 29, wherein the transponders are arranged in a three-dimensional sense, selectively being a three-dimensional sense in the x, y, and z axes or coordinates.

Claim 31 (new): The method of claim 29, including employing at least one Bluetooth™ equipped mobile personal device associated with at least one user, the at least one device communicating with Bluetooth™ enabled location transponders in a network.

Claim 32 (new): The method of claim 29, wherein the at least one Bluetooth™ equipped mobile personal device contains at least one specific algorithm to determine the relatively precise location of the at least one user within the network.

Claim 33 (new): The method of claim 29, wherein when the at least one Bluetooth™ equipped mobile personal device is within the range of certain location transponders, specified events are triggered.

Claim 34 (new): The method of claim 29, including the downloading of at least one message, to the at least one Bluetooth™ equipped mobile personal device.

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Claim 35 (new): The method of claim 29, including transmitting to selected transponders the location data of the at least one user, the selected transponders transmitting the data to a control center via other transponders within selectively at least one of a network, or intermediate stations.

Claim 36 (new): The method of claim 29, wherein the location data of the at least one user is processed and analyzed at selectively at least one of a control center or an intermediate station.

Claim 37 (new): The method of claim 29 including using a geographical zone, the zone being multi-dimensional, and messaging a movable entity that has a transponder or subscriber device, the device being selectively a cell phone, PDA, computer, or device which is configured to be in wireless communication with other devices through a suitable network.

Claim 38 (new): The method of claim 29, wherein messages are communicated with entities according to the location of the entities as mapped in the multi-dimensional space.

Claim 39 (new): The method of claim 29, including defining a geographical zone, the zone being multi-dimensional, and messaging or regulating a movable entity that has a transponder or subscriber device, the device being selectively a cell phone, PDA, computer or device which is configured to be in wireless communication with other devices through a suitable network.

Claim 40 (new): The method of claim 29, including a three-dimensional shape for the geographical zone.

Claim 41 (new): The method of claim 29, including downloading messages, and wherein the messages are directed to a user when the user is determined to be a particular location in the multidimensional space, and not when the user is outside the particular location.

Claim 42 (new): The method of claim 29, wherein the profile of the user includes the behavior of the user, and includes the length of time the user spends in the vicinity of different transponders in the zone.

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Claim 43 (new): The method of claim 29, including the downloading of at least one commercial message, selectively an advertisement, to the at least one Bluetooth™ equipped mobile personal device.

Claim 44 (new): The method of claim 29, including the downloading of a commercial message, selectively an advertisement, to the Bluetooth™ equipped mobile personal device.

Claim 45 (new): The method of claim 29, including transmitting to selected transponders the user's location data, the selected transponders transmitting the data to a control center via other transponders within selectively at least one of a network, relay station, or intermediate supplementing stations.

Claim 46 (new): The method of claim 29, wherein the profile of the user includes the behavior of the user includes at least one of the length of time the user spends in the vicinity of different transponders in the zone, the purchasing patterns of the user, the product or service preferences of a user; the commercial enquiries of a user, and the dining or entertainment preferences of the user.

Claim 47 (new): The method of claim 29 including creating multiple networks, each network communicating with a respective base station, and the respective base stations communicating with each other and a control station, these communications being effected at least in part by at least one of blue tooth or wi fi.

Claim 48 (new): The method of claim 29 wherein the multi-dimensional zone is such that there are networks at discreet and separate floors of a building, and there being a physical ceiling/floor barrier between each separate floor, and the network being such that with the multiple transponders utilizing selection parameters, the system narrows the plurality of transponders to the most practically near transponder to a user.

Claim 49 (new): The method of claim 29, wherein the profile of the user includes the purchasing patterns of the user.

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Claim 50 (new): The method of claim 29, wherein the profile of the user includes the dining or entertainment preferences of the user.

Claim 51 (new): The method of claim 29,wherein a transponder on one floor of a building, even though physically closer to a user is excluded as being a transponder being the most practically near to that user, and that physically further transponder on a different floor to the user is the most practically near to that user.

Claim 52 (new): A method of communicating data between at least one selected communication transponder and at least one selected mobile communication device comprising:

using a geographical zone, wherein the zone includes a plurality of spaced apart communication transponders; the transponders including a transmitter and receiver and wherein at least one of the transponders permits communication with a mobile device of a user;

sending data communication between pluralities of the transponders in a network communication protocol with each other, applying the plurality of transponders in the network with each other to define the zone,

communicating between at least one transponder to the mobile user and between at least one transponder; the communication between the mobile device of the user and the least one transponder being effected by at least one of a bluetooth or a wi fi protocol thereby to determine the location of the user in the zone through such communication;

arranging the transponders at locations in the zone, and the respective locations of the plurality of transponders in the zone being placed within a building structure;

obtaining and analyzing data related to the location of the mobile user according to the placement of the transponders in the zone;

enabling selected mobile communication devices to be in communication with at least one selected communication transponder when the devices are within range of the selected transponder;

effecting a location transponder selection by a general wireless communication of multiple location transponder located within communication range in the zone, obtaining unique location transponder radio addresses, searching for wireless devices of at least one subclass, the subclasses being selected to include specific types of wireless communication devices,

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selectively cell phones, pagers, PDAs, and laptop computers, or by searching for at least one specific wireless device operating in a specific mode;

associating respective users of respective mobile devices with a respective profile of the respective user of the respective mobile device;

sending a targeted message to a selected mobile device of a selected user from the selected communication transponder when the selected mobile device is in range; and

tailoring the targeted message to the profile of the user associated with the mobile device.

Claim 53 (new): A method of communicating data between at least one selected communication transponder and at least one selected mobile communication device comprising:

using a preconfigured geographical zone, wherein the zone includes a plurality of spaced apart communication transponders; the transponders including a transmitter and receiver and wherein at least one of the transponders permits communication with a mobile device of a user;

sending data communication between pluralities of the transponders in a network communication protocol with each other, applying the plurality of transponders in the network with each other to define the zone,

communicating between at least one transponder to the mobile user and between at least one transponder; the communication between the mobile device of the user and the least one transponder being effected by at least one of a bluetooth or a wi fi protocol thereby to determine the location of the user in the zone through such communication;

arranging the transponders at locations in the zone, and the respective locations of the plurality of transponders in the zone being placed within a building structure;

arranging the transponders in a multi-dimensional sense about the zone, the transponders being distributed in separate mesh networks, and the mesh networks being in different specific zones, and wherein different mesh networks of transponders are associated with a dedicated base station;

obtaining and analyzing data related to the location of the mobile user according to the placement of the transponders in the zone;

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enabling selected mobile communication devices to be in communication with at least one selected communication transponder when the devices are within range of the selected transponder;

associating respective users of respective mobile devices with a respective profile of the respective user of the respective mobile device;

sending a targeted message to a selected mobile device of a selected user from the selected communication transponder when the selected mobile device is in range; and

tailoring the targeted message to the profile of the user associated with the mobile device.

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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	James Ashley, Jr. et al.	Examiner:	Jianye Wu
Serial No.	12/350,817	Group Art Unit:	2462
Filed:	January 8, 2009	Docket No.	081221-011500
Customer No.:	33717	Confirmation No.:	7586
Title:	MAPPING IN A MULTI-DIMENSIONAL SPACE		

CERTIFICATE OF TRANSMISSION

I hereby certify that this document is being transmitted electronically to the United States Patent and Trademark Office via the EFS Web e-Filing system on June 22 , 2012.

Name: Rosemary D. Payton

AMENDMENT AFTER FINAL

MAIL STOP: AMENDMENT AF
Commissioner for Patents
Post Office Box 1450
Alexandria, Virginia 22313-1450

Sir/Madam:

In response to the Final Office Action mailed March 21, 2012, kindly enter the following amendments:

Amendments to the Claims begin on page 2.

Remarks/Argument begin on page 10.

Request for Continued Examination follows page 17.

Google Exhibit 1004, Page 1068 of 1125

Electronic Acknowledgement Receipt	
EFS ID:	13087776
Application Number:	12350817
International Application Number:	
Confirmation Number:	7586
Title of Invention:	MAPPING IN A MULTI-DIMENSIONAL SPACE
First Named Inventor/Applicant Name:	James Ashley
Customer Number:	33717
Filer:	Charles Berman/Rosemary Payton
Filer Authorized By:	Charles Berman
Attorney Docket Number:	081221-011500
Receipt Date:	22-JUN-2012
Filing Date:	08-JAN-2009
Time Stamp:	17:54:58
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$600
RAM confirmation Number	5211
Deposit Account	502638
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		081221-011500.pdf	2293695 774049917b4c29b64e2a6f51dbdc89f348a43024	yes	19

Multipart Description/PDF files in .zip description

Document Description	Start	End
Amendment After Final	1	1
Claims	2	9
Applicant Arguments/Remarks Made in an Amendment	10	17
Request for Continued Examination (RCE)	18	19

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	33798 63281b0743fbcb4457473956609ce95ecd87b354	no	2

Warnings:

Information:

Total Files Size (in bytes):	2327493

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Electronic Patent Application Fee Transmittal	
Application Number:	12350817
Filing Date:	08-Jan-2009
Title of Invention:	MAPPING IN A MULTI-DIMENSIONAL SPACE
First Named Inventor/Applicant Name:	James Ashley
Filer:	Charles Berman/Rosemary Payton
Attorney Docket Number:	081221-011500
Filed as Small Entity	

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Claims in excess of 20	2202	2	30	60
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension - 1 month with $0 paid	2251	1	75	75
Miscellaneous:				
Request for continued examination	2801	1	465	465
		Total in USD ($)		**600**

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
12/350,817	01/08/2009	

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)	SMALL ENTITY ☒		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT	06/22/2012	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 30	Minus	** 28	= 2	X $30 =	60	OR	X $ =	
	Independent (37 CFR 1.16(h))	* 4	Minus	***4	= 0	X $125 =	0	OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE	60	OR	TOTAL ADD'L FEE	

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)	OR	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/PARTHENIA D. MERRILL/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Electronic Acknowledgement Receipt	
EFS ID:	13156139
Application Number:	12350817
International Application Number:	
Confirmation Number:	7586
Title of Invention:	MAPPING IN A MULTI-DIMENSIONAL SPACE
First Named Inventor/Applicant Name:	James Ashley
Customer Number:	33717
Filer:	Charles Berman/Rosemary Payton
Filer Authorized By:	Charles Berman
Attorney Docket Number:	081221-011500
Receipt Date:	02-JUL-2012
Filing Date:	08-JAN-2009
Time Stamp:	12:58:08
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$180
RAM confirmation Number	13060
Deposit Account	502638
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		081221-011500-IDS.pdf	649833 b0a2b6cff41cdbad41e2aaf7bb4c37c9d0a52089	yes	4

	Multipart Description/PDF files in .zip description		
	Document Description	Start	End
	Transmittal Letter	1	3
	Information Disclosure Statement (IDS) Form (SB08)	4	4

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	30162 b060e6333d8f24c72440e25441e9b8104cd93b71	no	2

Warnings:

Information:

Total Files Size (in bytes):	679995

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/08A (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number

Substitute for form 1449B/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 1

Complete if Known	
Application Number	12/350,817
Filing Date	January 8, 2009
First Named Inventor	James Ashley, Jr.
Art Unit	2462
Examiner Name	Jianye Wu
Attorney Docket Number	081221-011500

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	1	US- 2010/0293106 A1	11-18-2010	Rhoads et al.	
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3] Number[4] Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include the name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published	T[2]

LA 130352366v1

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.
[1] Applicant's unique citation designation number (optional). [2] Applicant is to place a check mark here if English language Translation is attached.
This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	James Ashley, Jr. et al.	Examiner:	Jianye Wu
Serial No.:	12/350,817	Group Art Unit:	2462
Filed:	January 8, 2009	Docket No.:	081221-011500
Customer No.:	33717	Confirmation No.:	7586
Title:	MAPPING IN A MULTI-DIMENSIONAL SPACE		

CERTIFICATE OF TRANSMISSION

I hereby certify that this document is being transmitted electronically to the United States Patent and Trademark Office via the EFS Web e-Filing system on July 2, 2012.

Name: Rosemary D. Payton

INFORMATION DISCLOSURE STATEMENT [37 C.F.R. § 1.56]

MAIL STOP: AMENDMENT
Commissioner for Patents
Post Office Box 1450
Alexandria, Virginia 22313-1450

Sir/Madam:

Pursuant to 37 C.F.R. §§ 1.56, 1.97 and 1.98, applicant brings the references listed on the attached Form SB-08 to the examiner's attention. 37 C.F.R. § 1.56. Do not construe the filing of this information disclosure statement as a representation that applicant has made a search (37 C.F.R. § 1.97(g)), or as an admission that the information cited is, or is considered to be, material to patentability, or that no other material information exists. We enclose copies of any cited foreign documents. Copies of the U.S. references are not enclosed.

This Information Disclosure Statement is being submitted:

☐ 1. Within three months of the filing date of a national application other than a continued prosecution application under 37 C.F.R. § 1.53(d), or within three months of the date of entry of the national stage as set forth in 37 C.F.R. § 1.491 in an international application; or **before the mailing date of a first**

Google Exhibit 1004, Page 1077 of 1125

office action on the merits, and therefore, Applicant believes no fee is required;

☐ 2. After the period specified in paragraph (1) above of this section, but before the mailing date of either a final action under 37 C.F.R. § 1.113, or a notice of allowance under 37 C.F.R. § 1.311, whichever occurs first, and is accompanied by either:

☐ a. A statement that:

(i) Each item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application not more than three months before the filing of the information disclosure statement; or

(ii) No item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the statement after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months before the filing of the information disclosure statement;

☐ b. The fee for filing an Information Disclosure Statement under 37 C.F.R. § 1.17(p) is $180.00.

☒ 3. After the period specified in paragraph (2) of this section, but on or before payment of the issue fee and is accompanied by:

☒ a. A statement that:

(i) Each item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application not more than three months before the filing of the information disclosure statement; or

Google Exhibit 1004, Page 1078 of 1125

(ii) No item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the statement after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months before the filing of the information disclosure statement; and

☒ b. The fee set forth in 37 C.F.R. § 1.17(p).

Applicant would appreciate the examiner initialing and signing a copy of attached Form PTO-1449 indicating that he or she considered the information and made the information of record.

If the transmittal letter is separated from this document and the PTO determines that an extension or other relief is required, applicant petitions for any required relief including extensions of time and authorizes the Commissioner to charge the cost of such petitions and/or other fees due in connection with the filing of this document to Deposit Account No. 50-2638.

Authorization is hereby given to charge any fees due, or credit any overpayment of fees, to Deposit Account No. 50-2638.

Respectfully submitted,

Date: July 2, 2012

/charles berman/
Charles Berman
Reg. No. 29,249

GREENBERG TRAURIG, LLP
77 West Wacker Drive, Suite 3100
Chicago, IL 60601
Phone: (312) 456-8400
Fax: (312) 456-8435
E-mail: laipmail@gtlaw.com
LA 130352380v1

Google Exhibit 1004, Page 1079 of 1125

Electronic Acknowledgement Receipt	
EFS ID:	13156139
Application Number:	12350817
International Application Number:	
Confirmation Number:	7586
Title of Invention:	MAPPING IN A MULTI-DIMENSIONAL SPACE
First Named Inventor/Applicant Name:	James Ashley
Customer Number:	33717
Filer:	Charles Berman/Rosemary Payton
Filer Authorized By:	Charles Berman
Attorney Docket Number:	081221-011500
Receipt Date:	02-JUL-2012
Filing Date:	08-JAN-2009
Time Stamp:	12:58:08
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$180
RAM confirmation Number	13060
Deposit Account	502638
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		081221-011500-IDS.pdf	649833 b0a2b6cff41cdbad41e2aaf7bb4c37c9d0a52089	yes	4

	Multipart Description/PDF files in .zip description		
	Document Description	Start	End
	Transmittal Letter	1	3
	Information Disclosure Statement (IDS) Form (SB08)	4	4

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	30162 b060e6333d8f24c72440e25441e9b8104cd93b71	no	2

Warnings:

Information:

Total Files Size (in bytes):	679995

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Electronic Patent Application Fee Transmittal	
Application Number:	12350817
Filing Date:	08-Jan-2009
Title of Invention:	MAPPING IN A MULTI-DIMENSIONAL SPACE
First Named Inventor/Applicant Name:	James Ashley
Filer:	Charles Berman/Rosemary Payton
Attorney Docket Number:	081221-011500
Filed as Small Entity	

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

33717 7590 08/03/2012
GREENBERG TRAURIG LLP (LA)
c/o: Greenberg Traurig LLP Chicago Office
77 West Wacker Drive, Suite 3100
INTELLECTUAL PROPERTY DEPARTMENT
Chicago, IL 60601

EXAMINER
WU, JIANYE

ART UNIT	PAPER NUMBER
2462	

DATE MAILED: 08/03/2012

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/350,817	01/08/2009	James Ashley JR.	081221-011500	7586

TITLE OF INVENTION: MAPPING IN A MULTI-DIMENSIONAL SPACE

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$870	$300	$0	$1170	11/05/2012

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PTOL-85 (Rev. 02/11)

Google Exhibit 1004, Page 1084 of 1125

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

33717 7590 08/03/2012
GREENBERG TRAURIG LLP (LA)
c/o: Greenberg Traurig LLP Chicago Office
77 West Wacker Drive, Suite 3100
INTELLECTUAL PROPERTY DEPARTMENT
Chicago, IL 60601

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission
I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/350,817	01/08/2009	James Ashley JR.	081221-011500	7586

TITLE OF INVENTION: MAPPING IN A MULTI-DIMENSIONAL SPACE

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$870	$300	$0	$1170	11/05/2012

EXAMINER	ART UNIT	CLASS-SUBCLASS
WU, JIANYE	2462	370-310000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
- ❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. The following fee(s) are submitted:
- ❑ Issue Fee
- ❑ Publication Fee (No small entity discount permitted)
- ❑ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
- ❑ A check is enclosed.
- ❑ Payment by credit card. Form PTO-2038 is attached.
- ❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ❑ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.
- ❑ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Google Exhibit 1004, Page 1085 of 1125

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/350,817	01/08/2009	James Ashley JR.	081221-011500	7586

33717 7590 08/03/2012

GREENBERG TRAURIG LLP (LA)
c/o: Greenberg Traurig LLP Chicago Office
77 West Wacker Drive, Suite 3100
INTELLECTUAL PROPERTY DEPARTMENT
Chicago, IL 60601

EXAMINER	
WU, JIANYE	
ART UNIT	**PAPER NUMBER**
2462	

DATE MAILED: 08/03/2012

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 529 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 529 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

Google Exhibit 1004, Page 1086 of 1125

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No.	Applicant(s)	
	12/350,817	ASHLEY ET AL.	
	Examiner	Art Unit	
	JIANYE WU	2462	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *7/02/12*.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *24-53, renumbered as 1-30*.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☒ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☒ Examiner's Amendment/Comment
8. ☐ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

/Jianye Wu/
Primary Examiner, Art Unit 2462

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EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Charles Berman (reg# 29,249) on 7/18/12.

See attached document for claim amendment.

/Jianye Wu/
Primary Examiner, Art Unit 2462

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12350817	ASHLEY ET AL.
	Examiner	Art Unit
	JIANYE WU	2462

SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
Inventoship search, EAST keyword search, subclass 37/312 with keyword search.	10/1/2011	JY
Inventoship search update, EAST keyword search, subclass 37/312 with keyword search update.	1/23/2012	JY
Inventoship search update, EAST keyword search, subclass 37/312 with keyword search update.	3/8/2012	JY
Inventoship search update, EAST keyword search, subclass 37/312, 328 with keyword search update.	7/30/2012	JY

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner
	See search history for interference search	7/30/2012	JY

	/JIANYE WU/ Primary Examiner.Art Unit 2462

Google Exhibit 1004, Page 1090 of 1125

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Substitute for form 1449B/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 1

Complete if Known	
Application Number	12/350,817
Filing Date	January 8, 2009
First Named Inventor	James Ashley, Jr.
Art Unit	2462
Examiner Name	Jianye Wu
Attorney Docket Number	081221-011500

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	1	US- 6,531,963 B1	03-11-2003	Nyfelt	
	2	US- 2003/0137435 A1	07-24-2003	Haddad et al.	
	3	US- 2003/0141962 A1	07-31-2003	Barink	
	4	US- 2003/0158635 A1	08-21-2003	Pillar et al.	
	5	US- 2004/0203944 A1	10-14-2004	Huomo et al.	
	6	US- 2004/0215750 A1	10-28-2004	Stilp	
	7	US- 2005/0151654 A1	07-14-2005	Curwen	
		US-			

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3] Number[4] Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[5]

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include the name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published	T[2]

LA 130223164v1

Examiner Signature	/Jianye Wu/	Date Considered	06/29/2012

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.
[1] Applicant's unique citation designation number (optional). [2] Applicant is to place a check mark here if English language Translation is attached.
This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /J.W

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12350817	ASHLEY ET AL.
	Examiner	**Art Unit**
	JIANYE WU	2462

ORIGINAL		INTERNATIONAL CLASSIFICATION									
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED				
370	328	H	0	4	W	4 / 00 ()					

CROSS REFERENCE(S)					
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
370	312				

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	30	
/JIANYE WU/ Primary Examiner.Art Unit 2462	07/30/2012	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	8

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PTO/SB/08A (07-09)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Sheet 1 of 1

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Examiner Name	Jianye Wu
Attorney Docket Number	081221-011500

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	1	US- 2010/0293106 A1	11-18-2010	Rhoads et al.	
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3] Number[4] Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include the name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published	T[2]

LA 130352366v1

Examiner Signature	/Jianye Wu/	Date Considered	07/29/2012

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] Applicant's unique citation designation number (optional). [2] Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /J.W

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	3	(geographical adj zone) same2 (map near4 (multi$1dimension$5)) (user with vehicle) (node with user with (control adj station))	US-PGPUB; USPAT; DERWENT	AND	ON	2012/07/29 23:40
L2	0	Map$5 with (dimension$5) (device) with bluetooth with GPS PDS (mobile OR cell$5) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/07/29 23:40
L3	113	Map$5 with (dimension$5) (device) with bluetooth with GPS (mobile OR cell$5) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/07/29 23:40
L4	0	Map$5 with (dimension$5) (device) with bluetooth with GPS (mobile OR cell$5) (pixilated adj2 image) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/07/29 23:40
L5	41	Map$5 near2 (dimension$5) (device) with bluetooth near4 GPS (mobile OR cell$5) (pix$7 with image) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/07/29 23:40
L6	63	(device) with bluetooth near4 GPS (mobile OR cell$5) (pix$7 with image) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/07/29 23:40
L7	8	Map$5 with pix$7 with (dimension$5) (geographical near2 zone) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/07/29 23:40
L8	35	Map$5 with pix$7 with (dimension$5) (PDA with ((cell OR mobile) adj phone) with computer) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/07/29 23:40
L9	45	Map$5 with (longitude with latitude with elevation) ((cell OR mobile) adj phone) with computer (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/07/29 23:40
L10	0	Map$5 with pix$7 with (longitude with latitude with elevation) ((cell OR mobile) adj phone) with computer (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/07/29 23:40
L11	10	Map$5 with pix$7 Map$5 with (longitude with latitude with elevation) ((cell OR mobile) adj phone) with computer (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/07/29 23:40
L12	6	Map$5 with pix$7 user with (longitude with latitude with elevation) ((cell OR mobile) adj phone) with computer (@ad< "20090108" OR @rlad<	US-PGPUB; USPAT; DERWENT	AND	ON	2012/07/29 23:40

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		"20090108")				
L15	4	AICH with E$1AICH with differen$5	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2012/07/29 23:40
L16	1	(second adj preamble) with synchroni$7 with (one near4 receiv$5) with (other near4 transmi$7)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2012/07/29 23:40
L17	25	(second adj preamble) with synchroni$7 with receiv$5 with transmi$7	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2012/07/29 23:40
L18	35	(OFDM near2 symbol) near4 (sub$1carrier near2 band)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2012/07/29 23:40
L19	1	(second adj preamble) with synchroni$7 with (one near4 receiv$5) with (other near4 transmi$7) sub$1channel$9	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2012/07/29 23:40
L20	22	((three OR "3")$1dimension$5 with location with (device OR user OR object OR node)) location with (bluetooth OR WiFi OR "802.11"$5) building with floor (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/07/29 23:40
L21	1	(daisy adj chain) with (bluetooth OR WiFi OR WLAN OR "802.11"$5) building with floor (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/07/29 23:40
L22	0	(daisy near2 chain) with (bluetooth OR WiFi OR WLAN OR "802.11"$5) building with floor (@ad< "20041105" OR @rlad< "20041105")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/07/29 23:40
L23	6	(daisy near2 chain) with (bluetooth OR WiFi OR WLAN OR "802.11"$5) (@ad< "20041105" OR @rlad< "20041105")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/07/29 23:40
L24	11804	(370/312,328).CCLS.	US-PGPUB; USPAT; DERWENT	OR	OFF	2012/07/30 00:10
L25	2	24 Map$5 with pix$7 with (dimension$5) (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/07/30 00:11
L33	0	"Map$5 with dimension$5"	US-PGPUB; USPAT; DERWENT	AND	ON	2012/07/30 00:20
L34	77	Map$5 near2 (dimension$5) "near" near2 node (@ad< "20090108" OR @rlad< "20090108")	US-PGPUB; USPAT; DERWENT	AND	ON	2012/07/30 00:22
L37	0	(Map$5 near2 (dimension$5) "near" near2 node level(@ad< "20090108" OR @rlad< "20090108")).clm.	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2012/07/30 00:26
L39	0	(Map$5 near2 (dimension$5) "near" near2 node (level OR floor) (@ad<	US-PGPUB; USPAT;	AND	ON	2012/07/30 00:32

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		"20090108" OR @rlad< "20090108")).clm.	FPRS; EPO; JPO; DERWENT; IBM_TDB			

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L35	0	(Map$5 near2 (dimension$5) "near" near2 node (@ad< "20090108" OR @rlad< "20090108")).clm.	US-PGPUB; USPAT; UPAD	AND	ON	2012/07/30 00:25

7/ 30/ 2012 12:33:12 AM
C:\ Users\ jwu2\ Documents\ EAST\ Workspaces\ 12350817.wsp

AMENDMENTS TO THE CLAIMS

Claims 1 to 23 (cancel)

Claim 24 (currently amended): A method for developing a map for use by a user, the user being selectively individuals, vehicles, and other entities, comprising:

using a geographical zone, the zone selectively being a preconfigured geographical zone,

the zone including a plurality of spaced apart nodes, wherein the nodes are arranged in a multi-dimensional sense, the location of the plurality of nodes in the multidimensional sense being placed with a structure attached to the ground;

sending data communications between one or more of the nodes, one or more users, and one or more control stations; and

affecting multi-dimensional mapping according to the placement of the nodes and the communications between the nodes and the control stations, wherein the mapping is affected in a three-dimensional sense, selectively being a three-dimensional sense in the x, y, and z axes or coordinates and the structure is a building, the building having different ~~floors~~ elevational levels and there are nodes on different ~~floors~~ elevational levels whereby there are nodes at multiple different elevational levels, and wherein the system narrows the plurality of nodes for use by the user at a first elevational level to the most practically near node to ~~a~~ the user, such that a node ~~on one floor~~ at another elevational level, even though physically closer to ~~a~~ the user at the first elevational level is excluded as being a node the most practically near to that user, and a different node ~~on a different floor~~ at the elevational level of the user is selected as the most practically near to that user.

Claim 25 (previously amended): The method of claim 24, wherein the mapping is affected in a three-dimensional sense, selectively being a three-dimensional sense in the x, y, and z axes or coordinates and the structure is a building, t e building having at least three different floors and there are nodes on the three different floors whereby there are nodes on at least three different levels.

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Claim 26 (previously amended): The method of claim 24, wherein the mapping is affected in a three-dimensional sense, selectively being a three-dimensional sense in the x, y, and z axes or coordinates and the structure is a building, the nodes being contained in the building structure at different floors and there are nodes on the different floors whereby there are nodes on at least different levels.

Claim 27 (previously amended): The method of claim 24, wherein the mapping is affected in a three-dimensional sense, selectively being a three-dimensional sense in the x, y, and z axes or coordinates and the structure is a building, the nodes are fixed and non-movable relative to the ground and the nodes are on at least two different levels.

Claim 28 (previously amended): The method of claim 24, wherein the mapping is affected in a three-dimensional sense, selectively being a three-dimensional sense in the x, y, and z axes or coordinates and the structure is a building, the building having different floors and there are nodes on different floors whereby there are nodes at multiple different levels, and the multi-dimensional mapping is effected internally in the building.

Claim 29 (previously submitted): A method of communicating data between at least one selected communication transponder and at least one selected mobile communication device comprising:

using a geographical zone, wherein the zone includes a plurality of spaced apart communication transponders; the transponders including a transmitter and receiver and wherein at least one of the transponders permits communication with a mobile device of a user;

sending data communication between pluralities of the transponders in a network communication protocol with each other, applying the plurality of transponders in the network with each other to define the zone,

communicating between at least one transponder to the mobile user and between at least one transponder; the communication between the mobile device of the user and the least one transponder being effected by at least one of a bluetooth or a wi fi protocol thereby to determine the location of the user in the zone through such communication;

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arranging the transponders at locations in the zone, and the respective locations of the plurality of transponders in the zone being placed within a building structure;

obtaining and analyzing data related to the location of the mobile user according to the placement of the transponders in the zone;

enabling selected mobile communication devices to be in communication with at least one selected communication transponder when the devices are within range of the selected transponder;

the mobile user receiving selection parameter data from multiple transponders, and utilizing the selection parameters, such that the system narrows the plurality of transponders to the most practically near transponder, such most practically near transponder not necessarily being the transponder physically closest to the mobile user;

associating respective users of respective mobile devices with a respective profile of the respective user of the respective mobile device;

sending a targeted message to a selected mobile device of a selected user from the selected communication transponder when the selected mobile device is in range; and

tailoring the targeted message to the profile of the user associated with the mobile device.

Claim 30 (previously submitted): The method of claim 29, wherein the transponders are arranged in a three-dimensional sense, selectively being a three-dimensional sense in the x, y, and z axes or coordinates.

Claim 31 (previously submitted): The method of claim 29, including employing at least one Bluetooth™ equipped mobile personal device associated with at least one user, the at least one device communicating with Bluetooth™ enabled location transponders in a network.

Claim 32 (previously submitted): The method of claim 29, wherein the at least one Bluetooth™ equipped mobile personal device contains at least one specific algorithm to determine the relatively precise location of the at least one user within the network.

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Claim 33 (previously submitted): The method of claim 29, wherein when the at least one Bluetooth™ equipped mobile personal device is within the range of certain location transponders, specified events are triggered.

Claim 34 (previously submitted): The method of claim 29, including the downloading of at least one message, to the at least one Bluetooth™ equipped mobile personal device.

Claim 35 (previously submitted): The method of claim 29, including transmitting to selected transponders the location data of the at least one user, the selected transponders transmitting the data to a control center via other transponders within selectively at least one of a network, or intermediate stations.

Claim 36 (previously submitted): The method of claim 29, wherein the location data of the at least one user is processed and analyzed at selectively at least one of a control center or an intermediate station.

Claim 37 (previously submitted): The method of claim 29 including using a geographical zone, the zone being multi-dimensional, and messaging a movable entity that has a transponder or subscriber device, the device being selectively a cell phone, PDA, computer, or device which is configured to be in wireless communication with other devices through a suitable network.

Claim 38 (previously submitted): The method of claim 29, wherein messages are communicated with entities according to the location of the entities as mapped in the multi-dimensional space.

Claim 39 (previously submitted): The method of claim 29, including defining a geographical zone, the zone being multi-dimensional, and messaging or regulating a movable entity that has a transponder or subscriber device, the device being selectively a cell phone, PDA, computer or device which is configured to be in wireless communication with other devices through a suitable network.

Claim 40 (previously submitted): The method of claim 29, including a three-dimensional shape for the geographical zone.

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Claim 41 (previously submitted): The method of claim 29, including downloading messages, and wherein the messages are directed to a user when the user is determined to be a particular location in the multidimensional space, and not when the user is outside the particular location.

Claim 42 (previously submitted): The method of claim 29, wherein the profile of the user includes the behavior of the user, and includes the length of time the user spends in the vicinity of different transponders in the zone.

Claim 43 (previously submitted): The method of claim 29, including the downloading of at least one commercial message, selectively an advertisement, to the at least one Bluetooth™ equipped mobile personal device.

Claim 44 (previously submitted): The method of claim 29, including the downloading of a commercial message, selectively an advertisement, to the Bluetooth™ equipped mobile personal device.

Claim 45 (previously submitted): The method of claim 29, including transmitting to selected transponders the user's location data, the selected transponders transmitting the data to a control center via other transponders within selectively at least one of a network, relay station, or intermediate supplementing stations.

Claim 46 (previously submitted): The method of claim 29, wherein the profile of the user includes the behavior of the user includes at least one of the length of time the user spends in the vicinity of different transponders in the zone, the purchasing patterns of the user, the product or service preferences of a user; the commercial enquiries of a user, and the dining or entertainment preferences of the user.

Claim 47 (previously submitted): The method of claim 29 including creating multiple networks, each network communicating with a respective base station, and the respective base stations communicating with each other and a control station, these communications being effected at least in part by at least one of blue tooth or wi fi.

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Claim 48 (previously submitted): The method of claim 29 wherein the multi-dimensional zone is such that there are networks at discreet and separate floors of a building, and there being a physical ceiling/floor barrier between each separate floor, and the network being such that with the multiple transponders utilizing selection parameters, the system narrows the plurality of transponders to the most practically near transponder to a user.

Claim 49 (previously submitted): The method of claim 29, wherein the profile of the user includes the purchasing patterns of the user.

Claim 50 (previously submitted): The method of claim 29, wherein the profile of the user includes the dining or entertainment preferences of the user.

Claim 51 (previously submitted): The method of claim 29,wherein a transponder on one floor of a building, even though physically closer to a user is excluded as being a transponder being the most practically near to that user, and that physically further transponder on a different floor to the user is the most practically near to that user.

Claim 52 (previously submitted): A method of communicating data between at least one selected communication transponder and at least one selected mobile communication device comprising:

using a geographical zone, wherein the zone includes a plurality of spaced apart communication transponders; the transponders including a transmitter and receiver and wherein at least one of the transponders permits communication with a mobile device of a user;

sending data communication between pluralities of the transponders in a network communication protocol with each other, applying the plurality of transponders in the network with each other to define the zone,

communicating between at least one transponder to the mobile user and between at least one transponder; the communication between the mobile device of the user and the least one transponder being effected by at least one of a bluetooth or a wi fi protocol thereby to determine the location of the user in the zone through such communication;

Google Exhibit 1004, Page 1102 of 1125

arranging the transponders at locations in the zone, and the respective locations of the plurality of transponders in the zone being placed within a building structure;

obtaining and analyzing data related to the location of the mobile user according to the placement of the transponders in the zone;

enabling selected mobile communication devices to be in communication with at least one selected communication transponder when the devices are within range of the selected transponder;

effecting a location transponder selection by a general wireless communication of multiple location transponder located within communication range in the zone, obtaining unique location transponder radio addresses, searching for wireless devices of at least one subclass, the subclasses being selected to include specific types of wireless communication devices, selectively cell phones, pagers, PDAs, and laptop computers, or by searching for at least one specific wireless device operating in a specific mode;

associating respective users of respective mobile devices with a respective profile of the respective user of the respective mobile device;

sending a targeted message to a selected mobile device of a selected user from the selected communication transponder when the selected mobile device is in range; and tailoring the targeted message to the profile of the user associated with the mobile device.

Claim 53 (previously submitted): A method of communicating data between at least one selected communication transponder and at least one selected mobile communication device comprising:

using a preconfigured geographical zone, wherein the zone includes a plurality of spaced apart communication transponders; the transponders including a transmitter and receiver and wherein at least one of the transponders permits communication with a mobile device of a user;

sending data communication between pluralities of the transponders in a network communication protocol with each other, applying the plurality of transponders in the network with each other to define the zone,

communicating between at least one transponder to the mobile user and between at least one transponder; the communication between the mobile device of the user and the least one

Google Exhibit 1004, Page 1103 of 1125

transponder being effected by at least one of a bluetooth or a wi fi protocol thereby to determine the location of the user in the zone through such communication;

arranging the transponders at locations in the zone, and the respective locations of the plurality of transponders in the zone being placed within a building structure;

arranging the transponders in a multi-dimensional sense about the zone, the transponders being distributed in separate mesh networks, and the mesh networks being in different specific zones, and wherein different mesh networks of transponders are associated with a dedicated base station;

obtaining and analyzing data related to the location of the mobile user according to the placement of the transponders in the zone;

enabling selected mobile communication devices to be in communication with at least one selected communication transponder when the devices are within range of the selected transponder;

associating respective users of respective mobile devices with a respective profile of the respective user of the respective mobile device;

sending a targeted message to a selected mobile device of a selected user from the selected communication transponder when the selected mobile device is in range; and

tailoring the targeted message to the profile of the user associated with the mobile device.

Google Exhibit 1004, Page 1104 of 1125

Examiner-Initiated Interview Summary	Application No.	Applicant(s)	
	12/350,817	ASHLEY ET AL.	
	Examiner	Art Unit	
	JIANYE WU	2462	

All participants (applicant, applicant's representative, PTO personnel):

(1) *JIANYE WU*. (3)_____.

(2) *Charles Berman (reg# 29,249)* . (4)_____.

Date of Interview: *18 July 2012*.

Type: ☒ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☐112 ☐102 ☒103 ☐Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: *24*.

Identification of prior art discussed: _____.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

Examiner informed Applicant that claim 24 was inconsistent with the definition of "practically near" in the specification. Applicant agreed to amend the claim and sent an amendment proposal. Appliant also stated that the support for the amendment could be found in [0050] and [0107] in the specification.

Applicant recordation instructions: It is not necessary for applicant to provide a separate record of the substance of interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

/Jianye Wu/ Primary Examiner, Art Unit 2462	

Google Exhibit 1004, Page 1105 of 1125

Electronic Patent Application Fee Transmittal

Application Number:	12350817
Filing Date:	08-Jan-2009
Title of Invention:	MAPPING IN A MULTI-DIMENSIONAL SPACE
First Named Inventor/Applicant Name:	James Ashley
Filer:	Charles Berman/Rosemary Payton
Attorney Docket Number:	081221-011500

Filed as Small Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl issue fee	2501	1	885	885
Publ. Fee- early, voluntary, or normal	1504	1	300	300

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1185**

Electronic Acknowledgement Receipt	
EFS ID:	13998496
Application Number:	12350817
International Application Number:	
Confirmation Number:	7586
Title of Invention:	MAPPING IN A MULTI-DIMENSIONAL SPACE
First Named Inventor/Applicant Name:	James Ashley
Customer Number:	33717
Filer:	Charles Berman/Rosemary Payton
Filer Authorized By:	Charles Berman
Attorney Docket Number:	081221-011500
Receipt Date:	16-OCT-2012
Filing Date:	08-JAN-2009
Time Stamp:	16:16:26
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$1185
RAM confirmation Number	3064
Deposit Account	502638
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	081221-011500-Issue-Fee-Transmittal.pdf	416791 135c7b96d6136569dbbd3c8e36998b92080265bb	no	2
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	31660 b60150207e688c0f72917af2193f4e76086214a4	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	448451		

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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

33717 7590 08/03/2012
GREENBERG TRAURIG LLP (LA)
c/o: Greenberg Traurig LLP Chicago Office
77 West Wacker Drive, Suite 3100
INTELLECTUAL PROPERTY DEPARTMENT
Chicago, IL 60601

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/350,817	01/08/2009	James Ashley JR.	081221-011500	7586

TITLE OF INVENTION: MAPPING IN A MULTI-DIMENSIONAL SPACE

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$870	$300	$0	$1170	11/05/2012

EXAMINER	ART UNIT	CLASS-SUBCLASS
WU, JIANYE	2462	370-310000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Greenberg Traurig, LLP
2
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: WIRELESSWERX INTERNATIONAL, INC.

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Urbanizacion Marbella, Panama Canal Zone

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

☒ Issue Fee
☒ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**

☐ A check is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number 50-2638 (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.
☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature /charles berman/ Date October 16, 2012

Typed or printed name Charles Berman Registration No. 29,249

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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CERTIFICATE OF TRANSMISSION

I hereby certify that this document, **FEE TRANSMITTAL**, for Application Number 12/350,817 is being transmitted electronically to the United States Patent and Trademark Office via the EFS Web e-filing system on October 16, 2012.

Name: Rosemary D. Payton

PTO/SB/08A (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 6 of 7

Complete if Known	
Application Number	12/350,817
Filing Date	January 8, 2009
First Named Inventor	James Ashley Jr.
Art Unit	2473
Examiner Name	Kwang Bin Yao
Attorney Docket Number	081221-011500/US

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Grant/Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US- 2004-0249560	12-2004	Kim et al.	
		US- 2005-0026627	02-2005	Boling et al.	
		US- 5,479,482	12-1995	Grimes	
		US- 7,016,478	03-2006	Potorny et al.	
		US- 2002-0072348	06-2002	Wheeler et al.	
		US- 2006-0003809	01-2006	Boling et al.	
		US- 7,317,927	05-2006	Staton	
		US- 2006-0009240	01-2006	Katz	
		US- 2005-0048987	03-2005	Glass	
		US- 2004-0192271	09-2004	Eisner et al.	
		US- 2003-0186709	10-2003	Rhodes et al.	
		US- 2007-0004378	01-2007	Muhonen et al.	
Change(s) applied to document, /L.K.H./ 9/12/2012		US- 2006-0234727	10-2006	Ashley Jr.	
		US- 2005-0070315	03-2005	Rai et al.	
		US- 6,801,974	10-2004	~~Dell Products~~	Watts, Jr., et al.
		US- 6,574,484	06-2003	Carley	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Office Action Country Code[3] Number[4] Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	1	WO2003-049060A	06-12-2003	Lahaye et al.		
	2	WO2001-46926A	01-28-2001	Osterhuber et al.		
	3	WO2001-35190A	05-17-2001	StatSignal Systems		
	4	DE19960219	06-05-2001	Eisenlohr et al.		
	5	GB2322248A	08-19-1998	Fujitsu Ltd.		
	6	WO2001-63318A	08-31-2001	Advanced B Science		
	7	WO2000-41428A	06-13-2000	Erickson, Inc.		
	8	EP1345148A	08-17-2003	Nokia Corp.		

Examiner Signature	/Jianye Wu/	Date Considered	09/26/2011

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.
[1] Applicant's unique citation designation number (optional). [2] Applicant is to place a check mark here if English language Translation is attached.
This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /JY/

Google Exhibit 1004, Page 1112 of 1125

[0010] In one or more embodiments, the mapping is affected in a three-dimensional sense, selectively being a three-dimensional sense in the x, y, and z axes or coordinates. Additionally, the nodes are enabled selectively to communicate with GPS and/or with Bluetooth™ protocols. The nodes are enabled with a Bluetooth™ protocol to effect communications between nodes and users of the mapping, where the users of the mapping having mobile devices being at least Bluetooth™ protocol enabled. Also, the nodes are selectively part of a mesh network or other suitable network configuration. In addition, the nodes selectively communicate with users having a selected subscriber device, the device being selectively a cell phone, personal digital assistant (PDA), or computer device.

DRAWINGS

[0011] The foregoing aspects and advantages of the present disclosure will become more readily apparent and understood with reference to the following detailed description, when taken in conjunction with the accompanying drawings, wherein:

[0012] **Figure 1** illustrates the high-level architecture of a computer system for controlling and monitoring movable entities.

[0013] **Figure 2** illustrates a component layout of a transponder or subscriber device used in a system for controlling and monitoring movable entities.

[0014] **Figure 3** illustrates a view of the exterior screen of the transponder or subscriber device, in the sense of a PDA incorporating a cell phone, in a system for controlling and monitoring movable entities.

Change(s) applied to document, /L.K.H./ 9/12/2012

[0015] **Figure 4A** illustrates a view of the exterior screen of the transponder or subscriber device that depicts the configuration application of the system for controlling and monitoring movable entities.

[0016] **Figure 5A** illustrates a pixel map of a zone.

[0017] **Figure 5B** illustrates a pixel map of a geographical zone.

PTO/SB/08A (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 7

Complete if Known	
Application Number	12/350,817
Filing Date	January 8, 2009
First Named Inventor	James Ashley Jr.
Art Unit	2473
Examiner Name	Kwang Bin Yao
Attorney Docket Number	081221-011500/US

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Grant/Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US- 2007-0244633A1	10-18-2007	Phillips et al.	
		US- 7,848,765B2	12-07-2010	Phillips et al.	
		US- 7,539,742B2	05-26-2009	Spector	
		US- 6,970,922B1	11-29-2005	Spector	
		US- 7,870,229B2	01-11-2011	Spector	
		US- 2002-0072356A1	06-13-2002	Yamashita et al.	
		US- 2002-0059434A1	05-16-2002	Karaoguz et al.	
		US- 6,014,089	01-11-2000	Tracy et al.	
		US- 6,496,575B1	12-17-2002	Vasell et al.	
		US- 6,717,513B1	04-06-2004	Sandelman	
		US- 2001-048755A1	12-06-2001	Weins et al.	
		US- 7,323,982	01-29-2003	Staton	
		US- 7,286,929	07-23-2007	Staton	
		US- 7,138,916	11-21-2006	Schwartz	
		US- 5,986,508A	11-1999	Nevin et al.	
		US- 6,531,924	03-2003	Aparin	
		US- 7,064,614	08-2007	Beffa	
		US- 3,518,674	06-1970	Moorhead et al.	
		US- 3,772,668	11-1973	Smith	
4,217,588		US- ~~4,217,088~~	08-1980	Freeny, Jr.	
Change(s) applied to document, /K.D.D./ 9/2/2012		US- 4,224,596	09-1980	Knickel	
		US- 4,688,026	08-1987	Scribner et al.	
		US- 4,884,208	11-1989	Marinelli et al.	
		US- 5,142,281	08-1992	Park	
		US- 5,365,516	11-1994	Jandrell	
		US- 5,627,517	05-1997	Theimer et al.	
		US- 5,917,405	06-1999	Joao	

Examiner Signature	/Jianye Wu/	Date Considered	09/26/2011

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.
[1] Applicant's unique citation designation number (optional). [2] Applicant is to place a check mark here if English language Translation is attached.
This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Substitute for form 1449B/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 3 of 7

Complete if Known	
Application Number	12/350,817
Filing Date	January 8, 2009
First Named Inventor	James Ashley Jr.
Art Unit	2473
Examiner Name	Kwang Bin Yao
Attorney Docket Number	081221-011500/US

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Grant/Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US- 4,958,645	09-1990	Cadell et al.	
		US- 6,243,039	06-2001	Elliot	
		US- 5,389,934	02-1995	Kass	
		US- 5,528,248	06-1996	Steiner et al.	
		US- 5,642,303	06-1997	Small et al.	
		US- 5,670,944	09-1997	Myllymaki	
		US- 5,699,244	12-1997	Clark, Jr. et al.	
		US- 5,796,634	08-1998	Craport et al.	
		US- 5,917,414	06-1999	Oppelt et al.	
		US- 5,917,415	06-1999	Atlas	
		US- 5,938,721	08-1999	Dussell et al.	
		US- 6,002,994	12-1999	Lane et al.	
		US- 6,102,856	08-2000	Groff et al.	
		US- 6,177,905	01-2001	Welch	
		US- 6,198,394	03-2001	Jacobsen et al.	
		US- 6,317,605	11-2001	Sakuma	
		US- 6,446,004	09-2002	Cao et al.	
Change(s) applied to document, /J.E./ 9/20/2012		US- ~~6,469,118~~ 6,496,116	12-2002	Farringdon et al.	
		US- 6,579,231	06-2003	Phipps	
		US- 6,611,206	08-2003	Eshelman et al.	
		US- 6,625,457	09-2003	Raith	
		US- 6,646,873	11-2003	Chu-Chia et al.	
		US- 6,826,473	11-2004	Burch et al.	
		US- 6,853,911	02-2005	Sakarya	
		US- 6,856,898	02-2005	Tompkins et al.	
		US- 6,867,733	03-2005	Sandhu et al.	
		US- 6,868,074	03-2005	Hanson	

Examiner Signature	/Jianye Wu/	Date Considered	09/26/2011

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.
[1] Applicant's unique citation designation number (optional). [2] Applicant is to place a check mark here if English language Translation is attached.
This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /JY/

PTO/SB/08A (07-09)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Sheet 2 of 7

Complete if Known	
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U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Grant/Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US- 6,043,748	03-2000	Touchton et al.	
		US- 6,236,358	05-2001	Durst et al.	
		US- 6,421,001	07-2002	Durst et al.	
		US- 6,509,830	01-2003	Elliot et al.	
		US- 2005-0159883A1	07-2005	Humphries et al.	
		US- ~~2006-0015223~~	01-2006	Olsen et al. 20060015233	
		US- 2004-0208344	10-2004	Liu et al.	
		US- 6,597,365	07-2003	Baecke et al.	
		US- 7,174,301	02-2007	Florence et al.	
		US- 4,847,773	07-1989	van Helsdingen et al.	
		US- 6,617,969	09-2003	Tu et al.	
		US- 6,665,613	12-2003	Duvall	
		US- 6,674,368	01-2004	Hawkins et al.	
		US- 6,812,824	11-2004	Goldinger et al.	
		US- 2001-0040513	11-2001	McDonald	
		US- 2002-0147006	10-2002	Coon et al.	
		US- 2002-0196151	12-2002	Troxler et al.	
		US- 2003-0149526	08-2003	Zhou et al.	
		US- 2003-0163287	08-2003	Vock et al.	
		US- 2004-0201454	10-2004	Waterhouse et al.	
		US- 6,009,330	12-1999	Kennedy, III et al.	
		US- 6,055,426	04-2000	Beasley	
		US- 6,617,969	09-2003	Mi et al.	
		US- 6,717,513	04-2004	Shprecher et al.	
		US- 2004-0196182	10-2004	Unnold	
		US- 2006-0109107	05-2006	Staton et al.	
		US- 4,819,860	04-1989	Hargrove et al.	

Change(s) applied to document,
/J.E./
9/20/2012

Examiner Signature	/Jianye Wu/	Date Considered	09/26/2011

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.
[1] Applicant's unique citation designation number (optional). [2] Applicant is to place a check mark here if English language Translation is attached.
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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /JY/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/350,817	11/20/2012	8315203	081221-011500	7586

33717 7590 10/31/2012

GREENBERG TRAURIG LLP (LA)
c/o: Greenberg Traurig LLP Chicago Office
77 West Wacker Drive, Suite 3100
INTELLECTUAL PROPERTY DEPARTMENT
Chicago, IL 60601

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 694 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

James Ashley JR., Norco, CA;
Patrick Mooney, Brea, CA;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

Large Entity Declaration

PATENT
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application Number: 12/350817 **Current Date** 02/01/2016

Filing Date: 08-Jan-2009

Patent Number: 8315203

Issue Date: 20-Nov-2012

CHANGE OF ENTITY STATUS PURSUANT TO 37 C.F.R. §1.27 (g)(2)

Commissioner for Patents
Mail Stop M Correspondence
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This communication hereby notifies the United States Patent and Trademark Office that small entity status is no longer applicable for the above-identified patent.

Respectfully submitted,

COMPANY or FIRM NAME AND ADDRESS:

WirelessWERX, Inc.
22687 Old Canal Road
Yorba Linda, CA 92887

Signature
James D Ashley

Printed Name
_CTO/ CEO

Title

OR
Reg. # if US Attorney_____

PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1
Stylesheet Version v1.2

EPAS ID: PAT7410484

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	ASSIGNMENT

CONVEYING PARTY DATA

Name	Execution Date
WIRELESSWERX INTERNATIONAL, INC.	06/09/2022

RECEIVING PARTY DATA

Name:	WIRELESSWERX IP LLC
Street Address:	5900 BALCONES DRIVE SUITE 100
City:	AUSTIN
State/Country:	TEXAS
Postal Code:	78731

PROPERTY NUMBERS Total: 16

Property Type	Number
Patent Number:	7286929
Patent Number:	7317927
Patent Number:	7323982
Patent Number:	7489939
Patent Number:	7564348
Patent Number:	7684782
Patent Number:	7881733
Patent Number:	8009037
Patent Number:	8200186
Patent Number:	8285245
Patent Number:	8290515
Patent Number:	8315203
Patent Number:	8368531
Patent Number:	8369866
Patent Number:	8428867
Patent Number:	8612278

CORRESPONDENCE DATA

Fax Number:

Correspondence will be sent to the e-mail address first; if that is unsuccessful, it will be sent using a fax number, if provided; if that is unsuccessful, it will be sent via US Mail.

Email:	carlos@dynaipdeals.com
Correspondent Name:	CARLOS GORRICHATEGUI
Address Line 1:	5900 BALCONES DRIVE SUITE 100
Address Line 4:	AUSTIN, TEXAS 78731

ATTORNEY DOCKET NUMBER:	81221-010301
NAME OF SUBMITTER:	CARLOS GORRICHATEGUI
SIGNATURE:	/COGIII/
DATE SIGNED:	06/30/2022
	This document serves as an Oath/Declaration (37 CFR 1.63).

Total Attachments: 4

source=2022 WirelessWERX International - WirelessWERX IP Assignment Agreement 06-20-22.pdf copy#page1.tif
source=2022 WirelessWERX International - WirelessWERX IP Assignment Agreement 06-20-22.pdf copy#page2.tif
source=2022 WirelessWERX International - WirelessWERX IP Assignment Agreement 06-20-22.pdf copy#page3.tif
source=2022 WirelessWERX International - WirelessWERX IP Assignment Agreement 06-20-22.pdf copy#page4.tif

3

EXHIBIT B -- ASSIGNMENT OF PATENT RIGHTS

This Assignment Agreement (the "Agreement") is made and entered into this ____ day of June 9, 2022 (the "Effective Date"), by WirelessWERX International Inc, a Corporation, having an address at ARIFA Building, 10th Floor, West Boulevard, Santa Maria Business District, P.O. Box 0816-01098, Panama, Republic of Panama ("Assignor") and WirelessWERX IP LLC, a Texas limited liability company having and address at 5900 Balcones Drive Suite 100, Austin, TX 78731 ("Assignee").

RECITALS

A. Assignor is the owner of:

- the United States Patents set forth on Exhibit A hereto (the "US Patents");
- the non-United States patents set forth on Exhibit B.1 hereto (the "Foreign Patents");
- the United States patent applications set forth on Exhibit B.2 hereto (the "US Patent Applications");
- the United States provisional patent applications set forth on Exhibit B.3 hereto (the "US Provisional Patent Applications"); and/or
- the foreign patent applications set forth on Exhibit B.4 hereto (the "Foreign Patent Applications");

which collectively shall be referred to herein as the "Patents".

B. Assignor and Assignee have agreed by way of a purchase agreement (the "Purchase Agreement") dated April 25, 2022 «EFFECTIVE_DATE», by and between Assignor and Assignee, that Assignor shall sell, transfer, and assign and set over unto Assignee and Assignee shall accept, all rights, title and interest in and to the Patents.

AGREEMENT

NOW, THEREFORE, in consideration of the foregoing premises, and the covenants and agreements in this Assignment, Assignor and Assignee agree as follows:

1. Assignor does hereby sell, transfer, convey, assign and deliver to Assignee all of Assignor's right, privilege, title and interest in, to and under the Patents and in the case of patent applications in and to any patents that may issue therefrom, including, in all instances, any counterparts of any of the foregoing in any jurisdiction throughout the world, and any and all divisions, continuations, reissues or reexaminations of any of the foregoing, and, further, all applications for industrial property protection, including without limitation, all applications for patents, utility models, copyright, and designs which may hereafter be filed

06/20/22

Google Exhibit 1004, Page 1121 of 1125

for any inventions described in said Patents in any country or countries, together with the right to file such applications and the right to claim for the same the priority rights derived from the inventions and the Patents under the laws of the United States, the International Convention for the Protection of Industrial Property, or any other international agreement or the domestic laws of the country in which any such application is filed, as may be applicable, in each instance the same to be held by Assignee for Assignee's own use and enjoyment, and for the use and enjoyment of Assignee's successors, assigns and other legal representatives, as fully and entirely as the same would have been held and enjoyed by Assignor if this Assignment and sale had not been made; together with all claims for damages, royalties, income or other remuneration (hereinafter "Damages") by reason of past, present and future infringements of the Patents or other rights being assigned hereunder, along with the right to sue for and collect such Damages for the use and benefit of Assignee and its successors, assigns and other legal representatives. Assignor agrees that this Assignment includes all right, title and interest in the Patents and (a) all causes of action (whether currently pending, filed, or otherwise) and other enforcement rights under the Patents including, without limitation, all rights to sue, to countersue and to pursue damages, injunctive relief, and any other remedies of any kind for past, current and future infringement; and (b) all rights to recover and collect settlement arrangements, license payments (including lump sum payments), royalties and other payments due now or hereafter due or payable with respect thereto, under or on account of any of the Patents or any of the foregoing; and (c) to the extent allowed under relevant law, any and all privileges of Assignor, including the benefit of all attorney-client privilege and attorney work product privilege.

2. Insofar as this assignment concerns foreign patents and patent applications, Assignor does hereby declare that it is the owner of said Patents and that Assignor has assigned same, along with all rights and duties appurtenant thereto, to Assignee and agrees that the assignment will be recorded by Assignee at Assignee's expense, in the register of the foreign Patent Office; and Assignee hereby declares that Assignee has agreed to the assignment of the aforementioned Patents to it and that Assignee will simultaneously apply, at Assignee's expense, for recording of the assignment in the register of the foreign Patent Office.

3. Assignor hereby authorizes and requests the Commissioner for Patents of the United States, and any officer of any country or countries foreign to the United States, whose duty it is to issue patents or other evidence or forms of intellectual property protection or applications as aforesaid, to issue the same to Assignee and its successors, assigns and other legal representatives in accordance with the terms of this instrument.

06/20/22

Google Exhibit 1004, Page 1122 of 1125

4. Assignor agrees that, whenever reasonably requested by Assignee, Assignor will execute all papers, take all rightful oaths, and do all acts which may be reasonably necessary for securing and maintaining the Patents in any country and for vesting title thereto in Assignee, its successors, assigns and legal representatives or nominees.

5. Assignor authorizes and empowers Assignee, its successors, assigns and legal representatives or nominees, to invoke and claim for any application for patent or other form of protection for the inventions, the benefit of the right of priority provided by the International Convention for the Protection of Industrial Property, as amended, or by any convention which may henceforth be substituted for it, or any other international agreement or the domestic laws of the country in which any such application is filed, as may be applicable, and to invoke and claim such right of priority without further written or oral authorization from Assignor.

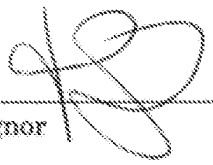
6. Assignor hereby acknowledges and agrees that all of the rights, title and interest in and to the Patents sold, transferred, assigned and set over to Assignee hereunder include all income, royalties, damages and payments now or hereafter due or payable with respect thereto, and all causes of action (whether in law or equity) and the right to sue, counterclaim, and recover for the past, present and future infringement of the rights assigned or to be assigned hereunder.

7. Assignor hereby consents that a copy of this Agreement shall be deemed a full legal and formal equivalent of any assignment, consent to file or like document that may be required in any country for any purpose and more particularly in proof of the right of Assignee or nominee to claim the aforesaid benefit of the right of priority provided by the International Convention for the Protection of Industrial Property, as amended, or by any convention which may henceforth be substituted for it.

IN WITNESS WHEREOF, the Parties have executed this Assignment on the Effective Date-written at Venue.

06/20/22

Google Exhibit 1004, Page 1123 of 1125

By: 
Assignor

Printed Name: Houston Staton

Dated: JUNE 20, 2022

On this _____ day of _____, before me, _____, the undersigned Notary Public, personally appeared _____ ASSIGNOR, personally known to me (or proved to me on the basis of satisfactory evidence) to be the person whose name is subscribed to the within instrument, and acknowledged to me that he or she executed the same. WITNESS my hand and official seal in _____ County of _____ on the date set forth in this certificate.

_____
Notary Public

By: _____
Assignee

Printed Name: Carlos Gorrichategui

Dated: June 9, 2022

Google Exhibit 1004, Page 1124 of 1125

AO 120 (Rev. 08/10)

TO:	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Western District of Texas, Waco Division on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
6:22-cv-01056	10/7/2022	Western District of Texas, Waco Division

PLAINTIFF	DEFENDANT
WIRELESSWERX IP, LLC	GOOGLE, LLC

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	US 8,315,203	11/20/2012	WIRELESSWERX IP, LLC
2			
3			
4			
5			

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE

Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy