Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	MAPPING IN A MULTI-DIMENSIONAL SPACE
First Named Inventor/Applicant Name:	James Ashley, Jr.
Filer:	Cynthia Anne Dixon/Shaula Stephenson
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:				
Utility filing Fee (Electronic filing)	4011	1	82	82
Utility Search Fee	2111	1	270	270
Utility Examination Fee	2311	1	110	110
Pages:				
Claims:				
Claims in excess of 20	2202	3	26	78
Independent claims in excess of 3	2201	1	110	110
Miscellaneous-Filing:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**650**

MAPPING IN A MULTI-DIMENSIONAL SPACE

ABSTRACT

A multi-dimensional, such as a three-dimensional, map is created using nodes in communication with each other. The nodes communicate with each other wirelessly via radio frequency (RF) using Bluetooth™ protocol. Detailed location information from the location nodes is downloaded. A mesh network of nodes is in communication with at least one base station and, in turn, is in communication with at least one control center. A mobile device associated with a user located in a specific area of a geographical location is in communication with a control center to create a multi-dimensional map.

Electronic Acknowledgement Receipt	
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Application Number:	12350817
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Title of Invention:	MAPPING IN A MULTI-DIMENSIONAL SPACE
First Named Inventor/Applicant Name:	James Ashley, Jr.
Customer Number:	33717
Filer:	Cynthia Anne Dixon/Shaula Stephenson
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Attorney Docket Number:	081221-011500
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	011500appdata.pdf	839429 44e411f308c467ab8d06d8337f6f8cb82c81d032	no	4
Warnings:					
Information:					
2		011500appl.pdf	310704 ddf3d3ad42444b114778f7ac365f4658aba05b95	yes	74

Multipart Description/PDF files in .zip description

Document Description	Start	End
Specification	1	69
Claims	70	73
Abstract	74	74

Warnings:					
Information:					
3	Drawings-only black and white line drawings	figs.pdf	2487367 42fd2c7044225be23f647024999a1b84ecc9b832	no	24
Warnings:					
Information:					
4	Fee Worksheet (PTO-06)	fee-info.pdf	37817 c4119d91de87a688ad7a4728fc7cc0f9272da38d	no	2
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PTO/SB/14 (07-07)
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	081221-011500
	Application Number	
Title of Invention	MAPPING IN A MULTI-DIMENSIONAL SPACE	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

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☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Applicant Information:

Applicant 1 Remove

Applicant Authority ◉ Inventor ○ Legal Representative under 35 U.S.C. 117 ○ Party of Interest under 35 U.S.C. 118

Prefix	Given Name	Middle Name	Family Name	Suffix
	James		Ashley	Jr.

Residence Information (Select One) ◉ US Residency ○ Non US Residency ○ Active US Military Service

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Applicant 2 Remove

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Residence Information (Select One) ◉ US Residency ○ Non US Residency ○ Active US Military Service

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Postal Code	92821	Country i	US

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

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Title of Invention	MAPPING IN A MULTI-DIMENSIONAL SPACE	

Customer Number	33717		
Email Address	laipmail@gtlaw.com	Add Email	Remove Email

Application Information:

Title of the Invention	MAPPING IN A MULTI-DIMENSIONAL SPACE		
Attorney Docket Number	081221-011500	**Small Entity Status Claimed**	☒
Application Type	Nonprovisional		
Subject Matter	Utility		
Suggested Class (if any)		**Sub Class (if any)**	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)	24	**Suggested Figure for Publication (if any)**	

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S. C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
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Please Select One:	◉ Customer Number	○ US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	33717		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78(a)(2) or CFR 1.78(a)(4), and need not otherwise be made part of the specification.

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
current	Continuation in part of	11848178	2007-08-30

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button. Add

Foreign Priority Information:

PTO/SB/14 (07-07)
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	081221-011500
	Application Number	
Title of Invention	MAPPING IN A MULTI-DIMENSIONAL SPACE	

This section allows for the applicant to claim benefit of foreign priority and to identify any prior foreign application for which priority is not claimed. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(a).

Remove

Application Number	Country [i]	Parent Filing Date (YYYY-MM-DD)	Priority Claimed
			(•) Yes ( ) No

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Assignee Information:

Providing this information in the application data sheet does not substitute for compliance with any requirement of part 3 of Title 37 of the CFR to have an assignment recorded in the Office.

Assignee 1 Remove

If the Assignee is an Organization check here. [X]			
Organization Name	WIRELESSWERX INTERNATIONAL, INC.		
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Country [i] PZ		Postal Code	
Phone Number		Fax Number	
Email Address			

Additional Assignee Data may be generated within this form by selecting the **Add** button. Add

Signature:

A signature of the applicant or representative is required in accordance with 37 CFR 1.33 and 10.18. Please see 37 CFR 1.4(d) for the form of the signature.

Signature	/cynthia a. dixon/			Date (YYYY-MM-DD)	2009-01-08
First Name	Cynthia	Last Name	Dixon	Registration Number	58926

This collection of information is required by 37 CFR 1.76. 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 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet 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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MAPPING IN A MULTI-DIMENSIONAL SPACE

BY

JAMES ASHLEY, JR.

PATRICK MOONEY

CROSS REFERENCE TO RELATED APPLICATIONS AND PATENTS

[0001] This application is a Continuation in Part of United States Patent Application Serial No. 11/848,178, filed August 30, 2007, and claims the benefit of the prior filing date of United States Provisional Patent Application Serial No. 60/625,467, filed November 5, 2004. These applications are incorporated by reference in their entirety. This application is related to United States Patent Application Serial No. 12/044,840, filed March 7, 2008, which is incorporated by reference in its entirety.

BACKGROUND

[0002] *1. Field of the Disclosure*

[0003] This application relates generally to monitoring wireless devices and to messaging by wireless communication between wireless devices in a specific geographical location and remote centers.

[0004] The disclosure also relates to configuring and using geographical zones in multi-dimensional spaces. In particular, it relates to systems and methods to remotely control and monitor movable entities, their functions and to positioning data in relation to geographical zones. Such zones can be pre-configured geographical zones. Moveable entities include, but are not limited to, people and vehicles.

[0005] *2. Background of the Disclosure*

[0006] Personal and vehicle tracking systems have become increasingly popular and more economically accessible to businesses and individuals. Most tracking locator

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systems utilize Global Positioning System (GPS) technology. In personal tracking, individuals use GPS tracking information to obtain their current location in relation to another location, etc.

[0007] While current GPS tracking systems provide benefits such as Latitude/Longitude (Lat/Long) of a location, triangulation and safety, these benefits are yet to be maximized. Current systems are limited to relaying the GPS information to a control center or a web server and plotting the position of the person or vehicle on a computer map.

[0008] Previous systems have been developed to attempt to locate a wireless communication device utilizing wireless access points and routers. For example, the wireless communication device could be in a location having several buildings in range of the wireless communication device. However, these systems do not necessarily provide a precise location. In another situation, the wireless communication device may be in a building with several floors, each floor having its own location node. In this situation, the wireless communication device may be closer to a location node on a different floor.

SUMMARY OF THE DISCLOSURE

[0009] The present disclosure relates to an apparatus, system, and method for developing a map of a multi-dimensional space for use by a user. The user being selectively individuals, vehicles, and/or other entities. In one or more embodiments, the system for generating the map involves using a geographical zone, where the zone is selectively a preconfigured geographical zone. In addition, the zone includes a plurality of spaced apart nodes, and the nodes are arranged in a multi-dimensional sense. The system further includes sending data communications between one or more of the nodes, one or more users, and one or more control stations. Also, the system contemplates affecting multi-dimensional mapping according to the placement of nodes and the communications between the nodes and the control stations.

[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.

[0015] **Figure 4** 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.

[0018] **Figures 6-1 through 6-4** illustrate component diagrams of a backend control system.

[0019] **Figure 7A** illustrates a screenshot of an instance of a client console.

[0020] **Figure 7B** illustrates a screenshot of an instance of a client console.

[0021] **Figure 7C** illustrates a screenshot of an instance of a client console.

[0022] **Figure 7D** illustrates a screenshot of an instance of a client console.

[0023] **Figure 8** illustrates a screenshot of an instance of a control center console.

[0024] **Figure 9** illustrates a screenshot of an instance of the operations data processor.

[0025] **Figure 10** illustrates a screenshot of an instance of the history data processor.

[0026] **Figure 11** illustrates a screenshot of an instance of a disabled transponder or subscriber device processor.

[0027] **Figure 12** illustrates an exemplary top-level system diagram in accordance with the present disclosure.

[0028] **Figure 13** illustrates a flowchart of the algorithm utilized for detecting the precise location of the wireless communication device in accordance with the present disclosure.

[0029] **Figure 14** illustrates an exemplary system in accordance with the present disclosure.

[0030] **Figure 15** illustrates an exemplary messaging application of the system in accordance with the present disclosure.

[0031] **Figure 16** illustrates an exemplary health check application of the system in accordance with the present disclosure.

[0032] **Figure 17** illustrates an exemplary exception handling application of the system in accordance with the present disclosure.

[0033] **Figure 18** illustrates an exemplary decision tree at the location node in accordance with the present disclosure.

[0034] **Figures 19A and 19B** illustrate an exemplary mesh network showing different nodes in communication with different base stations, and in turn, in communication with a control center.

[0035] **Figure 20** illustrates an exemplary system for data mining and communications with users associated with mobile devices that are located within particular geographical areas.

[0036] **Figure 21** illustrates an exemplary system of a multi-dimensional mesh network of nodes for communicating emergency messages to users.

DETAILED DESCRIPTION

[0037] The present disclosure provides a system and method that allows a user to control and monitor individuals, vehicles and other movable entities by using geographical zones. These zones can be pre-configured geographical zones. Such zones have a plurality of nodes. In different situations, messages can be sent between one or more of these mobile users and one or more control stations. The users can be a single user or multiple users in a group with whom there are message communications. The messages can be targeted to the one or multiple users.

[0038] The multi-dimensional sense can be a three-dimensional sense in the x, y and z axes or coordinates. The system allows for three-dimensional mapping according to the placement of nodes in a three-dimensional sense. Further messages can be communicated with movable entities according to their location in the three-dimensional space, and the messages may be commercial or emergency messages.

[0039] The nodes are preferably part of a mesh network or other suitable network configuration. The nodes preferably communicate with transponders or subscriber devices that can be a cell phone, Personal Digital Assistant (PDA) or similar device using the Bluetooth™ protocol.

[0040] In one particular aspect, there is the ability to effect fine resolution determination of a movable entity's location. This can include three-dimensional mapping of that location. Disclosed in the present application is an apparatus and method for the relative precise three-dimensional mapping of a specific location. The apparatus and method can utilize a Bluetooth™ equipped device that communicates wirelessly via Radio Frequency (RF) using Bluetooth™ protocol with location nodes in a mesh network. The Bluetooth™ equipped device uses at least one specific algorithm to determine its three-dimensional location within the mesh network. This resulting location data is used to generate a fine resolution map centering on that specific location.

[0041] In another specific aspect, there is the ability to obtain and mine data related to the location of a mobile user. This can include an apparatus and method for mining data relating to the relatively precise three-dimensional location of a user. The apparatus and method can employ a Bluetooth™ equipped mobile personal device associated with a user that communicates wirelessly via RF using Bluetooth™ protocol with location nodes in a mesh network. The Bluetooth™ equipped mobile personal device contains at least one specific algorithm to determine the relatively precise location of the user within the mesh network. When the Bluetooth™ equipped mobile personal device is within the range of certain location nodes, specific events are triggered. These include, but are not limited to, the downloading of appropriate advertisements to the Bluetooth™ equipped mobile personal device. In addition, the location nodes transmit the user's location data to a central station via other nodes within the mesh network, relay stations, and/or intermediate supplementary stations. The user's location data can then be processed and analyzed at the central station and/or intermediate supplementary stations.

[0042] In another specific aspect, there is the ability to provide a security support system utilizing three-dimensional user location data. This can include an apparatus and method for providing security support to mobile users using three-dimensional location data of the users. The apparatus and method can employ a Bluetooth™ equipped mobile personal device associated with a user that communicates wirelessly

via RF using Bluetooth™ protocol with location nodes in a mesh network. The Bluetooth™ equipped personal device uses at least one downloaded algorithm to determine the relatively specific three-dimensional location of the user within the mesh network. When an emergency event occurs, a central station and/or intermediate supplementary stations transmit emergency notifications to the users that are located within a specific group of nodes in the mesh network. These emergency notifications are transmitted to the users' personal devices via other nodes within the mesh network and/or through relay stations.

[0043] In one aspect, there is a method to define a geographical zone, which can be in two or three dimensions, and which can be utilized to regulate a movable entity that has a transponder or subscriber device. The device can be a cell phone, PDA, pager, computer or similar device, which is configured to be in wireless communication with other devices through a suitable network.

[0044] The method comprises loading from a computing device to a memory in a transponder or subscriber device a plurality of coordinates. The coordinates are mapped on a pixilated image so as to assign one pixel to each coordinate of the plurality of coordinates. The distance between each assigned pixel is configurable. The plurality of assigned pixels are connected with lines forming a contiguous line, and the connected line encloses an area in the pixilated image. The pixels that lie on the lines in order to form a contiguous array of pixels that enclose a shape in the pixilated image are activated. In another aspect, the method to define a geographical zone allows for regulation of the movable entity by monitoring, controlling and visualizing the status of the entity. The status of the entity may be movement, non-movement, and position of the entity. The movable entity is controlled and monitored depending on the location of the movable entity relative to said geographical zone.

[0045] In another aspect, the plurality of coordinates are entered by a user of a computer device and transmitted to the transponder or subscriber device. The user is allowed to enter geographical coordinates in a three-dimensional sense by allowing a user to select points in a map in a computer by clicking on the map and calculating the

geographical coordinates of each selected point in the map. In another aspect, the user is allowed to enter geographical coordinates by typing on the computer the longitude and latitude. The plurality of geographical coordinates can defined either by various systems including, but not limited to, the Mercator system and/or a latitude and longitude system.

[0046] In yet another aspect, the position of the movable entity in relation to the geographical zone as described in the method to define a three-dimensional geographical zone is determined by the steps of locating the transponder or subscriber device within the pixilated image by activating a pixel corresponding to the geographical coordinates where the transponder or subscriber device is located. Two vertical lines are extended in opposite directions and originating from the pixel, two horizontal lines are extended in opposite directions and originating from the pixel. The number of times each line crosses the boundary of the geographical zone is determined, and an outside status is assigned to each line that crosses the boundary a even number of times. An inside status is assigned to each line that crosses the boundary a odd number of times. The transponder or subscriber device is identified as being inside the boundary if the status of three out of four lines indicate an inside status.

[0047] In another aspect, a subscriber device has a ground- or elevation-positioning system receiver that calculates the transponder or subscriber device coordinates, and allows a user or control center to identify the location of the movable entity in the pixilated image as one pixel in the computer image.

[0048] In another aspect, the geographical area is a geometrical shape such as a square, rectangle, triangle, circle, oval, or trapezoid in two or three dimensions. The shape of the geographical area can also be the shape of a non-geometrical shape such as the shape of the border delimiting a building, address, street, state, city, county, or country.

[0049] In one aspect, there is a method to define a geographical zone in two or three dimensions utilized to regulate a movable entity having a transponder or subscriber device. The method comprises allowing a user to enter a plurality of waypoints, each

waypoint in the plurality of waypoints being defined by a geographical coordinate and a radius; wherein the geographical coordinate in two or three dimensions is represented by a latitude and longitude and elevation, and the radius is represented by a distance magnitude; and loading the plurality of waypoints on a transponder or subscriber device.

[0050] In another aspect, the transponder or subscriber device can determine whether the transponder or subscriber device is inside or outside the geographical zone in two or three dimensions by obtaining global positioning coordinates, and calculating whether the global positioning coordinates are inside at least one waypoint of the plurality of waypoints. The shape of the geographical area is the shape of a non-geometrical shape. The elevation relationship and positions can be determined by nodes set at different elevation levels.

[0051] In another aspect, all waypoints in the plurality of waypoints have the same coordinate but different radii, such that all the waypoints in the plurality of waypoints are concentric.

[0052] In one aspect, there is a method to identify a geographical area in one, two, or three dimensions for regulating a movable entity. The method comprises allowing a user to identify a geometrical area, region or space in a computer map. The geometrical area, region or space uses two or more coordinate attributes, and the identified geometrical area, region or space is divided into a grid. A user is allowed to select at least one section from within the grid in order to define a geographical area, region or space. The at least one section is associated with at least one pixel in a pixilated computer image such that the pixels selected by the user in the identified geometrical area are identified as being in the geographical area, region or space. The pixilated computer image is loaded to a memory in a transponder or subscriber device.

[0053] In another aspect, the pixilated computer image has a directly proportional number of columns and rows as the identified geometrical area, region or space. Alternatively, the pixilated computer image has the same number of columns and rows as the identified geometrical area, region or space. In another aspect, the geometrical area, region or space is rectangular or circular. In yet another aspect, a second

geographical area, region or space is defined by a plurality of geographical areas, regions or spaces.

[0054] In one or more embodiments, the identified geometrical area, region or space is divided into a grid of three-dimensional squares and/or rectangles. The three-dimensional squares and/or rectangles of the grid may have various depths. The user is allowed to select at least one section from within the three-dimensional grid in order to define a three-dimensional geographical area, region, or space. The at least one section is associated with at least one pixel in a pixilated computer image such that the pixels selected by the user in the identified geometrical area are identified as being in the three-dimensional geographical area, region or space. The pixilated computer image is loaded to a memory in a transponder or subscriber device.

[0055] In yet another aspect the movable entity has a transponder or subscriber device associated with the entity and located in the geographical area, region or space. A position of the transponder or subscriber device is obtained from a ground or elevation positioning unit operably connected to the transponder or subscriber device. The position of the transponder or subscriber device is correlated in the geographical area, region or space to a representative position of the transponder or subscriber device in the pixilated computer image. The representative position of the transponder or subscriber device is determined as to whether the pixilated computer image falls on a pixel that is flagged as being in the geographical area, region or space.

[0056] The present disclosure provides a solution for providing wireless communication devices with relatively precise location awareness, system monitoring and area-specific messaging capabilities in environments where an accurate GPS position may not be able to be acquired, such as within a multi-story building.

[0057] The system-monitoring component performs health checks and validity tests on location nodes within an enabled environment, while the area-messaging component provides area-specific messaging to enabled wireless communication devices.

[0058] As used in this disclosure, "location node" is a stationary programmable device with a wireless transceiver, which is "Bluetooth™" capable for example, and a micro-controller. The location node is preferably programmed with one or more of its own device or "friendly" name-selection parameters, geographical positions, max power settings, installation identifiers, floor numbers and payload types.

[0059] A wireless communication device operable to detect a plurality of location nodes is disclosed. A wireless communication device periodically interrogates its environment and determines which location node is most practically near. The wireless communication device then communicates to that location node, and requests that any additional data information relevant to the specific location associated with that location node be sent back to the wireless communication device.

[0060] The most practically near node is defined as the node that is located at the closest accessible location to the movable entity. For example, a wireless communication device located on the second floor of a multi-story building may be closest to a location node located on the ceiling of the first floor, and may be next closest to a location node located on the second floor. Although the location node on the first floor is actually closer in distance to the movable entity than the location node on the second floor, since the location node on the first floor is not easily accessible to the movable entity located on the second floor, the location node on the second floor will be considered the most practically near node to the movable entity.

[0061] In one or more embodiments, the present disclosure relates to a system and method for the monitoring of and messaging to wireless communication devices within a predefined space, wherein the wireless communication device can be any wireless communication device with receiving and transmitting capabilities such as a cell phone, PDA, lap top computer, desktop computer and pager. The system and method utilizes, in its simplest form, at least two elements: at least one wireless communication device and at least one location node. When the system is activated, the wireless communication device will determine all of the location nodes within range. The wireless communication device will then determine the location of the most practically

near location node. The wireless communication device can then request information specific to its location from this most practically near location node.

[0062] It should be appreciated that for simplicity and clarity of illustration, elements shown in the Figures and discussed below have not necessarily been drawn to scale. For example, the dimensions of some of the elements are exaggerated relative to each other for clarity.

[0063] Management and monitoring devices of assets and individuals that use ground positioning systems allow users to track the position of individuals, vehicles, cargo and other movable entities. The method and system described below utilizes a transponder or subscriber device that communicates over cellular and satellite communication networks in combination with GPS satellites capable of providing position and status information of the movable entity on a global scale. Additionally there is the ability for more precise monitoring of assets and individuals. The transponder or subscriber device allows interaction with and control of a wide range of peripheral devices, including, but not limited to, operating the movable entity according to pre-configured geographical zones and triggered events.

[0064] A transponder or subscriber device can be mounted, attached, manufactured or otherwise included upon or in various articles or entities. Such individuals, articles or entities may include vehicles, aircraft, cargo, persons, animals or any other item where tracking its movement and/or location is beneficial. Within the context of the disclosed tracking system, the transponder or subscriber device works to collect, process and communicate information about the movable article or entity to which the transponder or subscriber device is associated. Furthermore, when requested, the transponder or subscriber device can issue various commands and instructions to the local article, entity, and/or command center.

[0065] The transponder or subscriber device has the features, flexibility, and capability of an intelligent device. The transponder or subscriber device may contain a Central Processing Unit (CPU). The CPU has at least a 4-bit processor, which can interface with at least one modem (cellular, satellite, and others), at least one GPS receiver, at

least one memory module, and/or other peripheral devices. Other components of the transponder or subscriber device may include, but are not limited to, at least one GPS antenna, at least one modem antenna, at least one serial port for communication and configuration, and at least one multiple connector pin which contains at least one input and at least one output. The at least one input and output are configurable to be associated with a configurable event or configurable operation.

[0066] The transponder or subscriber device can include many different combinations of the components listed above and/or similar components. For example, a transponder or subscriber device may have two modems, where one modem is a satellite modem and one modem is a cellular modem. Additionally, a transponder or subscriber device can contain a Bluetooth™ equipped receiver, Bluetooth™ equipped transmitter, Bluetooth™ equipped transceiver, and/or GPS receiver in combination with the other components. In one or more embodiments, any or all of the components are co-located on the same integrated circuit (IC) chip within the transponder or subscriber device. The components of the transponder or subscriber device depend upon which capabilities the movable entity requires.

[0067] Among its many capabilities, the CPU of the transponder or subscriber device can be configured to manage configurable events or configurable operations. Managing events means that among other capabilities, the transponder or subscriber device can report, observe, recognize, process, and analyze numerous configurable events or configurable operations. In addition, the transponder or subscriber device can give and respond to various commands, effectuate numerous events in its local installation, and contain a history recording component.

[0068] An event message can be triggered by physical and logical events including the event message itself and/or other such information. Other such information includes, but is not limited to, latitude, longitude, elevation, speed, direction, time, state of all the inputs, state of all outputs, event reason or source, and/or any other relevant information concerning the entity.

[0069] The transponder or subscriber device is configurable to include as few or as many configurable logical events or physical events as the user desires. Events may be physical or logical. Logical events may be based on rules using a combination of the GPS position of the movable entity, and one other factor, such as time or speed. However, logical events can be based upon a combination of factors. Physical events are those events that are physically manifested by the individual, the vehicle, or the object being tracked.

[0070] Other configurable events or configurable operations include the location of the vehicle, individual or object in terms of latitude, longitude, and/or elevation; the time and corresponding location of the last configurable event reported; the direction of the vehicle, individual or object; the state of any assigned inputs or outputs or change thereof; a pre-selected distance; a pre-selected time interval; pre-selected intervals based upon date and time reference; a pre-selected schedule for reporting and recording any of the configurable events or configurable operations; a pre-selected speed; length of relative stationary time; and length of non movement for an individual or object.

[0071] Additional configurable events or configurable operations include the entering or exiting of a pre-set waypoint or a pre-set zone in a multi-dimensional space such as two or three dimensions being the longitude, latitude and elevation coordinates, namely the x, y and z coordinates. A waypoint is a circular, cylindrical, or spherical area defined by a geographical center point and radius in the multi-dimensional space. The area or space defined by the waypoint is configurable by changing the radius and the position of the geographical center point. A zone is an irregular region defined by a series of line segments enclosing an area or space.

[0072] The configurable events or configurable operations or combinations thereof can be processed in order to transmit a specific message, respond to a specific query or command, enable or disable a specific mechanism, or recognize a specific event. For example, the CPU can be configured to process that, if at a pre-selected time the individual, vehicle or object has not moved a pre-selected distance, then the

transponder or subscriber device is sent a command to alter the state or conditions of the individual, vehicle, object, transponder or subscriber device.

[0073] The configurable events or configurable operations may occur in many situations. These situations include, but are not limited to, where configurable events or configurable operations occur in response to a command; where configurable events or configurable operations occur in response to a query, or where configurable events or configurable operations occur upon recognition of pre-selected conditions.

[0074] Configurable boundaries or geographical zones may also be employed and can be configurable to any shape the user desires. For example, the boundary or zone can trace the border of a building, floor of a building or structure, part of a building, part or whole of a facility, a campus, a select portion of a building falling within a GPS address designation, a state line, or trace the route of a selected highway or path. The boundary or zone can trace the border of the premises of a school zone, a no-fly zone, a city, etc. The boundary or zone can also be a geometric shape or non-geometric shape in a multi-directional coordinate sense. A further benefit of the present disclosure is that the transponder or subscriber device can be updated and configured locally or wirelessly.

[0075] **Figure 1** illustrates the high-level architecture of a computer system for controlling and monitoring movable entities including, but not limited to, vehicles and people. A plurality of vehicles **110** has at least one transponder or subscriber device **105** that can be tracked and allows the functionality to remotely control functionality of the vehicle **115** or an individual **115a**.

[0076] The transponder or subscriber device **105** connects with a plurality and any combination of communication networks. In one embodiment, such a communications network is a cellular network including multiple cellular base stations **120** and service providers **135**. In another embodiment, such a communications network is a cellular network including multiple cellular base stations with SMS receivers **125** and service providers **140**. In another embodiment, such a communications network is a satellite network including multiple satellite receivers and transmitters **130** and satellite ground

stations **145**. In yet another embodiment, such a communications network is a shortwave radio communications network.

[0077] The communications network permits the transponder or subscriber device **105** to communicate with a backend control system **150**. The transponder or subscriber device **105** sends event information to the backend control system **150** and responds to commands sent to the transponder or subscriber device **105** by the backend control system **150** through the communications network. The backend control system **150** includes a plurality of gateways **151**, **152**, **153** and **154** which interact with a codec **155**. The codec **155** is the central codifier and decodifier of the backend control system **150** and allows the backend control system to adapt and communicate with any communications network. The modular design enables the introduction of new hardware and network protocols without having to change monitoring and reporting software. The backend control system **150** also includes an asynchronous routing system **159** that allows incoming and outgoing communications to be handled asynchronously and efficiently. In one embodiment, the asynchronous routing system **159** includes a plurality of routing services **156**, at least one database **157** and a web server **158**. The messages routed by the routing services **156** are directly communicated to a client console **176**. The client console **176** presents vehicle **115** and transponder or subscriber device **105** information to the operator. The client console **176** sends commands to the transponder or subscriber device **105** through the backend control system **150** and a communication network.

[0078] Multiple applications may connect to the central database **157** to provide further system functionality. An administrator console **175** permits operators to add, edit or delete transponder or subscriber device **105** information, vehicle **115** or individual **115a** information, user information, etc. A history processor console **174** allows an operator to view reports and replay event data. An operations data processor **173** permits an operator to define geographical zones and waypoints for operation of the transponder or subscriber device **105**. A configuration utility **172** permits operators to easily configure the transponder or subscriber device **105** features and functionality.

[0079] Vehicle or individual information can be presented to the operator through alternative mediums besides a client console **176**. In one embodiment, vehicle information can be presented to an operator through a website or an email by transmitting such information from a web server **158** via the Internet **160** to a web client **171**. In another embodiment, vehicle information can be presented to the operator by sending a text or voice messages to a predetermined wireless device **180**.

[0080] **Figure 1** illustrates the wireless connectivity of the transponder or subscriber device **105** on a vehicle **115** or an individual **115a**. The transponder or subscriber device **105** receives radio signals from a GPS constellation satellite **130** allowing the transponder or subscriber device **105** to process positioning information. The transponder or subscriber device **105** can communicate wirelessly to various networks through multiple wireless devices integrated in the transponder or subscriber device's **105** hardware such as short range radio **154**, a cellular receiver **120** and **125**, and a satellite **130**.

[0081] **Transponder or Subscriber Device Hardware Configuration**

[0082] **Figure 2** illustrates the internal board **240** of the transponder or subscriber device **105**. The transponder or subscriber device board **240** contains at least one GPS receiver **215**, at least one CPU **210**, at least one cellular modem **220**, and at least one memory module **280**. At least one Bluetooth™ transmitter/receiver **225** can be included in the internal board **240**. The Bluetooth™ transmitter/receiver **225** can be implemented as a transceiver, as a separate transmitter and receiver, a transmitter alone, or a receiver alone. In one embodiment, the tracking system uses utilizes both cellular and satellite networks to provide the most affordable and complete global coverage.

[0083] The GPS receiver **215** is capable of positioning accuracy to within a few feet or less. For example, a 12-Channel Trimble SQ, Lapaic UV40, or small-range accurate receivers are contemplated.

[0084] The processor **210** is at least a 4-bit processor. The processor **210** includes at least 1 Kilo-byte of RAM. For example, a Motorola MMC2114 32-Bit RISC processor

with two built-in UART's is contemplated. However, a similar or more advanced processor is also contemplated. The memory module **280** includes at least two additional memory chips, wherein each additional memory chip is at least 128K.

[0085] In one embodiment, the cellular receiver or cellular modem **220** is the primary means for communication. The cellular modem **220** interfaces with at least one on-board processor's built-in serial ports. The cellular modem **220** may be a GSM, CDMA or similar modem. The satellite modem or transceiver **230** is external to the transponder or subscriber device **105** and is connected by a serial port. In one embodiment, the satellite modem **230** is located under fiberglass or any other non-metal material in order to provide maximum coverage. The satellite modem **230** is used primarily when there is little or no cellular coverage, or when the user specifies use of the satellite modem **230**. The efficient use of the satellite modem **230** functions to lower the cost of the tracking system to the user. One embodiment contemplates a satellite modem **230** such as a Sky Wave DMR-200 satellite modem. Similar contemplated satellite modems include features including, but not limited to, incorporating a built-in omni-directional antenna, providing worldwide coverage, and efficiently interfacing with the transponder or subscriber device's processor **210**.

[0086] The Bluetooth™ transmitter/receiver **225** has a range of at least 20 meters. For example, in one embodiment, a National Semiconductor Simply Blue LMX9820 Class 2 Bluetooth™ module is contemplated. However, similar or more advanced Bluetooth™ transceivers, transmitters, and/or receivers as well as any other transceiver, transmitter, or receiver that allows for radio connectivity and does not require a line of sight are contemplated. Preferably, the Bluetooth™ transmitter/receiver **225** is installed to utilize different capabilities such as integrating and supporting multiple wireless peripherals, acting as a shortwave radio to download data, or to serve as a local, traveling wireless "hotspot."

[0087] In one embodiment, the power source of the transponder or subscriber device, is a fused main power-in source with a recommended operating in a range between 12 and 24 volts. One embodiment contemplates low power consumption (65mA or less)

during normal operation. Furthermore, the transponder or subscriber device **105** includes circuitry for charging an optional backup battery. If the primary power source supply is below a minimum acceptable level, the transponder or subscriber device **105** will automatically switch to a backup power source as well as transmit a message identifying that the primary power source is at a critically low level.

[0088] The transponder or subscriber device **105**, such as a cell phone or PDA, is a small and affordable unit with numerous features. The external view of the transponder or subscriber device is illustrated in **Figure 3**. In one embodiment, the housing **335** of the transponder or subscriber device **105** is manufactured from plastic, metal, or any other material that functions to protect the inner components from external events such as physical damage, dust, water, excessive temperatures or any other event which could affect the integrity of the transponder or subscriber device. In one or more embodiments, the transponder or subscriber device **105** contains external communication ports, a multiple pin connector, at least four control outputs, a modem antenna connector, several indicators and/or a GPS antenna. In another embodiment, a Bluetooth™ antenna is incorporated in the transponder or subscriber device **105**.

[0089] There can be a passenger counter, which can interface with several door infrared motion sensors for the purpose of counting the number of people entering or exiting from at least one door of, for instance, a building or a room. A serial port can also be used to test and configure applications within the transponder or subscriber device **105**. In one embodiment, the serial port functions as a programming port which is used when programming the unit for the first time or re-programming the unit's core program.

[0090] The indicators associated with the transponder or subscriber device **105** can be for any type of connection, signal, power level, status, and any other similar communications. In one embodiment, an indicator is a light-emitting diode (LED) that appears red when the transponder or subscriber device **105** has power connected to it. Another indicator can be an LED that blinks green at a rapid pace when the GPS receiver is establishing a connection and slowly blinks green when a connection is

established. Another indicator can be an LED light that blinks green for every message received, and red for every message sent. Another indicator can be an LED that is red when the cellular modem **220** is roaming, and is green when it is at home.

[0091] Transponder or Subscriber Device Firmware Configuration

[0092] The transponder or subscriber device **105** has numerous features, functions, and capabilities described below. The transponder or subscriber device **105** is an intelligent device controlled by an at least 4-bit processor **210**. **Figure 2** depicts one embodiment where the processor **210** has the capability to interface with a GPS receiver **215**, a cellular modem **220**, a Bluetooth™ transmitter/receiver **225**, a memory module **280**, and a satellite modem **230**.

[0093] The transponder or subscriber device **105** can be configured to report, observe, and analyze numerous logical events. The transponder or subscriber device is also configurable to give and respond to various commands, and contains a configurable history-recording component. A further benefit of the present disclosure is that all the configurations to the transponder or subscriber device **105** can be done locally or wirelessly. Thus, the user is able to configure any features including the entire operating system of the transponder or subscriber device wirelessly. This wireless configuration can be accomplished through the use of the cellular modem **220**, the Bluetooth™ transmitter/receiver **225**, or any other wireless means.

[0094] Moreover, the transponder or subscriber device **105** can be configured locally through connecting to a serial port. Another benefit of the present disclosure is that during wireless or local configuration, the transponder or subscriber device **105** continues to operate normally. This means that the transponder or subscriber device **105** can be configured with losing little to no operability. Wireless configuration commands change the parameters used for processing physical and logical events on the fly. Wireless operating system updates are achieved using two executable code spaces, and a temporary code space for loading new code. Once the uploading of new code into the temporary code space is completed, the transponder or subscriber device

reboots, copies the new code into the secondary executable code space, and resumes execution with the most recent update.

[0095] **Figure 4** is an exemplary screen shot of the user interface for configuring the physical and logical events within the transponder or subscriber device in one embodiment. **Figure 4** serves only as an example of a general interface, with which the user can interact to configure the transponder or subscriber device **105**. One feature of the present disclosure is that configuring the transponder or subscriber device does not require the user to know scripts or hard-coded parameters. Instead, the present disclosure includes a software application with which the user can easily interface via logical windows, tabs, fields, checkboxes and radio buttons to configure the transponder or subscriber device.

[0096] **Figure 4** is a screen shot of a window that interfaces with the user to configure the transponder or subscriber device **105**. The window **400** has at least four tabs **401** from which the user can choose. The first tab **402** directs the user to a window **400** for configuring the cellular modem **220** of the transponder or subscriber device **105**.

[0097] Events can be physical or logical. Physical and logical events trigger the sending of a message over the air when certain conditions are met. Most logical events are based on rules using a combination of the GPS position and one other factor, such as time or speed. The event message triggered by physical and logical events includes, but is not limited to, the event message itself, and such information including latitude, longitude, speed, direction, time, state of all the inputs, event reason or source, and any other relevant information. The logical events are usually software driven, calculation based, and typically draw from GPS positions and/or positions from location nodes. The transponder or subscriber device **105** is configurable to include as few or as many logical events as the user desires. One embodiment includes at least six different configurable logical events.

[0098] The first logical event of one embodiment is a feature that reports the last known location of the transponder or subscriber device for a specified interval of time. The status report to the user may consist of other parameters such as latitude,

longitude, speed, direction, time and the state of the inputs. An example of a first logical event is where the user configured the time reporting interval for 60 seconds. This means that in this scenario, the last known location status and applicable parameters are reported every 60 seconds. This time-reporting feature gives the user flexibility, and the option to lower the cost of data transmission.

[0099] The second logical event of an embodiment is a feature that further refines the reporting capabilities of the time reporting feature. This event is Smart Time Reporting. The Smart Time Reporting feature functions to transmit a report only when the vehicle has moved a pre-selected distance since the last transmitted report. Thus, a user could configure the transponder or subscriber device **105** to report its location and applicable parameters by selecting a timed reporting interval in terms of seconds and a distance in terms of meters. For example, a user could select the time reporting interval for 60 seconds and the distance for 1000 meters. This would mean that every 60 seconds the transponder or subscriber device would send a report unless the transponder or subscriber device **105** has not moved at least 1000 meters since the last report. This Smart Time Reporting feature allows the user to tailor the amount of reporting and, thus, tailor the cost of data transmission.

[00100] Another contemplated reporting feature is a scheduled reporting feature. This feature sets the transponder or subscriber device's reporting feature on an interval based upon a date and time reference. Thus, the user can configure the transponder or subscriber device to report location and the other parameters on pre-selected days and hours of the week, month, or year. For example, a user could use the scheduled reporting feature to configure the transponder or subscriber device to only report at 8 am, 12 pm and 4 pm on weekdays and only once per weekend day. Another feature not depicted is a satellite scheduled reporting feature where the same scheduled reporting capabilities are applicable, only the message is transmitted via an optional satellite modem **230**.

[00101] A third logical event of an embodiment is a speeding feature. The transponder or subscriber device **105** can be configured to send reports dependent on the speed or

movement of the individual, vehicle or article the transponder or subscriber device **105** is associated. Thus, events are generated and recorded when a speed threshold has been exceeded, and when the speed has crossed below the threshold. When the transponder or subscriber device **105** crosses back below the threshold, an event message indicating this occurrence as well as a third message is transmitted indicating the maximum speed reached during the period when the transponder or subscriber device **105** was above the speed threshold. The speed time filter gives the user the option to set a time period in terms of seconds to allow the individual, vehicle, or article to cross the speed threshold without sending a message. This filter also allows for efficient data transmission. For example, the user can set the speed time filter for 15 seconds, which allows the vehicle to speed for 15 seconds without sending a report. Similar to the other logical events, the event message can also include information such as the latitude, longitude, elevation, speed, direction, time, and state of the inputs.

[00102] The transponder or subscriber device **105** can be configured to send reports dependent on the amount of time the individual, vehicle or article has been essentially relatively stationary. The event message records the time and location corresponding to when the threshold was exceeded.

[00103] Geofencing

[00104] The next logical event of one embodiment is a “geofencing” feature, which is the creation of a configurable boundaries or geographical zones feature. This feature consists of generating events when the transponder or subscriber device travels through waypoints and zones. A configurable boundary or geographical zone may be constructed through a combination of waypoints and/or zones. Because of this combination, the configurable boundary or geographical zone can be constructed in a very specific shape, which allows for the outlining of specific borders or routes. A waypoint is a circular area, cylindrical area, or spherical area defined by a geographical center point and radius. The area defined by the waypoint is configurable by changing the radius and the position of the geographical center point. Thus, the boundary created by the waypoints and zones is configurable.

[00105] In one embodiment, the transponder or subscriber device **105** is loaded with a plurality of waypoints, each waypoint is defined by a coordinate and a radius. A zone can be defined by a plurality of waypoints. Thus, for example, a building, campus, part of a building, and/or a city can be defined by two waypoints in multiple dimensions.

[00106] Using GPS data, the transponder or subscriber device, for example, can calculate whether it is located within two waypoints that define a city in two dimensions or three dimensions, namely longitude, latitude, and elevation. If the transponder or subscriber device determines that it is located inside one of the two waypoints, then the transponder or subscriber device **105** assumes that it is within the limits of the city.

[00107] The third dimension, namely the elevation, is defined by nodes located at different levels of elevation with which the transponder or subscriber device communicates. Also, more precise longitude, latitude, and elevation coordinates can be defined by the nodes, in a manner normally beyond GPS precision and ability.

[00108] A zone is an irregular region defined by a series of line segments enclosing an area. In one embodiment, each zone contains 3 to 256 or more deflection points for creating the line segments defining this irregular area. In one embodiment, this irregular area can create a configurable boundary or a geographical zone. The properties of a zone include a name, description, and a flag determining if the zone is an off-limits zone or an enclosed zone.

[00109] In one embodiment, a geographical zone may be created by selecting a plurality of coordinates and downloading the coordinates to the transponder or subscriber device **105**. The plurality of coordinates may be in the Mercator system. Next, the transponder or subscriber device **105** assigns each coordinate to a pixel in a pixilated image that is loaded in the transponder or subscriber device **105**. In order to perform the assignment, the transponder or subscriber device **105** utilizes logic to define a “bounding” square or box around the plurality of coordinates. Then the bounding box is pixilated, and the pixels where all the coordinates fall are marked as activated. Once the pixels for each coordinate are assigned, lines are extended from one pixel to the next so as to form an enclosed area in the pixilated image. The pixels that lie in the path

of the lines between the activated pixels are also activated. Thus, an enclosed and contiguous line of pixels is formed.

[00110] Waypoints and zones are built by the operations data processor **173**. Once a waypoint and/or zone has been built, it can be used with the transponder or subscriber device loads. Transponder or subscriber device loads are a collection of zones and waypoints slated to be loaded on a transponder or subscriber device **105**. These loads are loaded onto the transponder or subscriber devices with the configuration utility **172**.

[00111] **Figure 5A** illustrates a pixel map **500** of a zone in a broad two-dimensional sense. After all the deflection points for a given zone are uploaded, the zone is saved in the memory module **280** of the transponder or subscriber device **105** in the form of a pixel map **500**. The pixel map **500** is created by first drawing a square around the entire area of the zone. In one or more embodiments, the square is then divided into an 80/80-pixel map. Each pixel **505** is a square. These squares are then used to draw the outline shape **510** of the zone **515**. A geographical area is then mapped to each pixel **505** of the pixel map **500**. A position fix **520** in the pixel map **500** is mapped from the current geographical location of the individual, vehicle, or article. In another embodiment, the pixel map **500** of a zone can be depicted in a broad three-dimensional sense.

[00112] A test is performed for each zone for each position fix **520** in order to determine if the transponder or subscriber device **105** is located inside the zone **515** or outside the zone **515**. Thus, for each zone **515**, the test starts with a simple check to determine if the position fix **520** is located inside or outside the pixel map **500**. If the current position fix **520** is located inside the pixel map **500**, a more extensive test is completed by plotting the position fix **520** inside the bounding box, and drawing at least four lines in at least four directions (for example, north, south, east and west) **525** from the position fix **520** to the borders of the pixel map **500**. Subsequently, the number of zone boundary crossings **530** is counted for each of the at least four lines **525**.

[00113] Multiple boundary crossing tests are performed for accuracy. In one or more embodiments, if a given line **525** crosses an odd number of zone boundaries **510**, the

position fix **520** is considered to be located inside the zone **515**. In one or more embodiments, if a given line **525** crosses an even number of zone boundaries, the position fix **520** is considered to be located outside the zone **515**. In one or more embodiments, if at least three out of the at least four boundary crossing tests agree, the zone boundary crossings **530** are used to determine if the position fix **520** is located inside or outside the zone. In one or more embodiments, if three out of the at least four boundary tests do not agree, the position fix **520** is considered to be outside the zone **515**.

[00114] Position fixes **520** that are on the special locations in the pixel map **500** can yield specific location results. In one embodiment, position fixes **520** that land on a zone boundary **510** are determined to be located outside the zone boundary **510**. In another embodiment, position fixes **520** that land on a zone boundary **510** are determined to be located inside the zone boundary **510**. In one embodiment, position fixes **520** that land on a "long and narrow protrusion", which is only one pixel wide, can be considered to always be located inside the zone **515**. In another embodiment, position fixes **520** that land on a "long and narrow protrusion", which is only one pixel wide, can be considered to always be located outside the zone **515**.

[00115] Figure 5B illustrates a pixel map **550** of a geographical zone in a two-dimensional sense. The pixel map **550** is first presented to the user as a geographical map on a screen connected to a computing device. In one embodiment, the user selects a rectangular shape **555** around the geographical area **560** that the user desires to define. In another embodiment, the user may define a customized shape, which may be either two or three dimensions. The rectangular shape is then divided into smaller rectangles such that the area of the rectangle is divided into a grid. Each pixel in the grid can be activated to be part of the geographical zone. In one embodiment, the user may activate each pixel by double-clicking on each pixel. In another embodiment, the user may select a smaller rectangular region, and mark the smaller rectangular region as being part of the geographical zone **560** so that the pixels contained within the smaller geographical zone are activated. In yet another embodiment, the user may

select a circular area as being part of the geographical zone **560**, and all the pixels located in such circular area would be activated. In another embodiment, the user may define any customized two- or three-dimensional geometrical or non-geometrical shape.

[00116] Once all the desired pixels are selected by the user as being part of the geographical zone **560**, the rectangular shape **555** is mapped into a pixilated computer image. In one embodiment, the pixilated computer image contains the same number of pixels as the number of sections in the grid. The pixilated computer image can then be loaded to the transponder or subscriber device **105**. The transponder or subscriber device **105** can be programmed to determine the position of the entity with a simple calculation of whether the pixel in which the transponder or subscriber device's location falls is activated or deactivated. In another embodiment, the geographical zone is defined by selecting a two-dimensional rectangular region, a three-dimensional rectangular region, a circular region, cylindrical region, and/or a spherical region. The circular region, cylindrical region, and/or spherical region can each be defined by a waypoint.

[00117] An irregular zone or geographical zone may be defined by a collection of waypoints and pixilated images. Furthermore, each irregular zone may have additional parameters including, but not limited to, a speed threshold of the entity parameter, a flag parameter such as a flag indicating a "no-fly zone", a color coded parameter such as a specific color being used to indicate a danger or security threat, and a communication enablement or disablement parameter.

[00118] When the transponder or subscriber device **105** enters or exits waypoints and zones, an event message is transmitted indicating what reference point or zone has been entered or exited. The event message can include a date relating to latitude, longitude, speed, direction, time, state of the inputs, odometer, event reason or source, and any other relevant information. Thus, the zone boundaries and waypoints allow the user to track an individual, vehicle, or article through configurable boundaries or geographical zones, such as a state border or a specified route.

[00119] In one embodiment, the waypoint and zone events are configurable to one or more assigned outputs. Meaning, when the transponder or subscriber device **105** enters or exits waypoints and zones, it can initiate an output. An output can consist of an LED light unit within the vehicle, article, and/or on the subscriber or transponder device associated with an individual.

[00120] Commands

[00121] The transponder or subscriber device **105** is also configurable to respond to various queries and to set commands sent wirelessly. A position query command can command the transponder or subscriber device **105** to return the last valid GPS position, position from the location nodes, speed, direction, time, input state, and other relevant state. The transponder or subscriber device **105** can also be configured to respond to a query. Upon receiving a query command, the transponder or subscriber device **105** will return to the last valid GPS position, position from the location nodes, speed, direction, time, input state, and other relevant state.

[00122] The transponder or subscriber device **105** is also configurable to respond to various query commands sent over the optional satellite modem **230**. The satellite position query command commands the transponder or subscriber device **105** to return the last valid GPS position, position from the location nodes, speed, and time. The transponder or subscriber device **105** can also be configured to respond to a satellite odometer query. Upon receiving this query command, the transponder or subscriber device **105** transmits the state of its inputs and running odometer value. Examples of other forms of query commands that are sent to the transponder or subscriber device **105** include, but are not limited to, an Input and Output Signal Query, Analog to Digital Levels Query, Passenger Count Query, Firmware Version Query, Satellite Status Query, Satellite Position and Velocity Query, and Satellite IO Query.

[00123] Another optional command is the alarm acknowledgement. This command is sent to the transponder or subscriber device **105** to terminate the sending of a priority event (panic, medical or roadside assistance are examples of priority events). When the

alarm acknowledgement is received, no further priority messages for the current event are transmitted.

[00124] In one embodiment, the command is to set a single output. This is used to wirelessly change the state of an output to either active or inactive. An example would be to unlock the back door of an armored truck when it arrives at the bank. Another example is to turn on the fuel pumps for a tanker truck when it arrives at a gas station.

[00125] In another embodiment, the command may be to send a text message from the transponder or subscriber device **105** through the communication network to a device configured to receive and interpret text messages.

[00126] In another embodiment, the command is a configuration command to configure functionalities of the transponder or subscriber device **105** as previously discussed. Examples of configuration commands include, but are not limited to, Configure Timed Reporting, Set Odometer, Upload New Firmware, Configure Excess Speed Event, Configure Excessive Idle Event, Configure Satellite Timed Reporting, Configure Power Level Critical, Configure Satellite Communication Port, Enable Event, Configure Priority Events, Enable Cellular Message, Enable Short-Range Radio Message, Assert Output Event, Configure GPS Filter, Enable Input, Set Passenger Count, Configure Smart Timed Reporting, Configure Scheduled Reporting, and Configure Satellite Scheduled Reporting.

[00127] The transponder or subscriber device **105** also may include a history reporting component. Whenever the transponder or subscriber device **105** cannot transmit data packets due to a lack of coverage via the principle communication media, the packers are stored in one of at least two history logs on an on-board flash memory storage device. When the transponder or subscriber device determines that the communication link has been re-established, any packets stored in memory are sequentially transmitted, beginning with those messages identified as a priority. For example, emergency or roadside assistance would be a priority message, which would be the first message transmitted when the connection is re-established.

[00128] In an effort to combat GPS drift, two parameters are included to filter GPS positions received from the GPS receiver. The two parameters are related to maximum allowed speed and maximum allowed acceleration. The parameters can be customized for a specific type of installation. If a packet is received from the GPS receiver and either of these two parameters is exceeded, the position packet is discarded.

[00129] Backend Control System

[00130] Figures 6-1 through 6-4 illustrate a backend control system **150** utilized for vehicle fleet control. The backend control system **150** includes at least a plurality of gateway systems **151**-**153**, a codec **155**, and an asynchronous routing system **159**. In turn, as shown in **Figure 6-2**, the asynchronous routing system **159** includes a web server **158**, a plurality of router systems **620**, **622**, a real time database **630**, a history database **642**, and a fleet database **670**.

[00131] The real time database **630** maintains records of the most recent information from the transponder or subscriber device such as location, speed, direction, and heading. The history database **642** maintains records of all events and transactions that were received and sent from the asynchronous routing system **159**. Finally, the fleet database **670** keeps records of all the administrative entities such as the controlled mobile and static objects to which a transponder or subscriber device is associated (e.g. a vehicle, user, fleet, and object).

[00132] The backend control system **150** can be configured to run on any combination of computer servers. In one embodiment, the plurality of communication gateway systems **151**-**153** runs on independent computer systems. In another embodiment, the communication gateways **151**-**153** run on a common computer system.

[00133] The communications gateway systems **151**-**153** direct data flow from each of the transponder or subscriber devices **105** into the backend control system **150**. The gateway systems **151**-**153** also direct commands and queries to the appropriate transponder or subscriber device **105**. Each gateway establishes and maintains a communication link with a communications network **651**-**653**. In one embodiment, the

gateway is a Universal Datagram Protocol/Internet Protocol (UDP/IP) packet receiver and sender **151** which connects to an internet/cellular network **651**. There may be more than one UDP/IP gateway **151** transmitting and receiving data. The UDP/IP gateway **151** allows the backend control system **150** to communicate with transponder or subscriber devices **105** over GSM/GPRS, CDMA/1xRTT, and CDPD networks using UDP packets.

[00134] In another embodiment, the gateway system is a Short Message Peer to Peer (SMPP) gateway **152** that connects with a Short Message Service (SMS) network **652**. A plurality of SMPP gateway systems **152** transmit and receive data for the transponder or subscriber devices that communicate over SMS networks using an SMPP protocol. Each SMPP gateway system **152** opens and maintains a continuous connection to the service provider's Short Message Service Center (SMSC) for incoming data so that reception of the transponder or subscriber device's **105** data from the SMSC can be guaranteed.

[00135] In another embodiment, the gateway system is a satellite gateway **153** that connects to a satellite network **653**. As illustrated in **Figure 1**, the satellite network **653** may include one or more satellites **130**, and at least one ground station **145**. The satellite gateway **153** transmits and receives data for the transponder or subscriber devices **105** that communicate through satellite communication. In one embodiment, the satellite communication protocol used may be that of Inmarsat satellites using eight-byte packets of data. The satellite gateway **153** opens and maintains a continuous connection to the satellite network **653**.

[00136] The communications between the asynchronous routing system **159** and the transponder or subscriber devices are channeled through an appropriate gateway system **151**-**154**, as shown in **Figure 1**. An appropriate gateway system **151**-**154** is selected based on a unique combination of transponder or subscriber device manufacturer, the communications protocol, and the service provider. For example, communications from a transponder or subscriber device **105** that uses CDPD communication protocol would be routed through a different gateway system **151**-**154**

than communications from a transponder or subscriber device **105** that uses SMS communications protocol. Likewise, communications from transponder or subscriber devices **105** that use the same communication protocol such as CDPD, but have different service providers, would be routed through different gateways.

[00137] As shown in **Figure 6-4**, as the gateway system **151-153** receives each inbound packet of data, the gateway system **151-153** labels each packet of data with the date and time of arrival, the transponder or subscriber device's **105** manufacturer information, and the transponder or subscriber device's **105** address information. The gateway system **151-153** then repackages the packet of data for transmission to the codec **155**. The gateway **151-153** then places the repackaged data into a queue **665** that is read by a codec **155**.

[00138] When the gateway system **151-154** receives an outbound packet from an outbound queue **661-664**, the gateway system **151-154** uses the address information to send the packet to the target transponder or subscriber device **105**. If required, the gateway system **151-154** verifies before transmission that the gateway system **151-154** has an open and valid connection to the corresponding network **651-654**. Each gateway system **151-154** has at least one corresponding outbound queue **661-664**. For example, each UDP/IP gateway **151** has at least one outbound UDP/IP queue **661**. Each SMPP gateway **152** has at least on outbound SMS queue **662**. And, each satellite gateway **153** has at least one outbound satellite **663**. Also, each SMTP mail gateway **154** has at least one outbound SMTP queue **664**.

[00139] After a packet of data is placed in the inbound queue **665**, as shown in **Figure 6-1**, the data coming from various networks is decoded into a standard data format. Likewise, before a packet is placed in an outbound queue **661-664**, as shown in **Figure 6-4**, the data going to different communications networks is coded from a standard data format into a network specific format. The coding and decoding of data is carried out by the codec (coder-decoder) **155**. The codec **155** permits greater flexibility because the introduction of new communication network protocols is transparent to the asynchronous routing system **159**. Thus, if a new transponder or subscriber device model uses a new

communications network protocol, the backend control system **150** does not need to be upgraded. The system upgrades required would be a codec **155** update and a new gateway, if necessary.

[00140] When a packet of data comes into the asynchronous routing system **159**, each inbound packet that the codec **155** receives is first examined to determine the transponder or subscriber device model. If the codec **155** supports the specified transponder or subscriber device model, the packet of data is translated from the transponder or subscriber device **105** proprietary format into a standard system format. Once the codec **155** has interpreted the data, the codec **155** then writes the data into a response queue **610**, as shown in **Figure 6-2**. If the codec **155** does not recognize the transponder or subscriber device model, the codec **155** logs the unsupported packet of data, and emails the packet of data to a designated system or network technician.

[00141] When a packet of data is sent from the asynchronous routing system **159,** the codec **155** determines the transponder or subscriber device model to which the packet is sent. If the codec **155** supports the specified transponder or subscriber device model, the data is translated from the standard system format into the transponder or subscriber device **105** proprietary format. Likewise, if the packet of data is sent to another device that is not a transponder or subscriber device **105**, the codec **155** determines if it supports that device, and if so, translates the packet of data to the appropriate format. Once the codec **155** has interpreted and encoded the data, the codec **155** places the packet of data into the queue that corresponds to the appropriate type of network communication protocol. An SMS data packet would be placed into the outbound SMS queue **662**. If the codec **155** does not support the transponder or subscriber device model, the codec **155** will log the unsupported packet of data, and email the packet of data to a designated system or network technician.

[00142] Once a packet of data is processed by the codec **155**, it then gets processed. How the packet of data is processed depends upon whether it is an outbound or an inbound data packet. Outbound data packets are placed in an appropriate outbound queue **661**-**664**. Conversely, inbound data packets are received by the asynchronous

routing system **159** and placed in a response queue **610**, as shown in **Figure 6-2**. The response queue **610** feeds the data packets to the response router **620**. The response router **620** determines if a client console **176**, as shown in **Figure 1**, is tracking the transponder or subscriber device **105** associated with the incoming message. If so, the response router **620** routes the incoming message to the appropriate client console **176**. Thus, the client console **176** receives the message before any other process in the asynchronous routing system **159**. If no client console **176** is tracking the transponder or subscriber device **105** associated with the incoming message, the response router **620** places the incoming message into a new event queue **621**. The new event queue **621** feeds the incoming message to a new event router **622**. The new event router **622** analyzes each incoming message, and determines if the incoming message is associated with a new priority event for the transponder or subscriber device **105**. The new event router **622** determines if the incoming message is associated to a new event by searching a real time database **630** for a similar event associated to the transponder or subscriber device **105**. If no event is recorded for the transponder or subscriber device **105**, or if the event is of high priority, the new event router **622** sends a routing request to all client consoles **176** that have permission to view the incoming message. The request is intermittently sent to the client consoles **176** until at least one client console **176** accepts the routing request. Once the routing request is accepted, the client console **176** adds the transponder or subscriber device **105** to an inventory in that client console **176** so that the incoming message can be handled.

[00143] Asynchronously, a history queue **640** receives the inbound and outbound messages for all transponder or subscriber devices **105**. The inbound messages are fed from the history queue **640** to the history recorder **641**. The history recorder **641** geocodes all data packets that have a valid latitude and longitude. The geocoded information is saved in a history database **641** to be used later for reporting and statistical analysis.

[00144] Incoming messages from transponder or subscriber devices **105** may also be forwarded to an email address, cellular telephone, or any other communications device.

To achieve this functionality, the history recorder **641** also transmits the geocoded locations to remote notify routers **681** by placing the geocoded locations in a remote notify queue **680**. The remote notify router **681** that receives the geocoded location and event information queries the fleet database **670** to determine whether the configuration information associated with the transponder or subscriber device **105** requires a notification to a communications device **180**, as shown in **Figure 1**. If a notification is required, the remote notify router **681** retrieves the contact information for the appropriate communications device **180**. The remote notify router **681** then formats and encodes the message to be sent to the communications device **180**. The message is placed in the outbound SMTP queue **664** to be sent through the SMTP gateway **154**. Alternatively, the message can be placed in the outbound SMS queue **662** to be sent through the SMPP gateway **152**.

[00145] The real time database **630** is also updated with the new event information associated with the incoming message. Thus, the real time database **630** contains the latest information reported on a given transponder or subscriber device **105**. The real time database **630** is connected to a web server **158**. The web server **158** is directly connected to the Internet **160** and allows users of a web-tracking application **171** to make location requests, command requests **632,** and report requests. When a web server **158** receives a location request from the web tracking application **171**, the web server **158** queries the history database **642**. The history database **642** contains all events in a chronological order. The web server **158** retrieves all transactions related to the web tracking application **171** query, and forwards the data to the web tracking application **171** for displaying to the user in a web browser.

[00146] When a web server **158** receives a location request from the web tracking application **171**, the web server **158** queries the real time database **630** for the corresponding transponder or subscriber device **105** information. The real time database **630** provides transponder or subscriber device information as related to the very last incoming message from the incumbent transponder or subscriber device **105**. The web tracking application **171** may also send a command request **632** such as a

query as to the position of the transponder or subscriber device **105**. The command request **632** is sent to the command receiver **690** which, in turn, processes the position request command by activating the appropriate transponder or subscriber device **105** information. The message is encoded by the codec **155**, placed in the appropriate outbound queue **661**-**664** and sent through the corresponding gateway system **151**-**154** to the transponder or subscriber device **105**. The transponder or subscriber device **105** will then send back a response. The backend control system **150** then processes the response, and accordingly updates the real time database **630**. After the real time database **630** has been updated, the web server **158** may refresh the contents of the web tracking application **171**, thereby showing the new position of the transponder or subscriber device **105**.

[00147] The command receiver **690** processes all commands pertaining to all outbound messages to be sent to the transponder or subscriber devices **105**. The command receiver **690** may receive command messages from the client consoles **176**, the administrator consoles **175**, and/or from the web servers **158**. When the command receiver **690** receives a command message, the command receiver **690** labels each outbound message with the correct transponder or subscriber device **105** address by searching a fleet database **670**, and retrieving the address information. Each message is sent by the command receiver **690** to the codec **155** for encoding.

[00148] All of the commands that are processed by the command receiver **690** are ultimately sent remotely to the transponder or subscriber device **105**. In one embodiment, the command is a Position Query. Upon receiving this query command, the transponder or subscriber device **105** returns its last valid position, speed, direction, time and input state. In another embodiment, the command is an Odometer Query. Upon receiving this query command, the mobile products return their last valid GPS position, position from the location nodes, speed, direction, time, input state, and running odometer value. In another embodiment, the command is an Input/Output Query. Upon receiving this query command, the transponder or subscriber device returns its last updated state of all inputs and all outputs (e.g., active or inactive). For

any given input, the active state is relative to the configuration of that specific input. For instance, if an input is configured to be active-low (H-L), then 0 volts at the input translates into that input being "active." If the input is configured to be active high (L-H), then 12/24 volts at the input translates into that input being "active."

[00149] In another embodiment, the command is a Time Report Set and/or Home Internet protocol (IP). This command is sent to the transponder or subscriber device to configure the reporting interval for the Timed Reporting feature of the firmware. This command can also be used for setting the transponder or subscriber device's destination IP address. This command allows the transponder or subscriber device to be reconfigured wirelessly in order to be able to transmit to a new control center or home address if the IP address of the control center or home address changed.

[00150] In another embodiment, the command is Set All Outputs. This command is sent to the transponder or subscriber device to set all outputs simultaneously. Any individual output can be either high or low. In another embodiment, the command is Set Single Output. This command is sent to the mobile products to set one individual output either high or low. In another embodiment, the command is Enable/Disable Inputs and Events. This command is sent to the transponder or subscriber device to enable/disable all known transponder or subscriber device features. Both physical and logical events can be individually enabled and/or disabled. While the physical and logical events can be disabled, the ability to query the transponder or subscriber device for its location and status can remain enabled. In another embodiment, the command is an Alarm Acknowledgment. This command can be sent to the transponder or subscriber device to terminate the sending of an emergency event, such as panic, roadside assistance, or medical assistance. When the alarm acknowledgement is received, no further emergency messages for the current event are transmitted from the transponder or subscriber device **105**.

[00151] The asynchronous routing system **159** interacts with various control consoles, as depicted in **Figures 6-2 and 6-3**. Reporting consoles **174** connect to the fleet database **670** to display fleet information. Administrator consoles **175** also connect to

the fleet database **670** to retrieve the transponder or subscriber device's information. Administrator consoles **175** also connect to the command receiver **690** to send commands to the transponder or subscriber device **105**. Operations data processors **173** connect to the fleet database **670** in order to retrieve configuration information for a specific user or transponder or subscriber device **105**. Finally, the client console **176** receives information for a tracked transponder or subscriber device **105** from a response router **620**, receives information for a non-tracked transponder or subscriber device from a new event router **622**, and retrieves information from the fleet database **670**. The client console also transmits commands to a transponder or subscriber device **105** by sending the commands to the command receiver **690**.

[00152] Management Software

[00153] **Figure 7A** illustrates a screenshot of an instance of the client console **176**. The client console **176** provides real-time transponder or subscriber device **105** location mapping, location tracking, transponder or subscriber device control, and transponder or subscriber device message/event handling.

[00154] In one embodiment, the client console **176** connects to map databases and transponder or subscriber device databases by configuring multiple parameters. Such parameters include, but are not limited to, path definition for the console map sets **710**, custom data sets **711**, map information display symbols **712**, and console operating procedures **713**. The settings are maintained in the system registry and recalled at the program load. In another embodiment, the client console **176** provides the ability to configure mapping parameters used by the client console **176**. The client console **176** also provides the ability to define the console location, to set default zoom levels when displaying the various program-generated maps, to set the map to be used, and to determine whether or not street locations are displayed when mapping a location. **Figure 7B** illustrates a screenshot of an instance of the client console **176**. A graphical user interface (GUI) allows maps to be displayed on the client console **176**. In one embodiment, the client console **176** displays all available transponder or subscriber devices on one master map. In another embodiment, the client console **176** allows a

user to view transponder or subscriber devices by groups **721** or individually **720**. In another embodiment, the client console allows a user to view all transponder or subscriber devices that come within an area **722** displayed by the map. In another embodiment, the client console **176** allows a user to view all transponder or subscriber devices that are located within a waypoint. In another embodiment, the client console **176** allows a user to view all transponder or subscriber devices that are located within a zone.

[00155] The client console **176** allows a user to employ a variety of mapping tools to help manage the transponder or subscriber device **105** location processing. Provided tools include, but are not limited to, map zoom in/out, map pan, map feature label, map ruler, map location at a selected point, map legend, map centering on selected point, find a map feature and center map on that feature, display information for a selected custom dataset element, display information for a selected transponder or subscriber device, display information for a standard map feature, and print the displayed map.

[00156] Further, the displayed map uses color-coding for both location symbol and location identification to indicate special conditions relating to the transponder or subscriber device **105**. Special situations that are color-coded include, but are not limited to, transponder or subscriber device moving, transponder or subscriber device stopped, transponder or subscriber device not reporting, transponder or subscriber device location being old, and transponder or subscriber device having a priority message active.

[00157] The transponder or subscriber device summary table **750**, as shown in **Figure 7C**, displays all transponder or subscriber device information, and is updated in real time as the transponder or subscriber device reports the information to the client console **176**. The transponder or subscriber device data shown are the data corresponding to the transponder or subscriber devices associated with individuals, vehicles, and/or articles. The transponder or subscriber device summary table **750** uses icons and color-coding to alert the user of special conditions. Special situations that are color-coded include, but are not limited to, transponder or subscriber device moving, transponder or

subscriber device stopped, transponder or subscriber device not reporting, transponder or subscriber device location being old, and transponder or subscriber device having a priority message active. In another embodiment, the user has the ability to find any item in the transponder or subscriber device summary table **750**, select which columns are visible and to sort the table according to selectable sort types and sort orders for up to at least one column.

[00158] In another embodiment, the client console **176** provides a user the ability to select an item in the transponder or subscriber device summary table **750**, and perform an operation that is related to the selected item or its group. For example, if a transponder or subscriber device is selected, various operations related to the transponder or subscriber device may include, but are not limited to, adding the transponder or subscriber device to the master map; removing the transponder or subscriber device from the master map; creating a group map; creating an individual map; centering the map on the selected transponder or subscriber device location; viewing the input, output, and/or event states for the transponder or subscriber device; setting the message notification mode for the transponder or subscriber device; viewing an information screen that contains detailed information from the master database pertaining to the transponder or subscriber device; and viewing any supplementary information contained in the location data packet that is not otherwise displayed.

[00159] In another embodiment, the client console **176** provides a user the ability to select a transponder or subscriber device **105** in the transponder or subscriber device summary table **750** and send a command/query to the selected transponder or subscriber device **105**. The command/query list available to the user is dependent on the user's profile in the master system database. In another embodiment, the command is sent from a web-based client console, such as the web tracking application **171**.

[00160] In another embodiment, the client console **176** provides a user the ability to receive a pop-up alert notification, which may include a sound cue, whenever a message event, a standard event, or priority event is received at the client console **176**. Notification modes may be enabled or disabled for each transponder or subscriber

device. In one embodiment, the notification modes are configured in the fleet database **670**. In another embodiment, the notification modes are configured locally in the client console **176**. When a priority message is received, the user has the ability to cancel the message, switch reporting to the emergency mode, or continue to use the standard reporting mode. The transponder or subscriber device summary table **750** displays priority messages with a special icon under the transponder or subscriber device identification column.

[00161] Figure 7D illustrates a screenshot of an instance of a client console **176**. The client console **176** contains a map depicting the locations of a number of transponder or subscriber devices **105**.

[00162] Figure 8 illustrates a screenshot of an instance of a control center console **175**. The control center console **175** allows for the creation and maintenance of client or user configurations.

[00163] Figure 9 illustrates a screenshot of an instance of the operations data processor **173**. The operations data processor **173** allows for the creation and maintenance of zones, waypoints, and transponder or subscriber device loads for the transponder or subscriber device **105**. Zones, waypoints, and sites are created and maintained with a point-and-click mapping interface as illustrated by **Figure 9**. The graphical interface provided by the operations data processor **173** displays a map **910** of the area where a waypoint **920** is to be installed. In one embodiment, the graphical interface allows for the radius **930** to be expanded or contracted around the waypoint. In another embodiment, the radius information is entered by typing the number for the radius size on a given field of the graphical user interface (GUI). The operations data processor **173** allows for the maintenance of a list of waypoints **940**, and a view of each waypoint **920** on a corresponding map **910**.

[00164] In another embodiment, the history replay feature can replay the history according to a selected period. In another embodiment, the history replay feature can replay the history as related to a selected waypoint. In yet another embodiment, the history replay feature can replay the history as related to a selected zone.

[00165] **Figure 10** illustrates a screenshot of an instance of the history data processor **174**. In this figure, the screen displays the history of locations visited over time by a particular transponder or subscriber device **105**. **Figure 11** illustrates a screenshot of an instance of a disabled transponder or subscriber device processor **105**.

[00166] An exemplary embodiment of the location system **2010** in **Figure 12** illustrates the main components of the system **2010**. The system **2010** comprises a wireless communication device **2012** and a plurality of location transmitters or nodes. A plurality of location nodes **2014**, **2016**, **2018** are depicted to illustrate that multiple location nodes can be located within communication range of the wireless communication device **2010** at any specific time.

[00167] Each location node **2014**, **2016**, **2018** contains a programmable transceiver communication device incorporating a radio transceiver module **2020** and a micro-controller **2022**. In alternative embodiments, each location node **2014**, **2016**, **2018** may contain a separate transmitter and receiver instead of a single radio transceiver module **2020**. In exemplary embodiments, the micro-controller **2022** controls the radio transceiver module **2020**, responds to queries sent wirelessly from the wireless communication device **2012**, and stores and retrieves detailed location information in the form of data in the micro-controller's **2022** non-volatile memory.

[00168] Each location node's **2014**, **2016**, **2018** radio transceiver module **2020** will have its own location node name, or friendly name. Selection parameters and the geographic position may be encoded and stored in the location node name. In exemplary embodiments, the location node name will include information including, but not limited to, maximum power setting, installation identifier, floor number, payload type, node latitude and longitude, and an integral checksum.

[00169] In another embodiment, the location node name is limited to 16 characters and is encoded utilizing ASCII characters to efficiently and simply name the location node.

[00170] Detailed location node location information is found in the memory of each micro-controller **2022** of each location node **2014**, **2016**, **2018**. In one example, the

detailed location node location information is formatted into a database according to Table 1.

[00171]

Field	Data Type	Length
BT_NAME	CHAR	6
HOUSE_NO	CHAR	10
HOUSE_NO_SUFFIX	CHAR	4
PREFIX_DIRECTIONAL	ASCII	2
STREET_NAME	CHAR	60
STREET_SUFFIX	ASCII	2
POST_DIRECTIONAL	ASCII	2
POSTAL_COMMUNITY	CHAR	32
STATE	ASCII	2
ZIP_CODE	CHAR	10
BUILDING	CHAR	40
FLOOR	CHAR	5
UNIT_NO	CHAR	5
UNIT_TYPE	ASCII	2
LOCATION_DESCRIPTION	CHAR	60

TABLE 1

[00172] In exemplary embodiments, the detailed location information includes at least the address including the street number, the street name, the local community, the state and the zip code. The detailed location information may also include data including the name of the building, the floor number, the unit or room number, or type of room. In other embodiment, the detailed local information may include any relevant other information to provide specific or complementary information for quicker identification of the location.

[00173] In exemplary embodiments, the wireless communication device **2012** of the present disclosure is a Bluetooth™ enabled device. In one or more embodiments, the

wireless communication device **2012** is a cell phone, a laptop computer, a pager, a PDA, or any other wireless communication device with the ability to receive the detailed wireless communication device location information from the location node **2014, 2016, 2018**.

[00174] The wireless communication device **2012** includes software components to interact with each of the radio transceiver modules **2020** in the location nodes **2014**, **2016**, **2018**. The wireless communication device **2012** will periodically interrogate its environment, and when it is in range of a location node **2014**, **2016**, **2018**, the wireless communication device **2012** will connect to, and query the location node **2014**, **2016**, **2018**.

[00175] In the disclosed system and method, the wireless communication device **2012** will receive selection parameter data from each location node **2014**, **2016**, **2018**. Utilizing these selection parameters, the location node will narrow the plurality of location nodes **2014**, **2016**, **2018** to the most practically near location node **2014**, **2016**, **2018**. This is necessary because the closest location node to a wireless communication device **2012** on the second floor of a building could be on the ceiling of the first floor and, thus, be inaccessible from the second floor. In an exemplary embodiment, an algorithm **2050**, as shown in **Figures 13A and 13B**, located within the wireless communication device **2012** is utilized to determine the location node **2014**, **2016**, **2018** that is most practically near.

[00176] Figures 13A and **13B** illustrate an exemplary embodiment of the algorithm **2050** utilized by the wireless communication device **2012** to detect its location. The location node selection algorithm **2050** begins with a general wireless communication device discovery **2052** of all location node's **2014**, **2016**, **2018** located within communication range. The result of this wireless communication device discovery **2052** is a list of location node names, also known as friendly names, and the associated unique location node radio addresses. Because valid location node names have a special format and an integral checksum, radio wireless communication devices **2012** that are not location nodes are easily excluded from this list. In one or more alternative

embodiments, the wireless communication device **2012** performs a custom device discovery **2052** by searching for wireless devices of at least one specific subclass. Specific subclasses include, but are not limited to, location notes **2014, 2016, 2018** and specific types of wireless communication devices **2012**, such as cell phones, pagers, PDAs, and/or laptop computers. Also, in some alternative embodiments, the wireless communication device **2012** performs a custom device discovery **2052** by searching for at least one specific wireless device **2012** operating in a specific mode.

[00177] For example, if a building only has a single location node, and no other surrounding buildings maintain a location node, this single location node could be set using a "force use" flag. This would allow for a quicker, more efficient selection and determination of the location of the location node. Another example would be where several location nodes are located in a small area within a building. These location nodes could also be set using a "force use" flag. This again would allow for a quick, efficient selection and determination of node location.

[00178] After the wireless communication device discovery process **2052** completes, if only one valid location node has been discovered **2056**, this location node is selected. If more than one valid location node has been discovered then a series of steps begins to reduce this list down to one location node that is the most practically near to the wireless communication device. If after any step, only one valid transmitter remains in the list the selection process ends with that location node being selected.

[00179] As each location node is discovered by the wireless communication device, the name is parsed to confirm if it is a valid location node. At this time, if a location node has a valid "force use" flag, this location node is selected as the location node that is most practically near. Use of the "force use" flag can reduce the selection process time down to one or two seconds but should only be used when it is certain that any wireless communication device within radio range must select that location node with its force use flag set as true.

[00180] In another embodiment, the algorithm **2050** may then utilize a step **2060** to distinguish between different buildings or installations. When location nodes are

installed, all the location nodes installed that are part of the same installation are assigned the same identifier.

[00181] For example, if two commercial buildings are in close proximity, and both have location nodes installed, the installation identifiers will be different for each building. Therefore, if a wireless communication device in one building is within radio range of a location node in the other building it can more easily select a location node within its own building and installation area.

[00182] In exemplary embodiments, the installation identifier is not intended to provide a universally unique identification number but should provide a unique identifier for every installation within radio range of any other installation having location nodes.

[00183] First, the wireless communication device determines how many installation identifiers are in range of the wireless communication device **2060**. The wireless communication device will detect more location nodes in the building where it is located. If there are unequal numbers of location nodes within the different installations **2074**, then the location nodes in the building with fewer location nodes are removed **2076** from the list of possible location nodes.

[00184] In another embodiment, the algorithm may utilize a step **2062** distinguish between different floors of a building or installation. When location nodes are installed, all the location nodes installed that are on different floors of the same installation are assigned different floor identifiers in the location node name.

[00185] In this step **2062**, the wireless communication device determines if more than one floor number is represented within one installation identifier. If there are unequal numbers of location nodes on multiple floors **2064**, the wireless communication device eliminates those locations transmitters on the minority floors, i.e., on those floors which have the smaller number of location nodes **2068** sensed. If at this point, only one location node is available, the wireless communication device chooses this location node as the location node that is most practically near.

[00186] In another embodiment where equal numbers of location nodes exist on more than two different floors within one installation identifier, those location nodes on the upper most and lower most floors are removed from the list **2070**. This step may be repeated until there are no more than two different floors within one installation identifier.

[00187] At this point, if more than one location node remains in the list after the above steps then a serial port profile connection is attempted between the wireless communication device and each location node remaining in the list **2072**. If the connection is successful then the location node is queried for its received signal strength (RSS) for that connection **2074**.

[00188] RSS is queried from the location node because the interface on the wireless communication devices does not generally support a query for an RSS value. If at least one connection and query for RSS is successful and the RSS value associated with that location node is higher than the RSS value for all others **2076**, then that location node is selected by the wireless communication device as the location node that is most practically near to provide the detailed local information **2080**.

[00189] In the next step, if more than one location node has an identically highest RSS value retrieved then the "maximum transmit power" settings are compared **2082**. If one location node with highest RSS value has a maximum transmit power lower than the other(s) then this location node is selected **2084**.

[00190] In another step, if all attempts at serial port profile connections and retrieval of RSS values have failed then the "maximum transmit power" settings encoded in the location node names of the remaining location nodes are compared by the wireless communication device **2080**. In exemplary embodiments, the first character of the wireless communication device name includes maximum power transit setting. If one maximum transmit power setting is lower than all others then this location node is selected **2090** since, all other factors being equal, a location node with lower maximum transmit power will probably be most practically near to the wireless communication device.

[00191] In the next step of the algorithm **2050**, if, after all elimination steps are complete and more than one location node remain in the list, then one of the remaining location nodes is arbitrarily selected by the wireless communication device **2092**.

[00192] After the algorithm **2050** has been run, when queried, the precise detailed local information from the selected location node is returned to the wireless communication device.

[00193] Another exemplary embodiment is shown in **Figure 14**. Shown therein is a system including a management system **2200** including a database **2300**, a(n) Console(s) **2400**, base stations **2100**, LAN hub **2500** and location nodes **2014**, **2016**, **2018**. Consoles **2400** are utilized to administer the database **2300** and configure the monitoring and messaging services.

[00194] Management base stations **2100** are modules equipped with power circuitry, a micro-controller, and preferably a radio transceiver such as a Bluetooth™ radio and a Wi-Fi radio. The base stations **2100** are self-contained in packaging and can either be connected directly into a constant power source or battery-powered.

[00195] The management system **2200** interacts with an enabled location node environment via management base stations **2100** preferably over a wide-area network. The management system **2200**, for example, may communicate with the base stations **2100** through their Wi-Fi radios, while the base stations **2100** communicate with the location nodes **2014**, **2016**, **2018** though their Bluetooth™ radios. Only one base station **2100** is required per enabled environment, but multiple base stations **2100** can be used in sprawling areas or for load balancing.

[00196] In **Figure 15**, area specific messaging provides the ability to deliver messages to enabled wireless communication devices within a specific area, where the specific area could be defined by one location node **2014**, **2016**, **2018** to an entire enabled environment. The management system **2200** initiates messaging via the management base station(s) **2100**, and preferably utilizes a "daisy chain" approach to pass pending messages to location nodes **2014**, **2016**, **2018** that may be installed at locations far

beyond the range of any Bluetooth™ or Wi-Fi radio. Warnings are generated in the event a pending message cannot be delivered to a location node **2014**, **2016**, **2018** defining part of or all of the specific area.

[00197] Consoles **2400** are used to configure area-specific messaging, utilizing a map displaying the placement and range of every location node **2014**, **2016**, **2018** within a messaging enabled environment. A message, its severity and its delivery path are then defined (or selected from a list of existing paths), beginning with a management base station **2100**, and linking a series of location nodes **2014**, **2016**, **2018**. The message and its delivery path are then stored in the database **2300**, along with its delivery schedule.

[00198] A message may be sent via a console **2400** to a base station **2100**. From base station **2100**, as shown in **Figure 16**, the message is sent to the first location node in a chain. Throughout the following discussion it is to be understood that the nodes **2014**, **2016** and **2018** may be continuously connected or connected only on demand.

[00199] As illustrated in **Figure 17**, this first node is location node **2014**. The location node **2014** will execute an algorithm **2700** described below and shown in **Figure 18**.

[00200] Location node **2014** will begin execution of algorithm **2700** at operation **2702** by coupling with a base station **2100** if a message is to be sent to base station **2100** for forwarding to communication devices that are within range of the location nodes. Base station **2100** sends the message signal to the first location node **2014**. Control is then passed to operation **2704** where the incoming message signal is received by location node **2014**. Control is then passed to operation **2706**. Location node **2014** replies to the base station **2100** with a receipt message acknowledging that the message was successfully received. Had location node **2014** been in the middle of the chain instead of the current example where it is the first location node of the chain, location node **2014** would have sent a receipt message to the previous location node in the chain.

[00201] Control is then passed to query operation **2708**. Query operation **2708** asks whether the message is for that location node. If it is, then a message flag is set so that

the message is to be available in response to a query by wireless communication devices within its vicinity. If the message signal is not carrying the address for location node **2014**, the answer is no and control is passed to operation **2714**. If the message signal is carrying the address of location node **2014**, the answer is yes and operation is passed to operation **2710**.

[00202] At operation **2710** a message flag is made available to wireless communication devices in the vicinity when they perform their periodic inquiry or discovery of the location nodes. In one or more embodiments, the message flag contains information including, but not limited to, the type of message and/or the severity of the message. When the message flag is made available, the wireless communication device can then retrieve the message from location node **2014**.

[00203] Control is then passed to query operation **2712**. Query operation **2712** determines if the message signal is carrying the addresses of other location nodes farther down the chain and if it is, control is passed to operation **2714**. If the message signal is not carrying any other addresses, control is passed to the return operation **2716**.

[00204] At operation **2714** the message is forwarded to the next location node. In the current example that node is location node **2016**.

[00205] Control is now passed to **2716** where the location node **2014** effectively "goes to sleep" and awaits further instructions from the base station **2100** or to be queried again by a wireless communication device.

[00206] Area-specific messages may be initialized on a pre-defined schedule, or can be initialized immediately via a console **2400**. The initialization of an area-specific message begins at a management base station **2100**, and will leap from one location node **2014**, **2016**, **2018** to the next as defined in the daisy chain sequence. Location nodes **2014**, **2016**, **2018** will store the message in their flash memory if it is intended for them before passing that message on to the next location node **2014**, **2016**, **2018** in the sequence. The message initialization results are returned to the initiating management

base station **2100** in the reverse sequence of the daisy chain when the end of the daisy chain is reached. The management base station **2100** transmits the results to the management system **2200**, which are then recorded in the database **2300**.

[00207] An exception report is returned to the initiating management base station **2100** in the event an exception is encountered during the initialization of a message. The exception report is returned in the reverse sequence of the daisy chain beginning with the location node **2014**, **2016**, **2018** generating the exception. The management base station **2100** transmits the exception to the management system **2200,** which generates the appropriate notifications and records the exception in the Database **2300**. The management system **2200** will attempt to continue the initialization of the message utilizing alternate daisy chain path(s).

[00208] A message-pending flag is passed to enabled wireless communication devices as they interrogate, connect to and eventually select location nodes **2014**, **2016**, **2018** during the execution of the selection algorithm. If the selected location node **2014**, **2016**, **2018** is determined to have a message pending, and the severity level of that message falls within the criteria set on that wireless communication device, the message may be automatically downloaded and displayed on the wireless communication device. For example, "canned" messages may be transmitted and displayed automatically which could arise in emergency situations.

[00209] In another exemplary embodiment of operation of the system **2200**, which is shown in **Figures 15** and **16**, system monitoring may be used to verify that every location node **2014**, **2016**, **2018** within an enabled environment is running, has not been moved and its data has not been compromised. The management system **2200** initiates system monitoring via the management base station(s) **2100**, and utilizes a "daisy chain" approach to communicate with the location nodes **2014**, **2016**, **2018** installed far beyond the range of any Bluetooth™ or Wi-Fi radio. Warnings can be generated and the daisy chain rerouted in the event an exception is encountered.

[00210] Consoles **2400** are used to configure system monitoring, utilizing a map displaying the placement and range of every location node **2014**, **2016**, **2018** within an

enabled environment. A health check daisy chain is then defined, beginning with a management base station **2100**, and linking a series of location nodes **2014**, **2016**, **2018**. The specific series is then stored in the management system **2200**, along with its execution schedule. The management system **2200** will ensure that all location nodes **2014**, **2016**, **2018** within an enabled environment are included in at least one health check series.

[00211] System monitoring will execute on a pre-defined schedule, or can be launched manually via a Console **2400**. The monitoring begins at a management base station **2100**, and will then leap from one location node **2014**, **2016**, **2018** to the next as defined in the daisy chain sequence. Each location node **2014**, **2016**, **2018** in the sequence verifies that the next location node **2014**, **2016**, **2018** in the sequence is running, has not been moved and its data has not been compromised. The monitoring results are returned to the initiating management base station **2100** in the reverse sequence of the daisy chain when the end of the daisy chain is reached. The management base station **2100** transmits the results to the database **2300**.

[00212] Referring specifically to **Figure 17**, an exception report is returned to the initiating management base station **2100** in the event an exception, for example, at location node **2019**, is encountered during system monitoring. The exception report is returned in the reverse sequence of the daisy chain beginning with the location node **2019** generating the exception. The management base station **2100** transmits the exception to the management system **2200**, which generates the appropriate notifications and records the exception in the Database **2300**. The management system **2200** will continue system monitoring utilizing an alternate daisy chain path **2021**, indicated by solid lines in **Figure 17**, until the compromised location node **2019** is fixed, replaced or permanently removed from the system.

[00213] As a still further exemplary implementation of the disclosed system, a mobile client can send its location through the network shown in **Figures 15** and **16**. Here the system **2200** may be utilized to collect communication device information, such as cell phone numbers, etc. In this case, any communication device may respond with a

message such as "record that I'm here", or an equivalent signal, and thus the system may be used to track personnel locations. The system **2200** may also be used to track mobile nodes attached to moving entities in a similar manner, since the messages being transmitted may simply be acknowledgment signals that the mobile node is within response range of a location node **2014**, **2016** or **2018**.

[00214] **Figures 19A** and **19B** illustrate an exemplary mesh network **4001** of nodes **4000** in communication with base stations **4004** and, in turn, in communication with control centers **4008**. A multi-dimensional, such as three-dimensional, map is created using nodes **4000** in communication **4002** with each other. Detailed location information from each location node **4000** is downloaded to at least one mobile device **4010**. A mobile device **4010** is associated with at least one user, who is located at a specific area within a geographical zone. Each mobile device **4010** is in communication with at least one control center **4008** to download a two- or three-dimensional map of the location of the mobile device **4010** and/or, in some embodiments, a two- or three-dimensional map of the location of a different mobile device **4010**.

[00215] In exemplary embodiments, the mobile device **4010** of the present disclosure is a Bluetooth™ enabled device. In one or more embodiments, the mobile device **4010** is a cell phone, a laptop computer, a pager, a PDA, or any other wireless communication device with the ability to receive the detailed mobile device location information from at least one location node **4000**. The type of wireless communication employed by the system includes, but is not limited to, radio frequency (RF) communications and/or infrared communications.

[00216] The present application discloses a system for developing a multi-dimensional map of a multi-dimensional space for use by a user. The user being selectively an individual **4012**, a vehicle, and/or other entity. One or more geographical zones are utilized by the system. The zones can be selectively preconfigured geographical zones. Each zone includes a plurality of spaced-apart nodes **4000**, where the nodes **4000** are arranged in a multi-dimensional sense about the zone. For example, in **Figures 19A and 19B**, the nodes **4000** housed in the building **4020** are distributed in four separate

mesh networks **4001**. Each mesh network **4001** is located in one of four specific zones. The four specific zones depicted are the first floor **4012**, the second floor **4014**, the third floor **4016**, and the fourth floor **4018** of the building **4020**. In addition, each mesh network **4001** of nodes **4000** has associated with it at least one base station **4004**.

[00217] Data communications are sent between one or more of the nodes **4000 (4002)**, one or more mobile devices **4010**, and one or more control centers **4008 (4006)**. Multi-dimensional mapping is affected according to the placement of the nodes **4000**, and the communications between the nodes **4000**, the mobile devices **4010**, and the control centers **4008**.

[00218] The mapping of the geographical space is affected in a three-dimensional sense, selectively being defined by x, y and z axes or coordinates, which in some embodiments may correspond to latitude, longitude, and elevation. The nodes **4000** are enabled to communicate using GPS and/or Bluetooth™ protocol. The nodes **4000** are located at various locations within the geographical space, which comprises of at least one zone. The zones are typically defined as non-regular geometrical shapes. Such a non-regular shape is something different from a circle, square, rectangle, or a series of straight lines defining a bounded area. As such, the lines defining the non-regular geometrical shapes are irregularly shaped and/or curved to define the irregularity. In some embodiments, users have the ability to define and change the boundaries of the zones employed by the system.

[00219] In one or more embodiments, the nodes **4000** are enabled to communicate using Bluetooth™ protocol to effect communications between nodes **4000** and mobile devices **4010**, which are each associated with at least one user. In some embodiments, the mobile devices **4010** are also enabled to communicate with each other using Bluetooth™ protocol. The nodes **4000** are selectively part of a mesh network **4001**, or other suitable network configuration. The nodes **4000** selectively communicate with mobile devices **4010** associated with users. The mobile devices **4010** being selectively a cell phone, PDA, pager, or other computer device.

[00220] In different systems, the zone is affected in two or three dimensions, and this can be used to regulate the location of a user. The user can be a movable entity that is associated with a transponder or subscriber device **4010**. The transponder or subscriber device **4010** being selectively a cell phone, PDA, pager, computer, or device configured to be in wireless communication with other mobile devices **4010** and with nodes **4000** in a wireless communication network.

[00221] Mapping is attained by loading a plurality of mapping coordinates from a computer device to a memory module of a transponder or subscriber device **4010**, or by the user directly loading a plurality of mapping coordinates to a memory module of the transponder or subscriber device **4010**. The mapping coordinates are used to generate a pixilated image. The pixilated image is configured to form a contiguous array of pixels that enclose a shape in the pixilated image, whereby the enclosed shape forms a geographical space.

[00222] A user can enter geographical coordinates on a computer device, or on a transponder or subscriber device **4010**, by entering numerical values for the coordinates of a specific location or locations. For example, the user can enter numerical values for the longitude, latitude, and elevation of a specific location. Conversely, a user can enter geographical coordinates on a computer device, or on a transponder or subscriber device **4010**, by selecting points on a map displayed on a display screen by using a cursor to click on those point locations on the map. The computer device, or transponder or subscriber device **4010**, will calculate the corresponding geographical coordinates for each point on the map that has been selected by the user.

[00223] The system for mapping a geographical space comprises communicating mapping data between communication nodes **4000** and at least one selected mobile communication device **4010**. An array of communication nodes **4000** is arranged about a two- or three- dimensional geographical space. One or more different mobile communication devices **4010** are in communication with different communication nodes **4000** when the devices **4010** are within range of one or more selected nodes **4000**. A

mobile device **4010** is associated with the respective nodes **4000** such that the mobile device **4010** is locatable within the three-dimensional space.

[00224] In one or more embodiments, the mobile devices **4010** communicate with the nodes **4000** wirelessly via RF using Bluetooth™ protocol. When a mobile device **4010** determines its most practically near node **4000**, the mobile device **4010** will download from that node **4000** the location information of that node **4000**. The mobile device **4010** can use this location information in order to generate and display a two- or three-dimensional map of the mobile device's **4010** position within a geographical area and/or zone. In addition, the node **4000** will transmit wirelessly via RF using Bluetooth™ protocol the location information of the mobile device **4010** to the node's **4000** associated base station **4004**, or to other nearby nodes **4000** within the node's **4000** mesh network **4001**. The base station **4004** will, in turn, either communicate the location information of the mobile device **4010** via Wi-Fi to other base stations **4004**, or communicate the location information of the mobile device **4010** via Internet, Wi-Fi bridging, and/or Ethernet to at least one control center **4008**. Conversely, the location information of the mobile device **4010** may be communicated from nearby node **4000** to nearby node **4000** within the mesh network **4001** in a daisy-chain arrangement until the location information of the mobile device **4010** is finally communicated to at least one base station **4004** associated with the nodes' **4000** mesh network **4001**.

[00225] In one or more embodiments, the nodes **4000** communicate with each other wirelessly via RF using Bluetooth™ protocol (**4002**). In some embodiments, the nodes **4000** also communicate with the mobile devices **4010** wirelessly via RF using Bluetooth™ protocol (**4003**). In one or more embodiments, the mobile devices **4010** have the ability to communicate with each other wirelessly via RF using Bluetooth™ protocol. In some embodiments the nodes **4000** communicate with base stations **4004** wirelessly via RF using Bluetooth™ protocol (**4005**). In some embodiments, the base stations **4004** communicate with each other via Wi-Fi (**4006**). In one or more embodiments, the base stations **4004** can communicate with the control centers **4008** by

various means including, but not limited to, Internet communications, Wi-Fi bridging, and/or Ethernet communications (**4007**).

[00226] In one or more embodiments, a first mobile device **4010** may submit a location query to a second mobile device **4010** for that second mobile device's **4010** location information. In this embodiment, the first mobile device **4010** will transmit a specific location query to at least one node **4000** that is located within communication range of the first mobile device **4010**. The at least one node **4000** will then transmit the location query to the node's **4000** associated base station **4004**, or to other nearby nodes **4000** within the node's **4000** mesh network **4001**. The base station **4004** will, in turn, either communicate the location query via Wi-Fi to other base stations **4004**, or communicate the location query via Internet, Wi-Fi bridging, and/or Ethernet to at least one control center **4008**. Conversely, the location query may be communicated from nearby node **4000** to nearby node **4000** within the mesh network **4001** in a daisy-chain arrangement until the location query is finally communicated to at least one base station **4004** associated with the nodes' **4000** mesh network **4001**.

[00227] Once the location query reaches the control center **4008**, the control center **4008** will route the location query to at least one base station **4004** that is associated with the mesh network **4001** of nodes **4000** that are in close proximity to the second mobile device **4010**. Once the location query is downloaded onto the second mobile device **4010**, the second mobile device **4010** will display the location query to its associated user. If the user wishes to send his/her location information to the user associated with the first mobile device **4010**, the user will input a positive response in the second mobile device **4010**.

[00228] When the second mobile device **4010** receives a positive response to the location query, the second mobile device **4010** will transmit that response to at least one node **4000** that is located within communication range of the second mobile device **4010**. The at least one node **4000** will then transmit the response to the node's **4000** associated base station **4004**, or to other nearby nodes **4000** within the node's **4000** mesh network **4001**. The base station **4004** will, in turn, either communicate the

response via Wi-Fi to other base stations **4004**, or communicate the response via Internet, Wi-Fi bridging, and/or Ethernet to at least one control center **4008**. Conversely, the response may be communicated from nearby node **4000** to nearby node **4000** within the mesh network **4001** in a daisy-chain arrangement until the response is finally communicated to at least one base station **4004** associated with the nodes' **4000** mesh network **4001**.

[00229] Once the positive response reaches the control center **4008**, the control center **4008** will then retrieve the geographical location information for the second mobile device's **4010** most recent location. This location information is then sent by the control center **4008** to at least one base station **4004** that is associated with the mesh network **4001** of nodes **4000** that are in close proximity with the first mobile device **4010**. The at least one base station **4004** will route the location information through at least one node **4000** back to the first mobile device **4010**. Once the first mobile device **4010** receives this location information, the first mobile device **4010** will use this location information in order to generate and display a two- or three-dimensional map of the second mobile device's **4010** position within a geographical area and/or zone. In one or more embodiments, the first mobile device **4010** will display the second mobile device's **4010** position in relation to the first mobile device's **4010** position on the multi-dimensional map. In some embodiments, the first mobile device **4010** will display navigational directions from the first mobile device's **4010** location to the second mobile device's **4010** location. In one or more embodiments, the first mobile device **4010** can transmit location queries either directly to the second mobile device **4010**, through at least one node **4000** to the second mobile device **4010**, or through at least one node **4000** and at least one base station **4004** to the second mobile device **4010**.

[00230] In one or more embodiments, a first mobile device **4010** may initially configure a selective permission to allow specific subscribers associated with mobile devices **4010** to receive the first mobile device's **4010** location information. In these embodiments, the first mobile device **4010** will transmit permission instructions to at least one node **4000** that is located within communication range of the first mobile device **4010**. The at

least one node **4000** will then transmit the permission instructions to the node's **4000** associated base station **4004**, or to other nearby nodes **4000** within the node's **4000** mesh network **4001**. The base station **4004** will, in turn, either communicate the permission instructions via Wi-Fi to other base stations **4004**, or communicate the permission instructions via Internet, Wi-Fi bridging, and/or Ethernet to at least one control center **4008**. Alternatively, the permission instructions may be communicated from nearby node **4000** to nearby node **4000** within the mesh network **4001** in a daisy-chain arrangement until the permission instructions are finally communicated to at least one base station **4004** associated with the nodes' **4000** mesh network **4001**.

[00231] Once the permission instructions reach the control center **4008**, the control center **4008** will process the permission instructions. Once the control center **4008** has processed the permission instructions, the control center **4008** is configured to send the location information of the first mobile device **4010** to specific selected subscribers associated with mobile devices **4010** according to the permission instructions. In one or more embodiments, the control center **4008**, the base stations **4004**, and/or the location nodes **4000** may process the instructions and/or be configured to send the location information of the first mobile device **4010** to specific selected subscribers associated with mobile devices **4010** according to the permission instructions.

[00232] In these embodiments, a second mobile device **4010** will submit a location query for the first mobile device's **4010** location information. In these embodiments, the second mobile device **4010** will transmit a specific location query to at least one node **4000** that is located within communication range of the second mobile device **4010**. The at least one node **4000** will then transmit the location query to the node's **4000** associated base station **4004**, or to other nearby nodes **4000** within the node's **4000** mesh network **4001**. The base station **4004** will, in turn, either communicate the location query via Wi-Fi to other base stations **4004**, or communicate the location query via Internet, Wi-Fi bridging, and/or Ethernet to at least one control center **4008**. Conversely, the location query may be communicated from nearby node **4000** to nearby node **4000** within the mesh network **4001** in a daisy-chain arrangement until the location query is

finally communicated to at least one base station **4004** associated with the nodes' **4000** mesh network **4001**.

[00233] Once the location query reaches the control center **4008**, the control center **4008** will process the location query and determine if the second mobile device **4010** is associated with one of the specific selected subscribers that were listed in the first mobile device's **4010** permission instructions. If the control center **4008** determines that the second mobile device **4010** is associated with one of the specific selected subscribers that were listed in the first mobile device's **4010** permission instructions, the control center **4008** will route a message containing the current location information of the first mobile device **4010** to at least one base station **4004** that is associated with the mesh network **4001** of nodes **4000** that are in close proximity to the second mobile device **4010**.

[00234] Once the message containing the currently location information of the first mobile device **4010** is downloaded onto the second mobile device **4010**, the second mobile device **4010** will display the location information of the first mobile device **4010**. This location information includes, but is not limited to, a two- or three-dimensional map showing the location of the first mobile device **4010** in relation to the location of the second mobile device **4010**; a two- or three- dimensional map showing the location of the first mobile device **4010**; and/or detailed directional instructions of how the second mobile device **4010** will need to travel to reach the current location of the first mobile device **4010**.

[00235] Conversely, if the control center **4008** determines that the second mobile device **4010** is not associated with one of the specific selected subscribers that were listed in the first mobile device's **4010** permission instructions, the control center **4008** will route a denial message to at least one base station **4004** that is associated with the mesh network **4001** of nodes **4000** that are in close proximity to the second mobile device **4010**. In at least one embodiment, the denial message will notify the subscriber associated with the second mobile device **4010** that he or she is not granted access to the current location information of the first mobile device **4010**. Once the denial

message is downloaded onto the second mobile device **4010**, the second mobile device **4010** will display the denial message.

[00236] With this system, it is possible to obtain mapping not only in a latitude/longitude sense, but also in an elevational sense. The nodes **4000**, for instance, are placed on different floor levels **4012, 4014, 4016, 4018** of a high-rise building **4020** to allow for mapping in an elevation sense. In addition, this system provides for fine-resolution mapping of a geographical location. Current GPS systems can determine a location of a building **4020** in a relatively course manner, namely a street address. The disclosed system includes nodes **4000** that provide enhanced fine-resolution mapping within a building **4020**, and not only on a two-dimensional basis, but rather on a three-dimensional basis of the different floors **4012, 4014, 4016, 4018** within the building **4020**.

[00237] **Figure 20** illustrates an exemplary system for data mining and communications with users associated with mobile devices that are located within particular geographical areas.

[00238] In this system, mobile devices **4010** that are related to at least one user that is located in a specific area, or zone, at a geographical location are in communication **4003** with nodes **4000** that are located within that specific area, or zone. The at least one user can be an individual **4012**, vehicle, or article. The nodes **4000** are in communication with at least one control center. The nodes **4000** download user profile information and/or location information from the mobile devices **4010**, and transfer that profile information and/or location information to at least one control center. The user profile information includes, but is not limited to, a history of geographical locations that the user has visited, the amount of time the user spent in each of those locations, patterns of location activity of the user, and patterns of shopping habits of the user.

[00239] The nodes **4000** can transmit the profile information and/or location information to the control center either directly to the control center, through at least one node **4000** to the control center, or through at least one node **4000** and at least one base station that is associated with the at least one node **4000** to the control center. Once the profile

information and/or location information reaches the control center, the control center processes the information. Once the information is processed by the control center, the control center employs a messaging system to send messages to specific mobile devices **4010**, according to the personal profiles of the mobile device users and/or the location of the mobile device users relative to specific nodes **4000**. In one or more alternative embodiments, the nodes **4000**, the base stations, and/or the control centers process the information and/or use a messaging system to send messages to specific mobile devices **4010**, according to the personal profiles of the mobile device users and/or the location of the mobile device users relative to specific nodes **4000**.

[00240] Data mining and commercial communications are possible with users that are associated with mobile devices **4010** and located in particular geographical areas. For instance, when a user associated with a mobile device **4010** is located in a specific area of a shopping mall or a hotel, advertisements, promotions or suggestions that relate to that specific area of the shopping mall or hotel are downloaded real time to the user's mobile device **4010** for the user. For example, when the user's mobile device **4010** is located within communication range of a node **4000** that is in close proximity to a restaurant or buffet **5004**, the user may be offered wining and dining advertisements, promotions, and/or coupons for that particular restaurant or buffet **5004**. In another example, when the user's mobile device **4010** is located within communication range of a node **4000** that is in close proximity to a show ticketing counter **5002**, the user may be offered show advertisements, promotions, and/or coupons for various show tickets sold at the ticketing counter **5002**.

[00241] In a store environment, special advertisements can be offered to a user, depending on the user's perceived shopping habits or motion throughout the store. For instance, a person who spent a lot of time in the camera department of the store can strategically be messaged about promotions from that specific department. The behavior of the user can be part of the profile. Behavior of a user can include, but is not limited to, the amount of time the user spent in the vicinity of different nodes within the environment, the purchasing patterns of the user, the product or service preferences of

the user, the commercial enquiries of the user, the dining preferences of the user, and the entertainment preferences of the user. In one or more embodiments, a control system is used to generate a profile of a user. For example, if the user purchased various different products, this product purchasing data can be fed into a control system to create and/or update the user's profile.

[00242] In a hotel environment, for instance, a casino **5000**, a past profile of a user can be preloaded onto a mobile device **4010** associated with that user when the user checks into the hotel. The past profile may have been generated from the user's behavior during the user's prior stays at the hotel. This past profile can be updated according to the user's movement throughout the hotel and actions during the user's stay at the hotel.

[00243] In this system, message communications can being targeted to at least one or multiple users. This system permits a control center to be able to control and/or monitor individuals **4012**, vehicles and other mobile entities. The system utilizes at least one geographical zone. The zone can be a selectively preconfigured geographical zone, and will include a plurality of nodes **4000**.

[00244] Messages are sent between one or more of the mobile devices **4010** associated with at least one user, one or more nodes **4000**, one or more base stations, and/or one or more control centers. The message communications are targeted to at least one user. The nodes **4000** are arranged in a multi-dimensional sense, the multi direction sense selectively being a three-dimensional sense in the x, y and z axes or coordinates. Data is obtained and mined according to the location of the user's mobile device **4010** in relation to the placement of the nodes **4000** in a multi-dimensional sense.

[00245] In one or more embodiments, the mobile devices **4010** are Bluetooth™ equipped. The mobile devices **4010** communicate via RF using Bluetooth™ protocol to Bluetooth™ enabled location nodes **4000** in a mesh network. When a mobile device **4010** is located within the range of certain location nodes **4000**, specific events are triggered. These specific events include, but are not limited to, the downloading of a commercial message, such as an advertisement, to the user's mobile device **4010** for the user.

[00246] The selected nodes **4000** can communicate the location information of the mobile device **4010** associated with a user. The selected nodes will transmit the location information to a central station either directly or via other nodes **4000** within at least one mesh network. The mesh network may include the use of relay stations and/or intermediate supplementary stations.

[00247] A user is associated with a mobile device **4010**, or transponder or subscriber device **4010**. The device **4010** being selectively a cell phone, PDA, pager, computer, or device which is configured to be in wireless communication with other devices through a suitable network.

[00248] **Figure 21** illustrates an exemplary system of a multi-dimensional mesh network of nodes for communicating emergency messages to users.

[00249] At least one geographical zone **6006, 6008**, which can be multi-dimensional, such as in three dimensions, can be utilized to regulate the location of movable entities and their actions within the geographical zone **6006, 6008**. Detailed location information is downloaded from nodes **4000** to a mobile device **4010** within a geographical zone **6006, 6008**. A mobile device **4010** associated with at least one user located in a specific area of a geographical zone **6006, 6008** communicates with a control center through at least one node **4000**. Mobile devices **4010** interact with location nodes **4000** that are in communication range. A messaging system is used to send emergency and security communications to users associated with mobile devices **4010** that are located in particular locations.

[00250] The present system controls, regulates, and monitors users in an emergency or security environment. Users can include individuals, vehicles, and other moving entities. Regulating a user comprises at least one of monitoring, controlling, and visualizing the movement in a specific geographic zone **6006, 6008** of a mobile device **4010** associated with a user. The geographic zone **6006, 6008** can be a multi-dimensional zone selectively in a three dimensional sense having x, y and z axes or coordinates. The geographical zone **6006, 6008** is a zone that includes a mesh network of nodes **4000**.

[00251] Messages are sent between one or more of the mobile devices **4010**, and one or more control stations. Message communications relating to security and/or an emergency are targeted to at least one or multiple users. The messages are focused, target specific, and dependent on the location of the nodes **4000** arranged in a multi-dimensional sense in the geographic zone **6006, 6008**. This system creates a security support system utilizing user location data in relation to node **4000** placement.

[00252] The mobile personal devices **4010** associated with users are Bluetooth™ equipped, and communicate wirelessly via RF using Bluetooth™ protocol to location nodes **4000**. When an emergency and/or security event occurs, a central station and/or intermediate supplementary station transmits emergency and/or security notifications to mobile devices **4010** associated with users located within at least one specific geographic zone **6006, 6008** of nodes **4000** in a mesh network. The emergency and/or security notifications are transmitted to the users' personal devices **4010** selectively via at least one node **4000** within a mesh network, or via at least one node **4000** and through at least one relay station.

[00253] In some embodiments, when an emergency and/or security event occurs, at least one user associated with a mobile device **4010** enters an emergency and/or security notification into their corresponding mobile device **4010**. The notification may be entered into the mobile device **4010** textually, verbally, and/or by dialing an "emergency and/or security designated phone number or code," for example the dialing of "911." The emergency and/or security notification is then transmitted to a central station and/or intermediate supplementary station for processing. Once the notification is processed, the central station and/or intermediate supplementary station transmits emergency and/or security notifications to mobile devices **4010** associated with users located within at least one specific geographic zone **6006**, **6008** of nodes **4000** in a mesh network. The emergency and/or security notifications are transmitted to the users' personal devices **4010** selectively via at least one node **4000** within a mesh network, or via at least one node **4000** and through at least one relay station.

[00254] In this system, a plurality of coordinates relating to the emergency location **6009** are entered into at least one control center computer. The control center computer processes these location coordinates and determines which geographical zones **6006, 6008** are in close proximity to the emergency location **6009**. The control center then transmits customized emergency messages to the mobile devices **4010** that are located within those geographical zones **6006, 6008**.

[00255] For example, as shown in **Figure 21**, the emergency depicted is a small fire **6009** located on the fourth floor of the chemistry building **6000**. The coordinates of the fire **6009** are entered into the control center's computer. The control center computer processes these coordinates, and determines that the closest geographical zones to the fire **6009** are zones **6008,** and the next closest geographical zones to the fire **6009** are zones **6006**. Next, the control center transmits specific emergency messages to the mobile devices **4010** associated with the users located in zones **6008** and **6006**. Since the users in zones **6008** are closer to the fire **6009** than the users in zones **6006**, the users located in zones **6008** will receive emergency messages indicating that they are in very close proximity to the fire **6009** and the users located in zones **6006** will receive emergency messages indicating that they are in relatively close proximity to the fire **6009**. Thus, the emergency messages can be tailored for each specific geographical zone **6008, 6006**.

[00256] The messages are sent between one or more of the nodes **4000** and one or more mobile devices **4010** in a selected geographical zone. The nodes **4000** and the mobile devices **4010** are enabled selectively to communicate with GPS and with Bluetooth™ protocols. The nodes **4000** selectively communicate with users associated with a mobile device **4010**, the device **4010** being selectively a cell phone, PDA, pager, or computer device.

[00257] In an emergency or security environment, data is communicated between communication nodes **4000** and a selected mobile device **4010** using the geographical zone as a selected area for communication. Messages are sent between one or more of the mobile devices **4010**, and one or more control stations, where the message

communications are targeted to at least one or multiple users. The nodes **4000** are arranged in a multi-dimensional sense. The security support system utilizes user location data of movable entities, and the existence of emergency and security conditions.

[00258] The system permits for individual, vehicles or other persons to be communicated to in areas and spaces that can be isolated and separated from other areas and spaces. In this manner if there is a security situation in one place, individuals or vehicles or other mobile entities can be targeted with messages or instructions to remain in a location removed or isolated from a danger area.

[00259] While the above description contains many specifics, these should not be construed as limitations on the scope of the disclosure, but rather as an exemplification of one embodiments thereof.

[00260] The method and system described above contemplate many applications of the present disclosure. The present disclosure includes a system which has the capability to control and monitor a moving object or a static object prone to being moved. The object can be many things such as vehicle, aircraft, airborne items, animals, persons, cargo, specialized and/or volatile cargo such as chemicals, weapons, or hazardous materials. In addition, fragile cargo can include, but is not limited to items such as, medicine, patients, organs for donation, where monitoring parameters such as temperature, pressure, humidity, blood pressure, EKG, and other conditions are critical to the integrity of the item.

[00261] Another climate-sensitive object for which tracking, monitoring and local control is beneficial includes produce and perishable goods. For example, the transponder or subscriber device could monitor humidity and have the ability to control the amount of moisture in cargo containing perishable items that are susceptible to humidity. Moreover, these objects can include any other item where tracking its movement and/or location is beneficial.

[00262] A transponder or subscriber device can be mounted, attached, manufactured, or otherwise included upon or within these various articles. The transponder or subscriber device is contemplated to be of many different sizes including nano- and/or micro scale- transponder or subscriber device. Within the context of the tracking system, the transponder or subscriber device works to collect, process, and communicate various information about the article or vehicle the transponder or subscriber device is attached to.

[00263] Furthermore, when requested, the transponder or subscriber device can issue various commands and instructions to the local article or vehicle. These commands or instructions to the local article or vehicle are contemplated to include any command that can change, alter, or enhance, the mechanism, the function, the structure or the composition of the article or vehicle. For example, a medical application of the present disclosure contemplates a transponder or subscriber device with the ability to monitor a patient's vital signs. The transponder or subscriber device can be hardwired or hooked up to intravenous tubes, medical machines, and other medical equipment. Thus, for example, the user is capable of remotely administering medicine by commanding the transponder or subscriber device to perform the function. Furthermore, a change in vital signs could send an event message to the transponder or subscriber device where the transponder or subscriber device could send a message to a response center or directly to a cellular phone of the patient's physician or to a plurality of cellular phones, such as to family members, for example.

[00264] Additional applications and situations include military applications where it is necessary to not only track and monitor a vehicle or person, but where it is also beneficial to be able to control functions on the vehicle or person. For example, it may be desired to control the firing ability of a military vehicle, or control similar functions once the vehicle enters a certain territory or turn off certain capabilities once the vehicle enters a peaceful zone. Similarly, an additional application to aircrafts and airborne items considered. The transponder or subscriber device would have the same capabilities; however, the transponder or subscriber device could position based upon

on a three-dimensional point in space, not merely longitude and latitude. Naturally, each one of these applications remains configurable and controllable wirelessly.

[00265] Furthermore, the disclosure includes any combination or subcombination of the elements from the different species and/or embodiments disclosed herein. One skilled in the art will recognize that these features, and thus the scope of this disclosure, should be interpreted in light of the following claims and any equivalents thereto.

[00266] While the above description contains many particulars, these should not be considered limitations on the scope of the disclosure, but rather a demonstration of embodiments thereof. The system and methods disclosed herein include any combination of the different species or embodiments disclosed. Accordingly, it is not intended that the scope of the disclosure in any way be limited by the above description. The various elements of the claims and claims themselves may be combined in any combination, in accordance with the teachings of the present disclosure, which includes the claims.

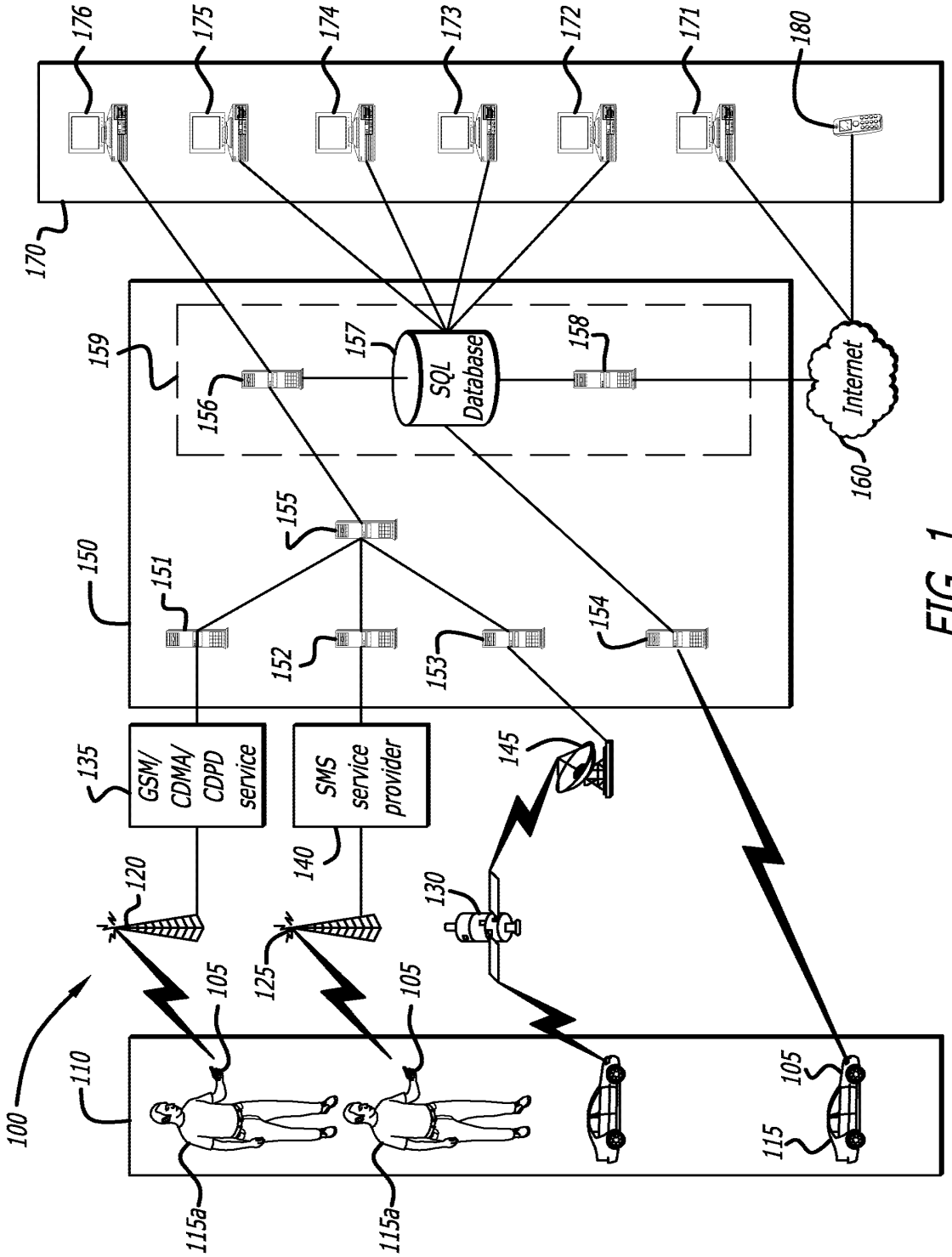

176
175
174
173
172
171
180
170
159
157
SQL Database
158
156
Internet
160
155
150
151
154
152
153
135
GSM/ CDMA/ CDPD service
SMS service provider
145
140
120
130
105
125
105
105
110
100
115a
115a
115

FIG. 1

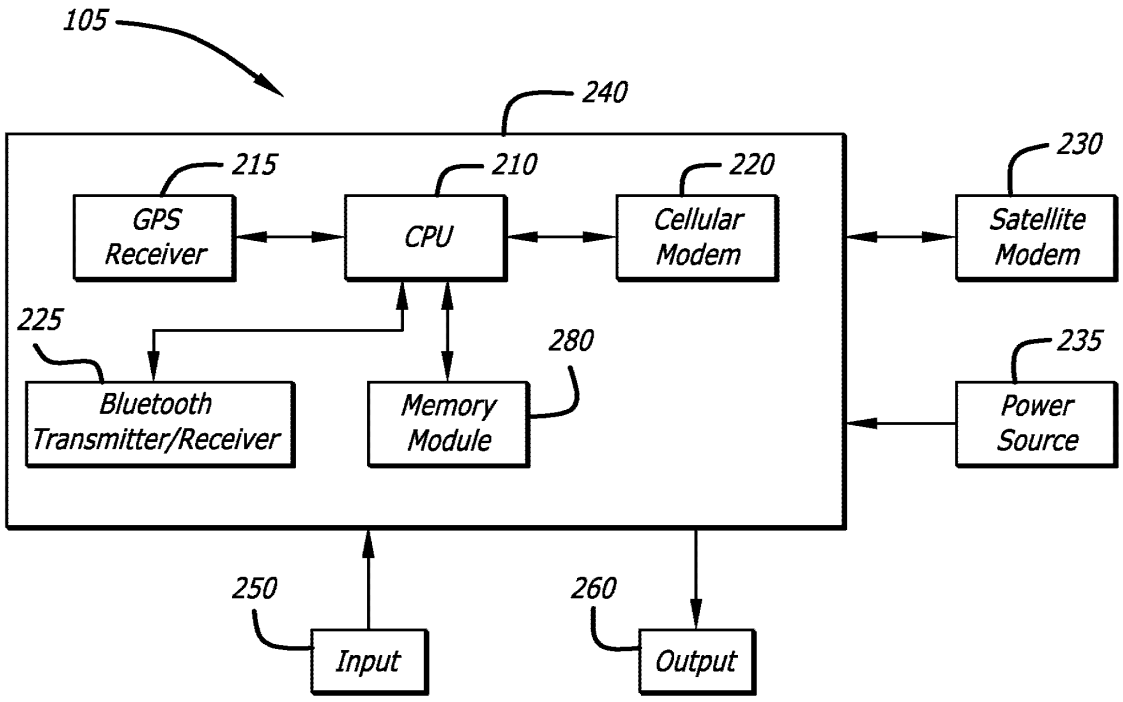

105
240
215
GPS Receiver
210
CPU
220
Cellular Modem
230
Satellite Modem
225
Bluetooth Transmitter/Receiver
280
Memory Module
235
Power Source
250
Input
260
Output

FIG. 2

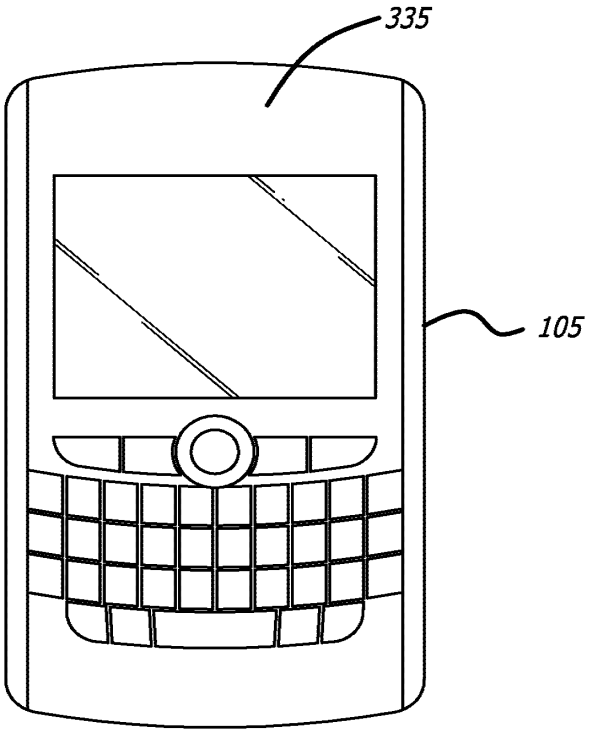

335
105

FIG. 3

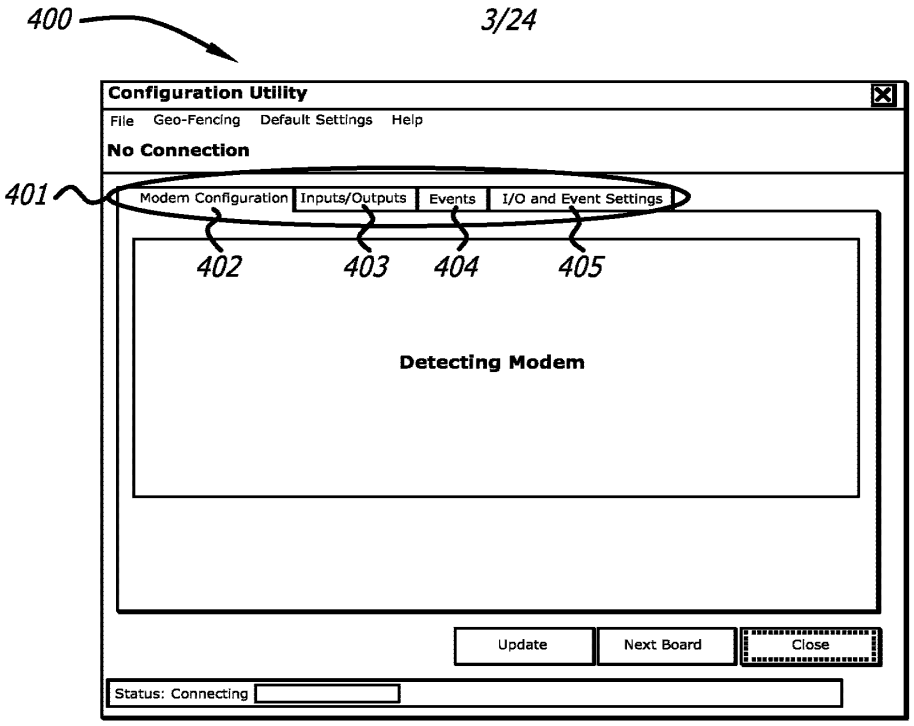

400
Configuration Utility
File
Geo-Fencing
Default Settings
Help
No Connection
401
Modem Configuration
Inputs/Outputs
Events
I/O and Event Settings
402
403
404
405
Detecting Modem
Update
Next Board
Close
Status: Connecting

FIG. 4A

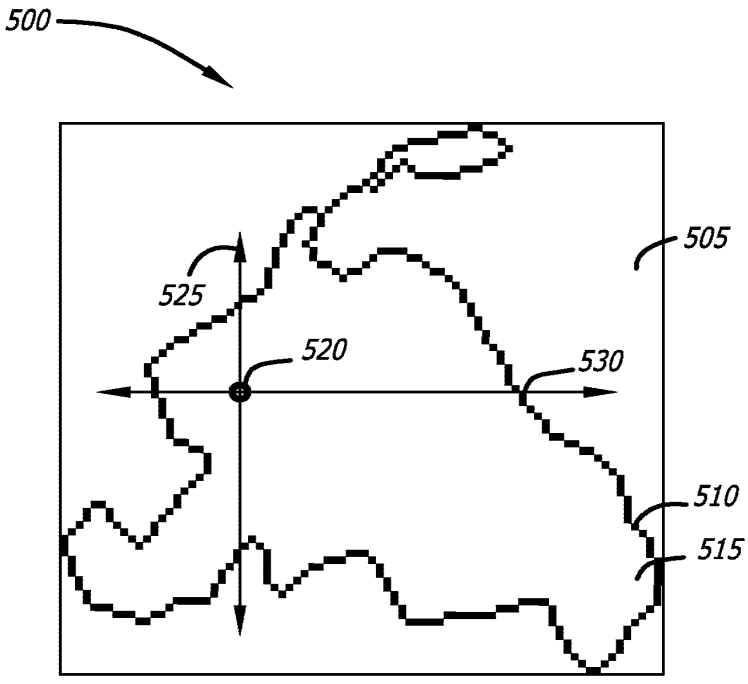

500
505
525
520
530
510
515

FIG. 5A

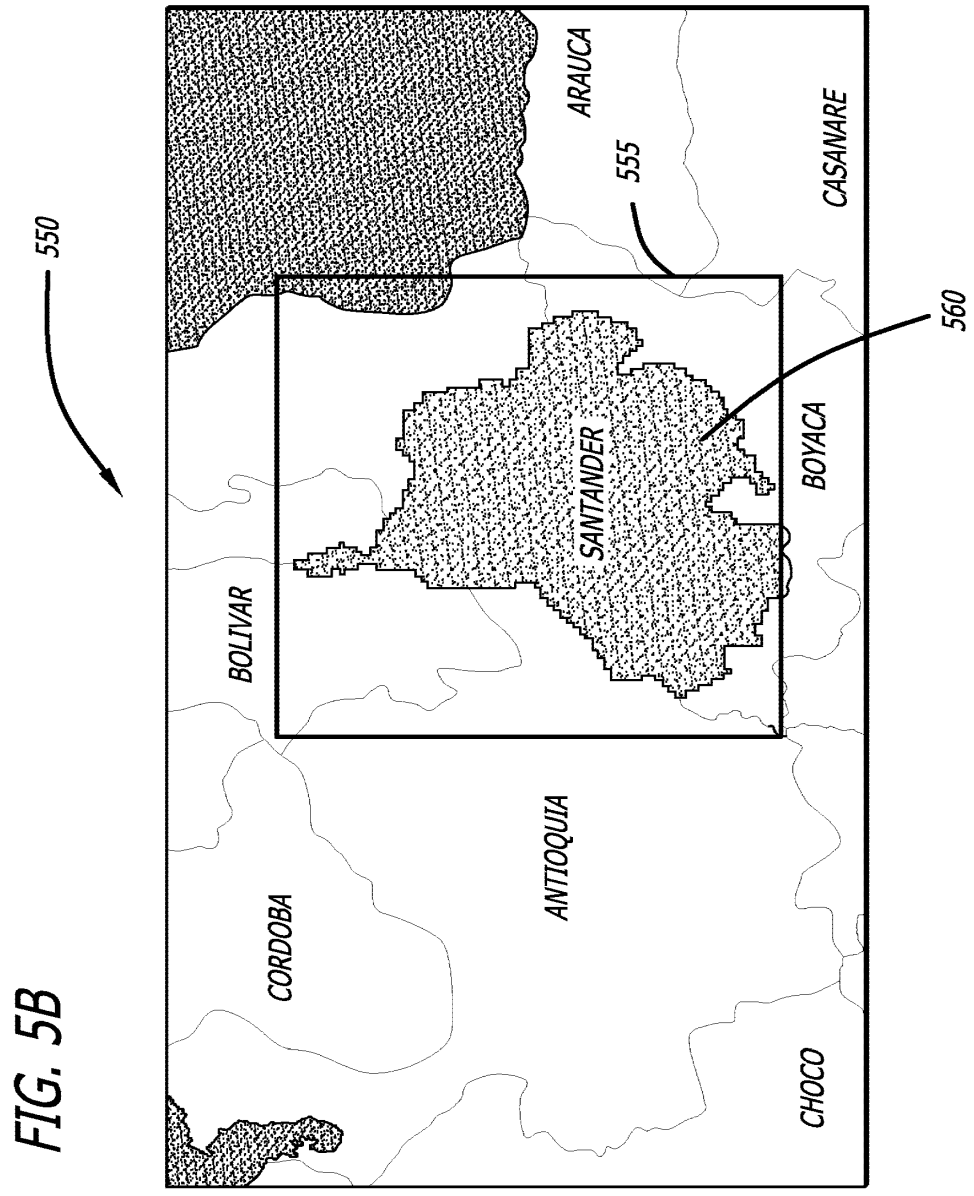

550
555
560
ARAUCA
CASANARE
BOYACA
SANTANDER
BOLIVAR
ANTIOQUIA
CORDOBA
CHOCO

FIG. 5B

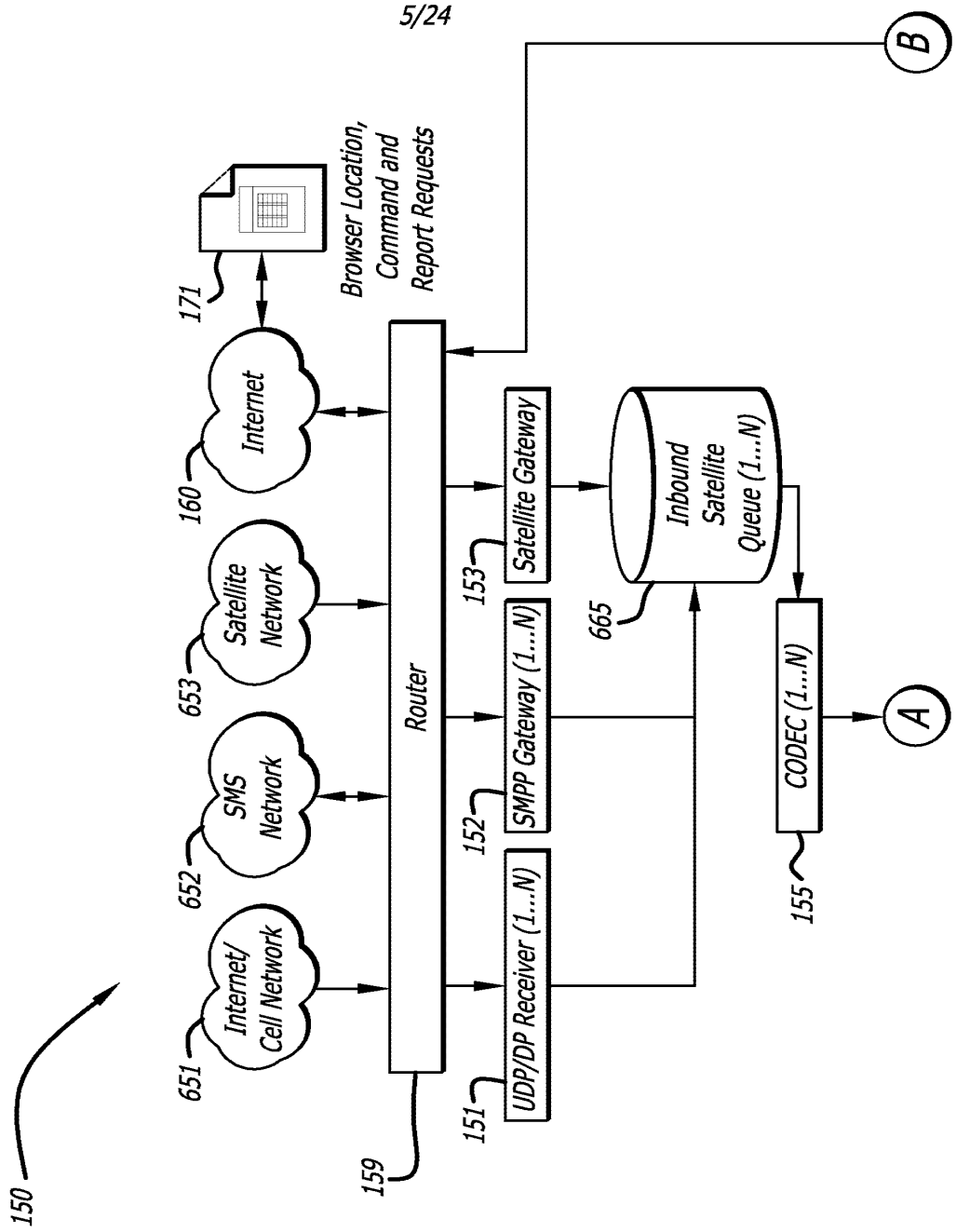

150
651
Internet/
Cell Network
652
SMS
Network
653
Satellite
Network
160
Internet
171
Browser Location,
Command and
Report Requests
159
Router
151
UDP/DP Receiver (1...N)
152
SMPP Gateway (1...N)
153
Satellite Gateway
665
Inbound
Satellite
Queue (1...N)
155
CODEC (1...N)
A
B

FIG. 6-1

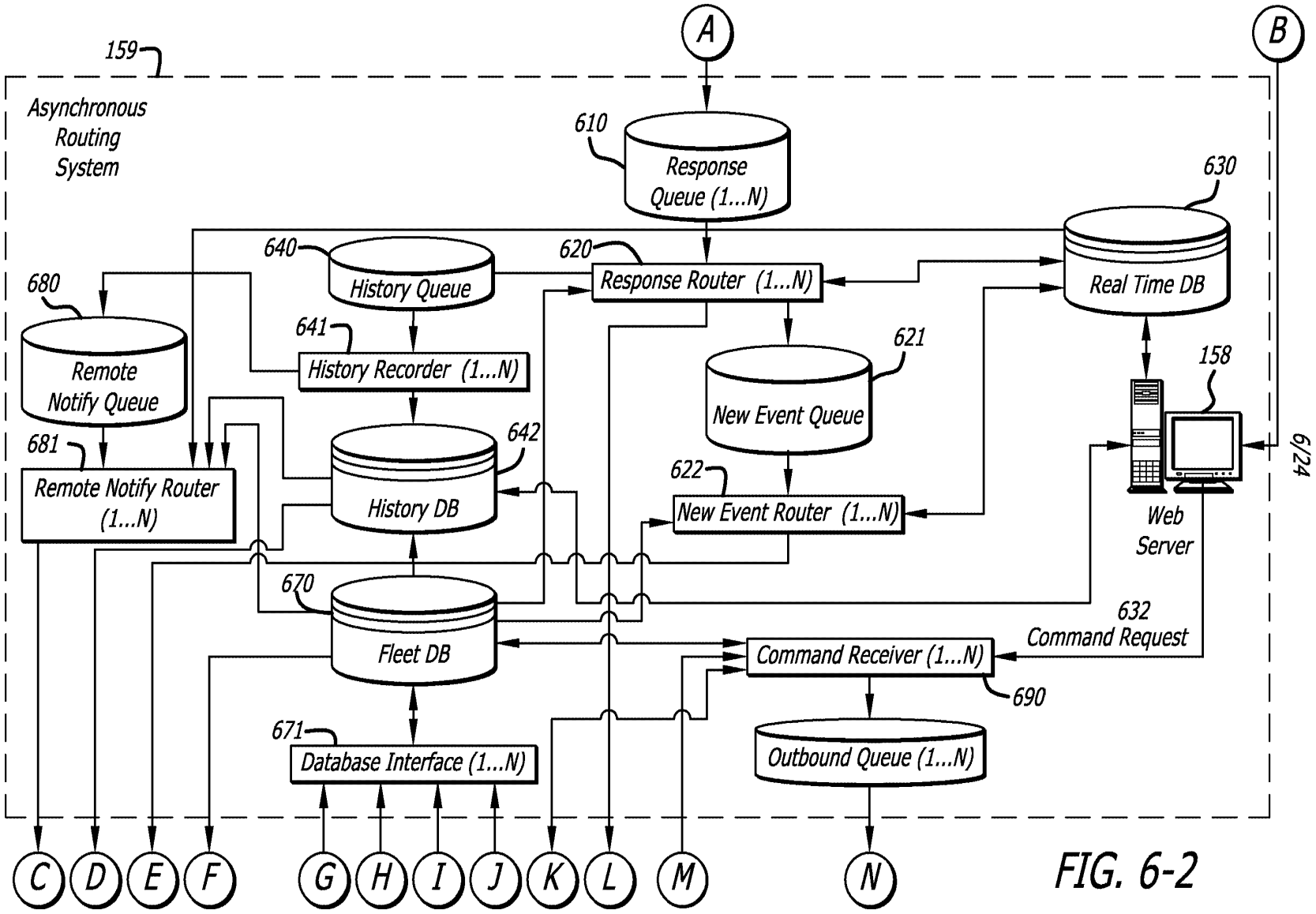


FIG. 6-2

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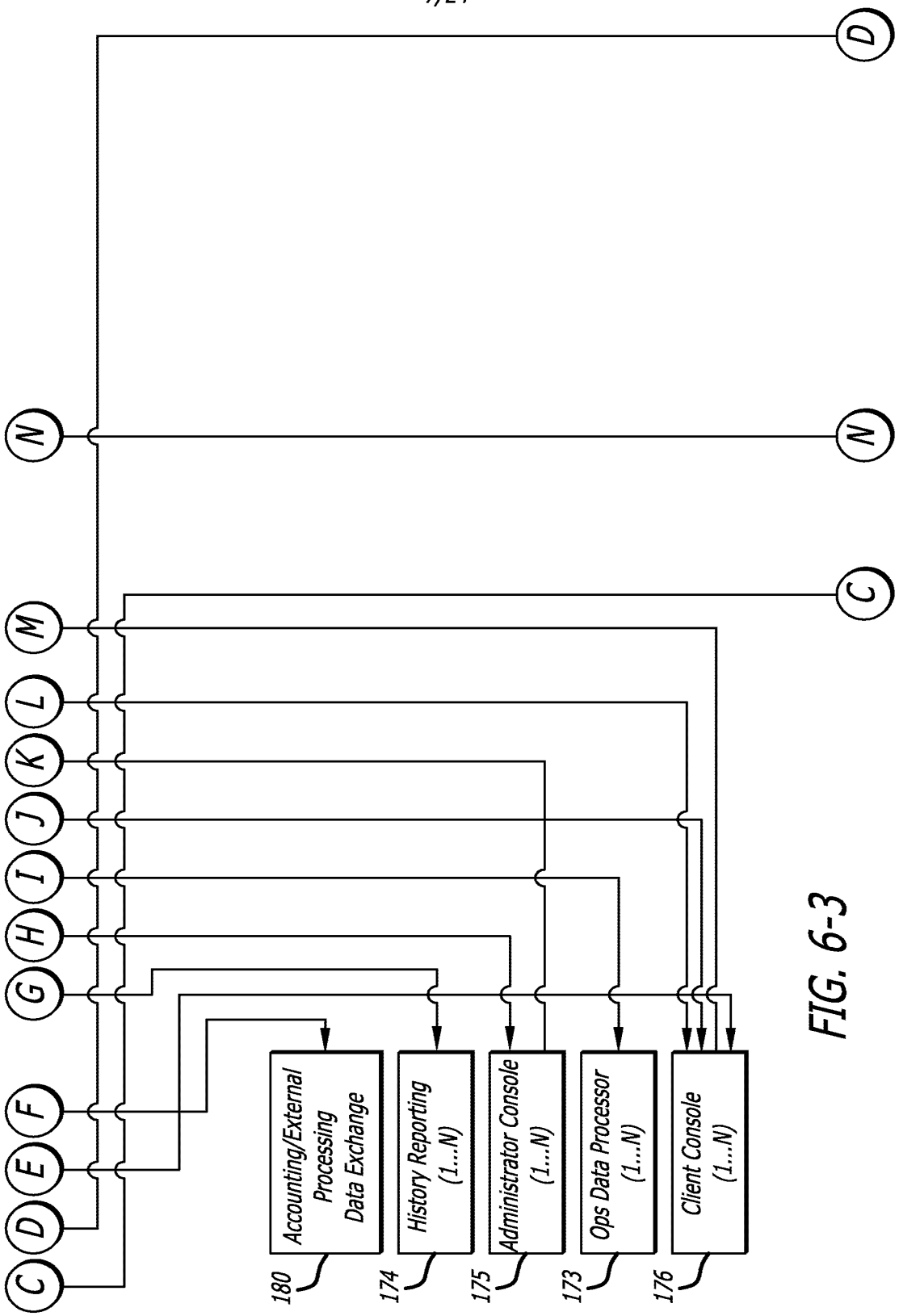

C
D
E
F
G
H
I
J
K
L
M
N
D
N
C
Accounting/External Processing Data Exchange
History Reporting (1...N)
Administrator Console (1...N)
Ops Data Processor (1...N)
Client Console (1...N)
180
174
175
173
176

FIG. 6-3

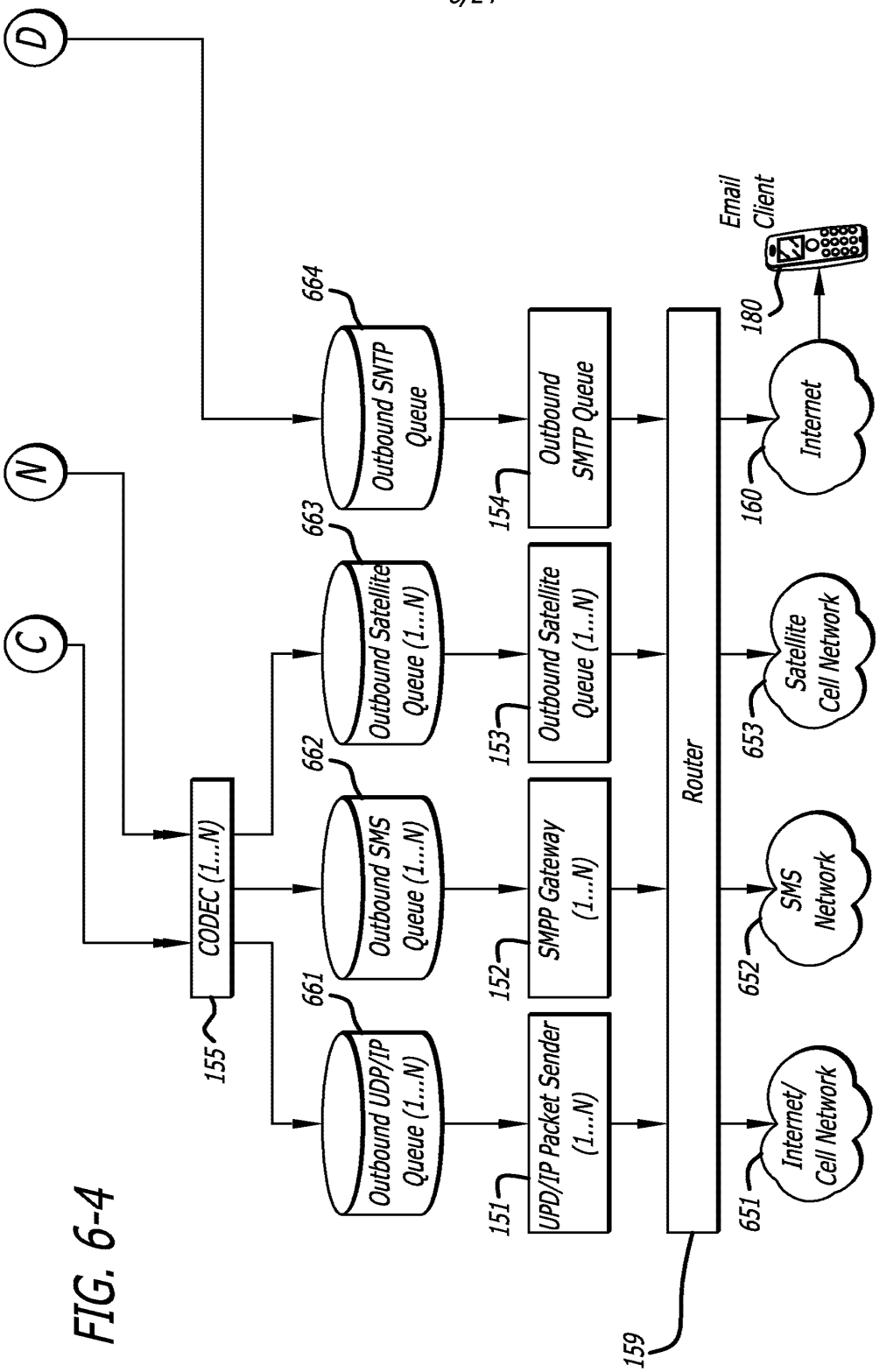

D
N
C
CODEC (1...N)
155
Outbound UDP/IP Queue (1...N)
661
Outbound SMS Queue (1...N)
662
Outbound Satellite Queue (1...N)
663
Outbound SNTP Queue
664
UPD/IP Packet Sender (1...N)
151
SMPP Gateway (1...N)
152
Outbound Satellite Queue (1...N)
153
Outbound SMTP Queue
154
Router
159
Internet/ Cell Network
651
SMS Network
652
Satellite Cell Network
653
Internet
160
Email Client
180

FIG. 6-4

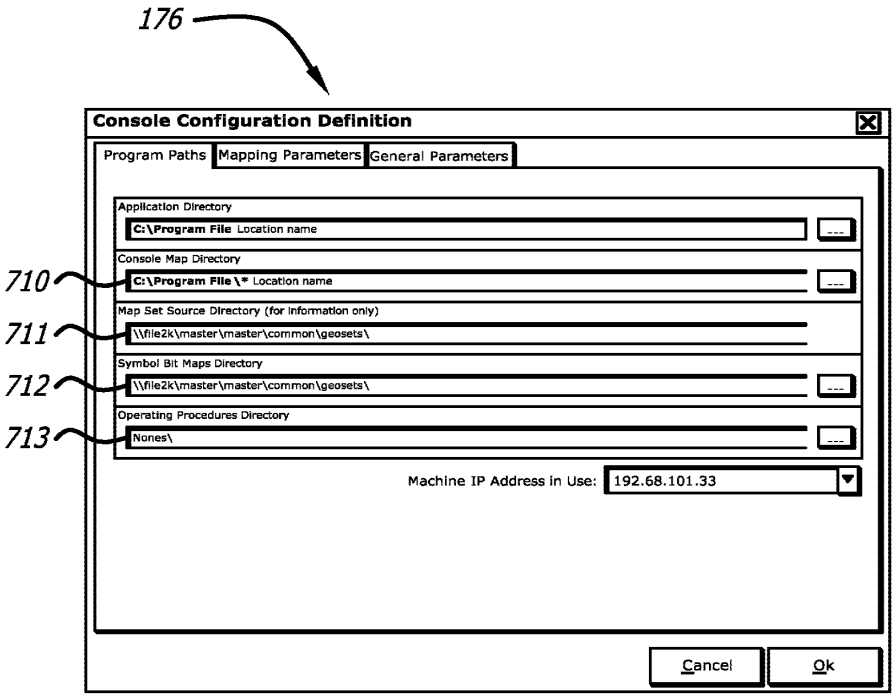

176
Console Configuration Definition
Program Paths
Mapping Parameters
General Parameters
Application Directory
C:\Program File Location name
Console Map Directory
C:\Program File * Location name
Map Set Source Directory (for information only)
\\file2k\master\master\common\geosets\
Symbol Bit Maps Directory
\\file2k\master\master\common\geosets\
Operating Procedures Directory
Nones\
Machine IP Address in Use:
192.68.101.33
Cancel
Ok
710
711
712
713

FIG. 7A

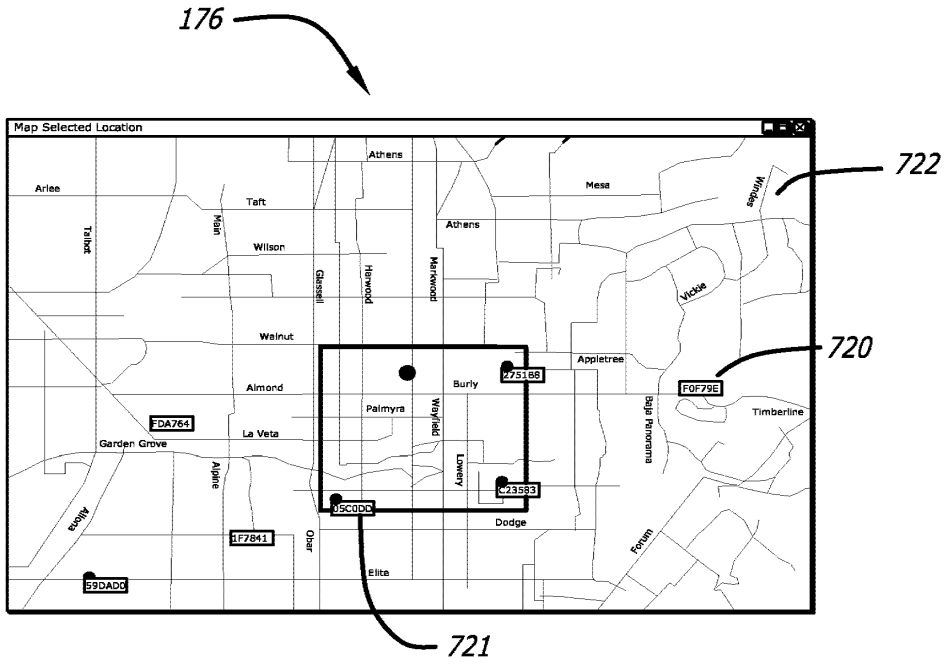

176
Map Selected Location
Athens
Arlee
Taft
Mesa
Talbot
Main
Wilson
Glassell
Harwood
Marwood
Walnut
Almond
Palmyra
Burly
Appletree
Victoria
Timberline
Baja Panorama
Garden Grove
La Veta
Lowry
Dodge
Alpine
Obar
Elite
Forum
275188
F0F79E
FDA764
C23583
05C0D0
1F7841
59DAD0
720
721
722

FIG. 7B

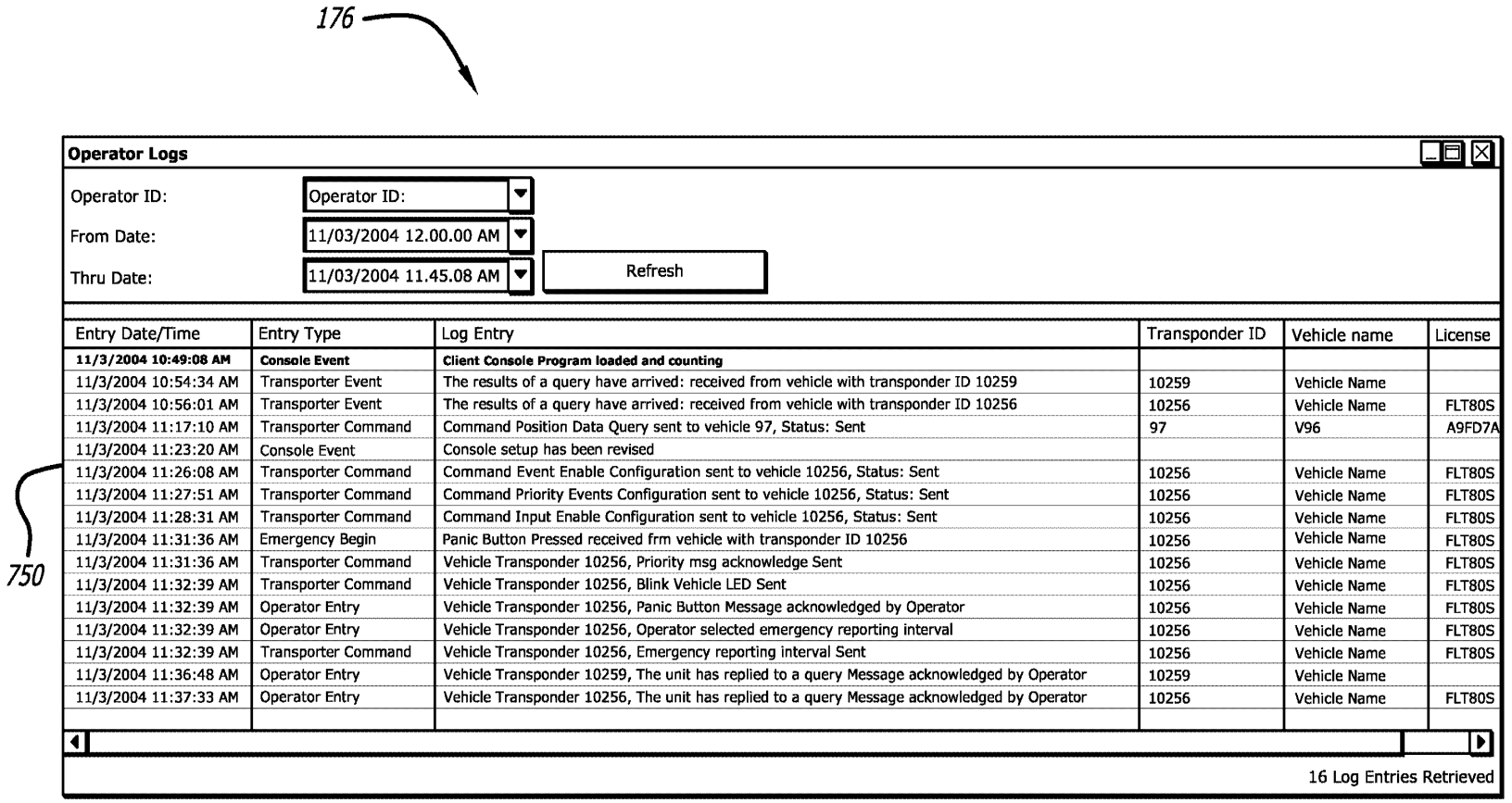
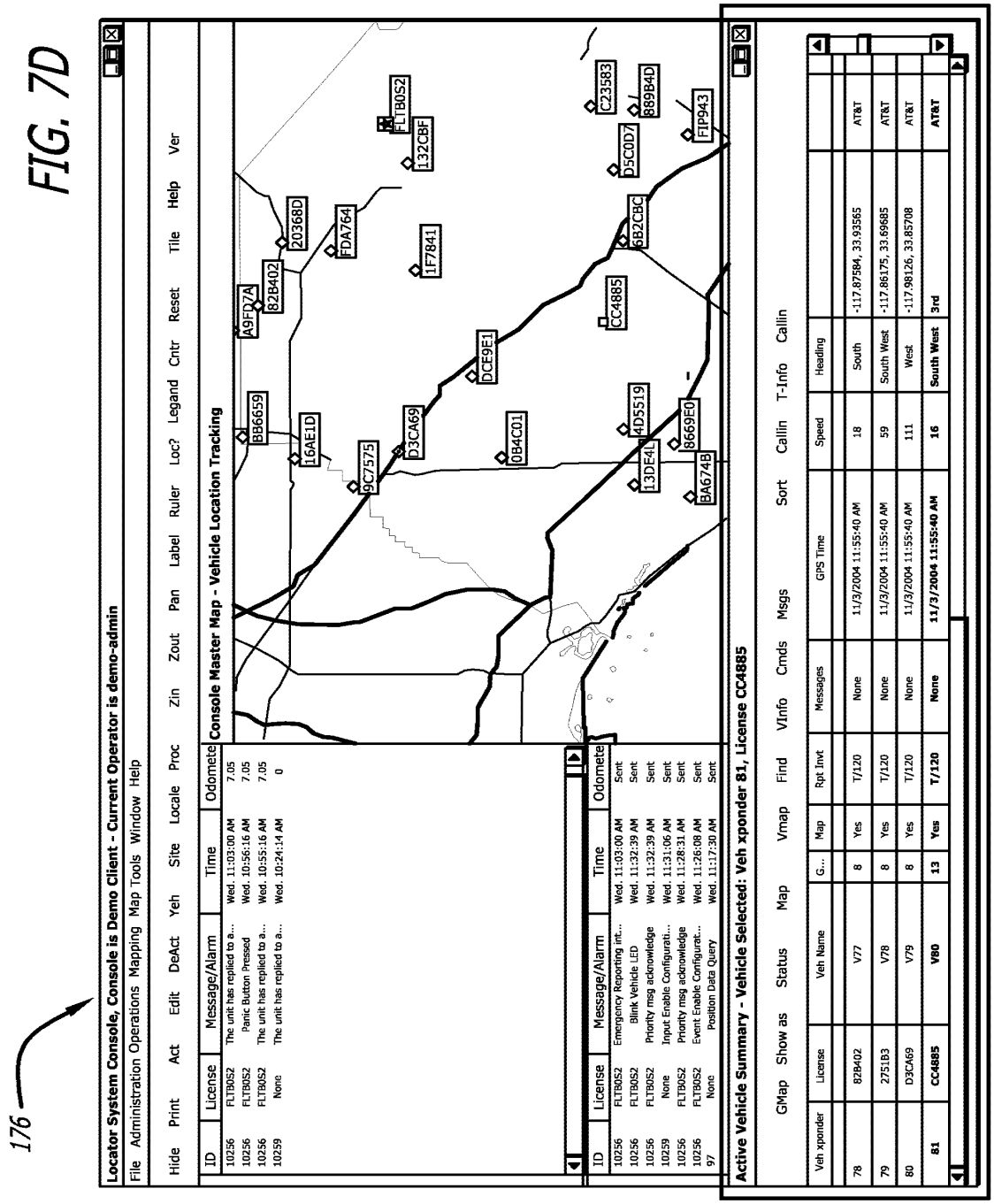


FIG. 7C

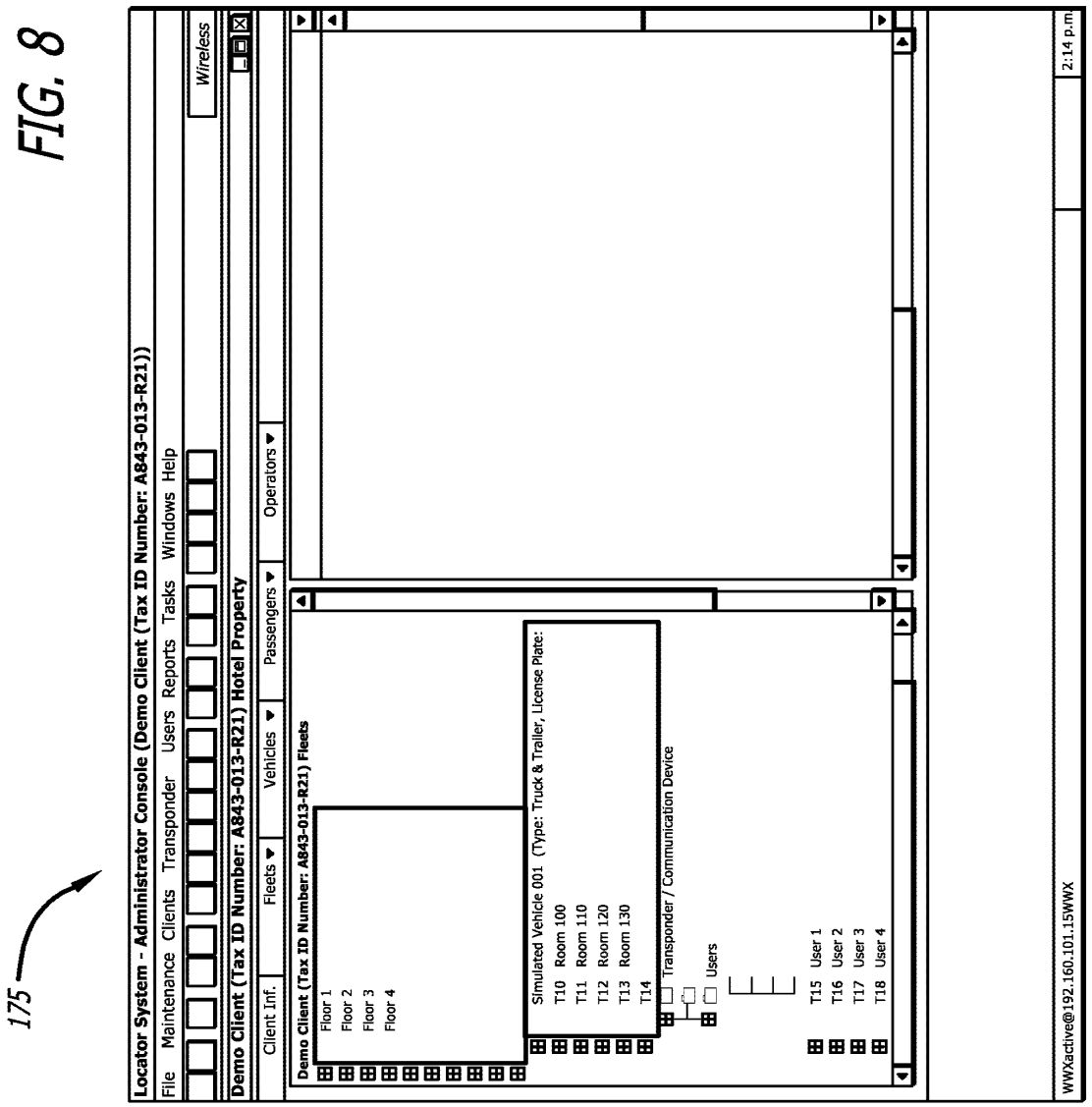
Google Exhibit 1004, Page 89 of 1125

FIG. 7D



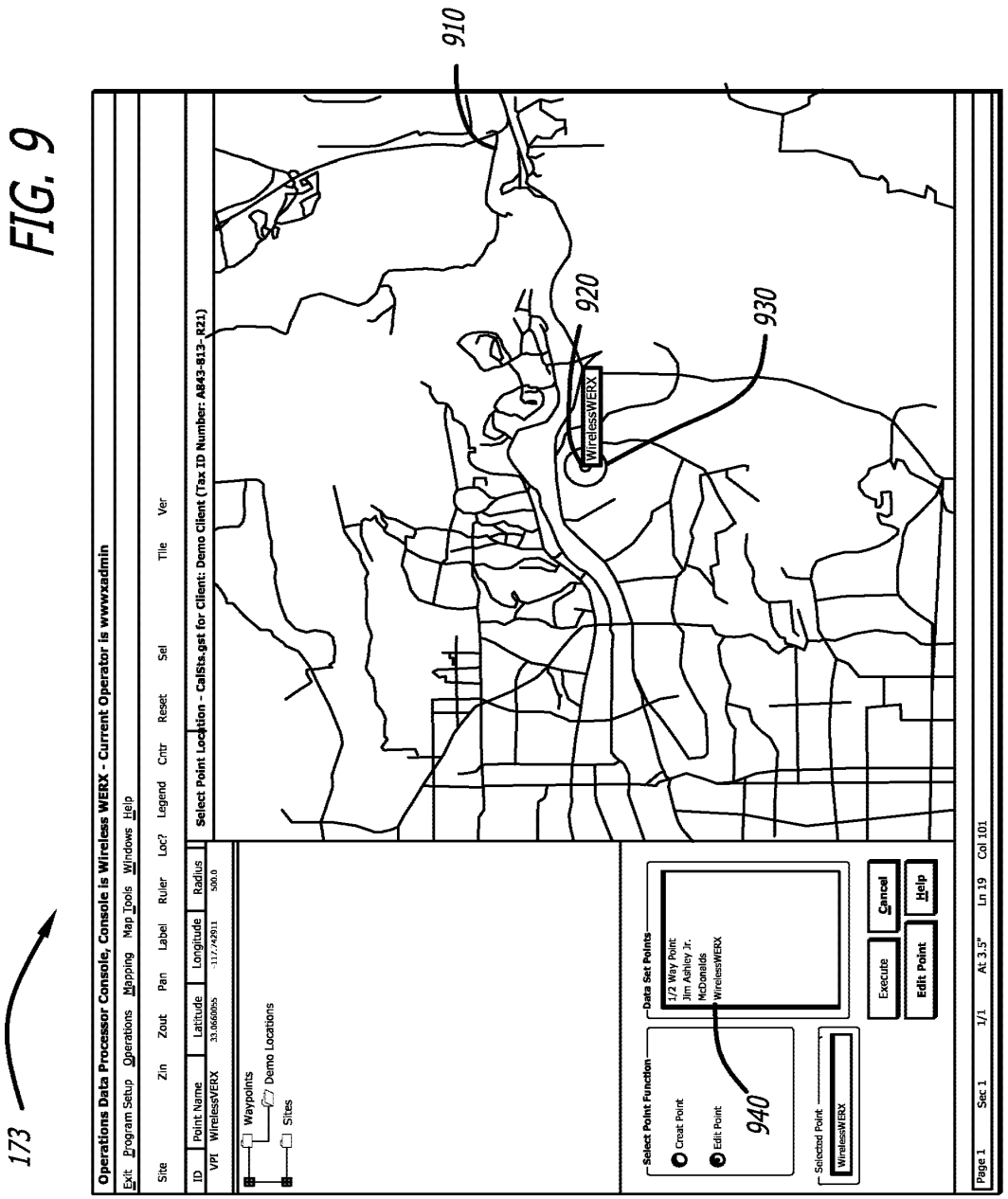
Google Exhibit 1004, Page 90 of 1125

FIG. 8



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FIG. 9


173
910
920
930
940
Operations Data Processor Console, Console is Wireless WERX - Current Operator is wwwxadmin
Exit Program Setup Operations Mapping Map Tools Windows Help
Site Zin Zout Pan Label Ruler Loc? Legend Cntr Reset Sel Tile Ver
ID Point Name Latitude Longitude Radius
VPI WirelessVERX 33.060005 -117.74911 500.0
Waypoints
Demo Locations
Sites
Select Point Location - CallSts.get for Client: Demo Client (Tax ID Number: AB43-813- R21)
WirelessWERX
Select Point Function
Creat Point
Edit Point
Data Set Points
1/2 Way Point
Jim Ashley Jr.
McDonalds
WirelessWERX
Selected Point
WirelessWERX
Execute
Cancel
Edit Point
Help
Page 1 Sec 1 1/1 At 3.5" Ln 19 Col 101

174

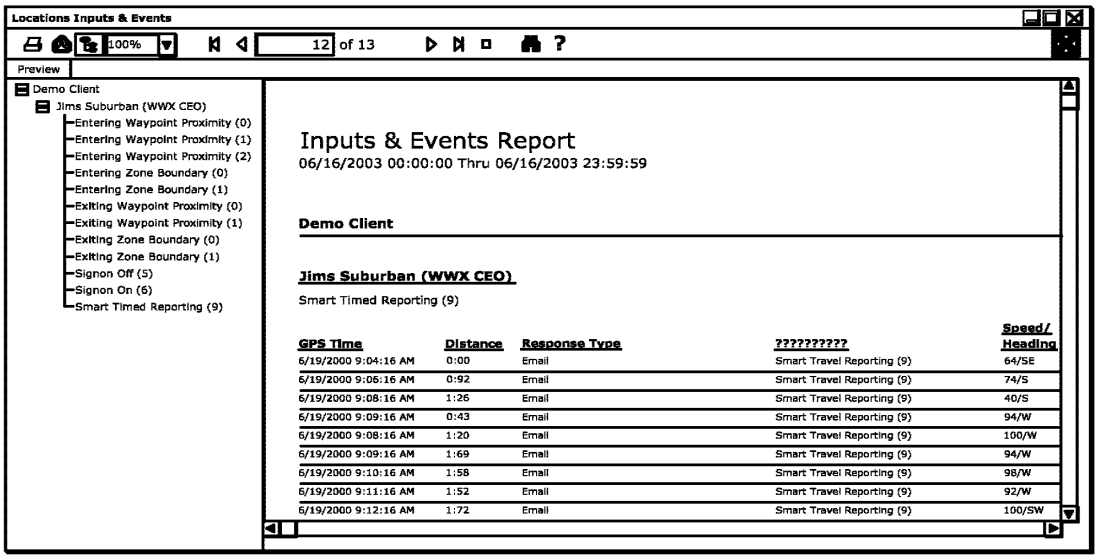


FIG. 10

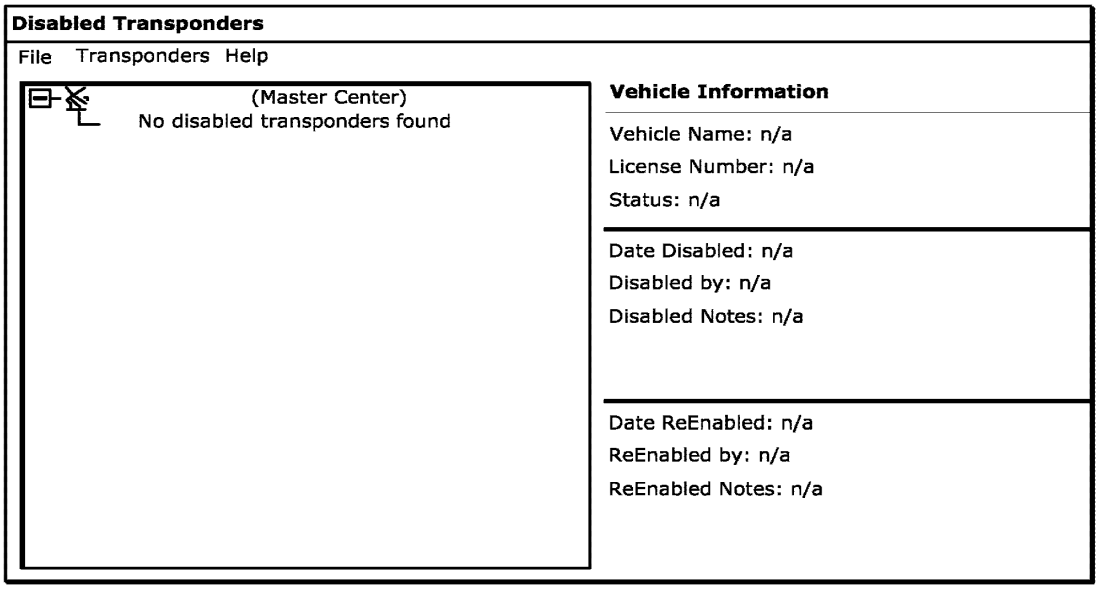


FIG. 11

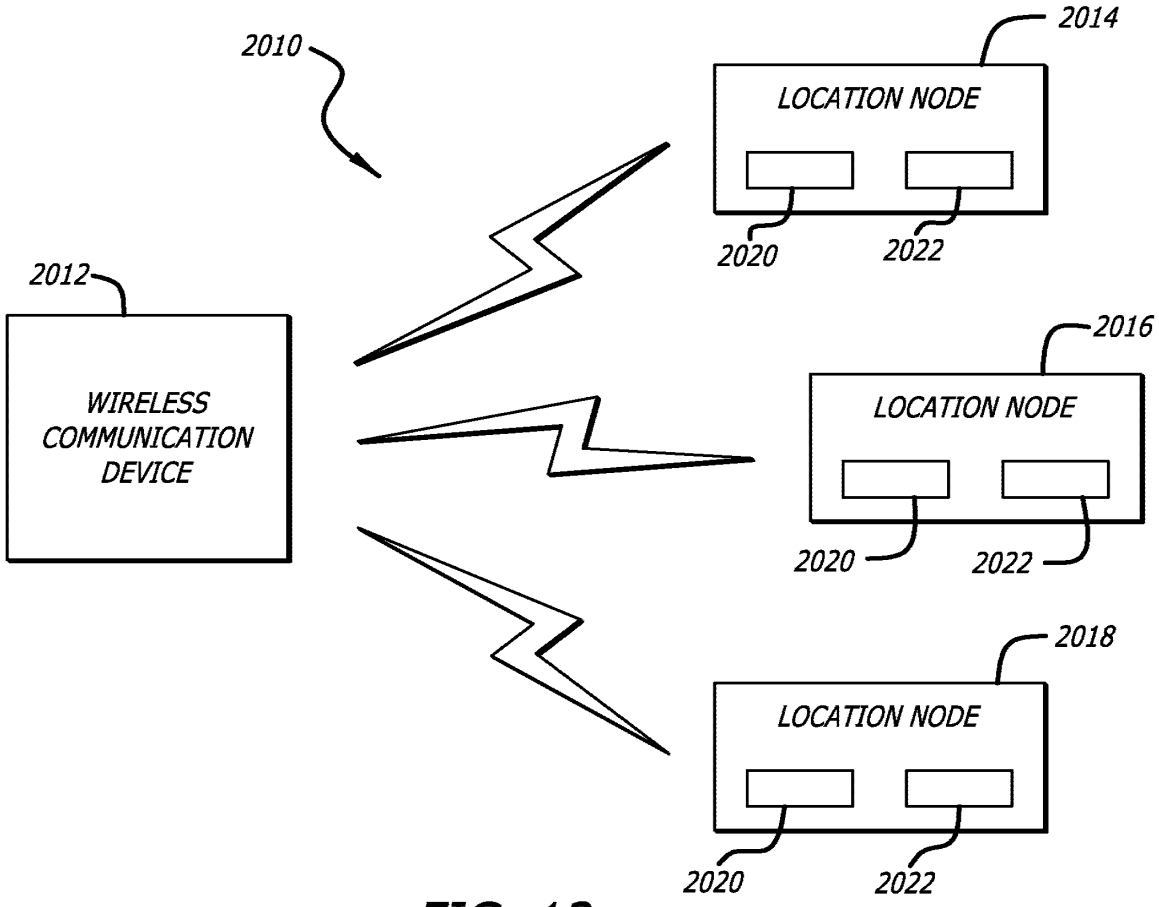
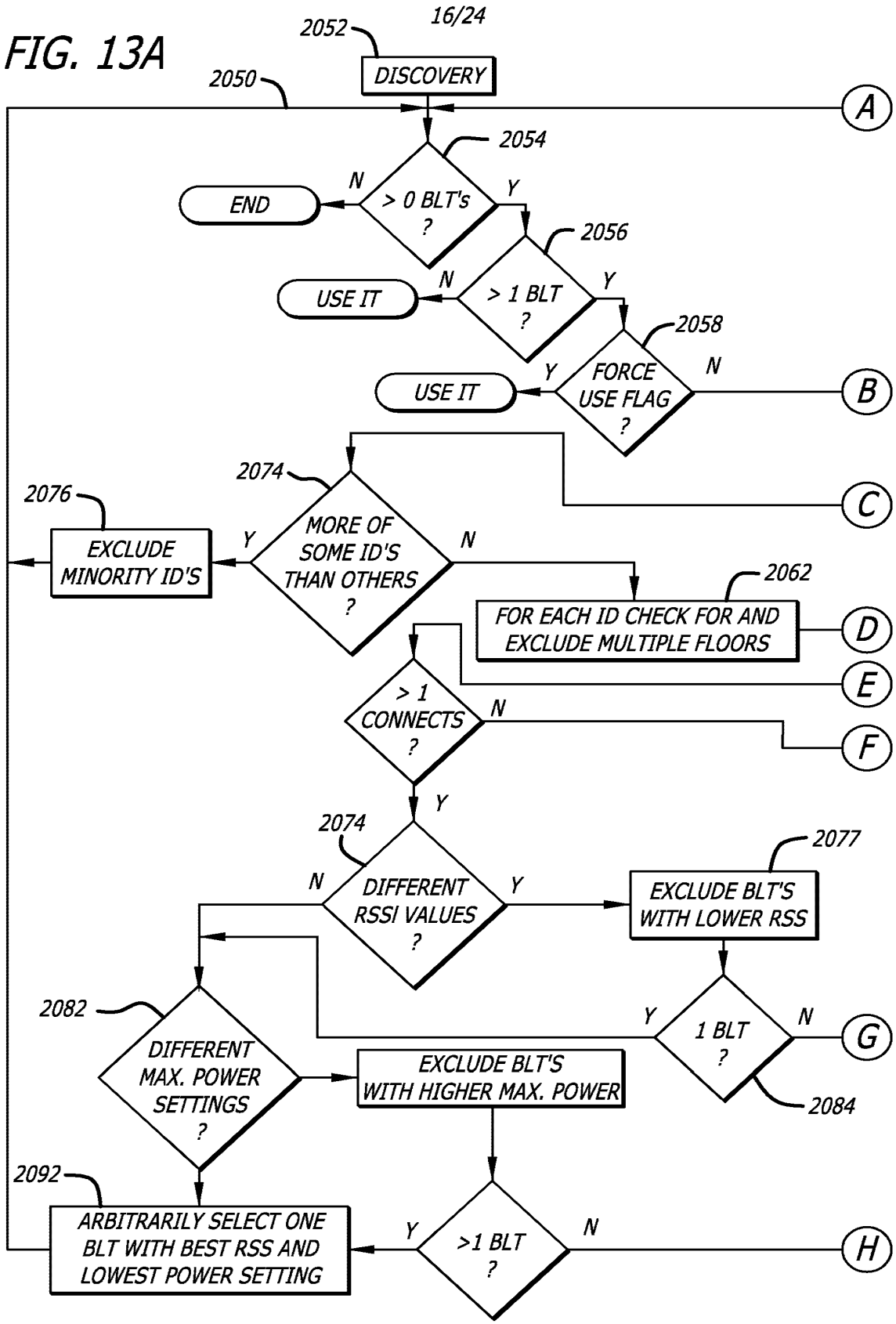

2010
2014
LOCATION NODE
2020
2022
2012
WIRELESS COMMUNICATION DEVICE
2016
LOCATION NODE
2020
2022
2018
LOCATION NODE
2020
2022

FIG. 12

FIG. 13A


2052
DISCOVERY
2050
A
2054
> 0 BLT's ?
N
END
Y
2056
> 1 BLT ?
N
USE IT
Y
2058
FORCE USE FLAG ?
Y
USE IT
N
B
2074
MORE OF SOME ID'S THAN OTHERS ?
C
2076
EXCLUDE MINORITY ID'S
Y
N
2062
FOR EACH ID CHECK FOR AND EXCLUDE MULTIPLE FLOORS
D
E
> 1 CONNECTS ?
N
F
Y
2074
DIFFERENT RSSI VALUES ?
N
Y
2077
EXCLUDE BLT'S WITH LOWER RSS
1 BLT ?
Y
N
G
2084
2082
DIFFERENT MAX. POWER SETTINGS ?
EXCLUDE BLT'S WITH HIGHER MAX. POWER
2092
ARBITRARILY SELECT ONE BLT WITH BEST RSS AND LOWEST POWER SETTING
Y
>1 BLT ?
N
H

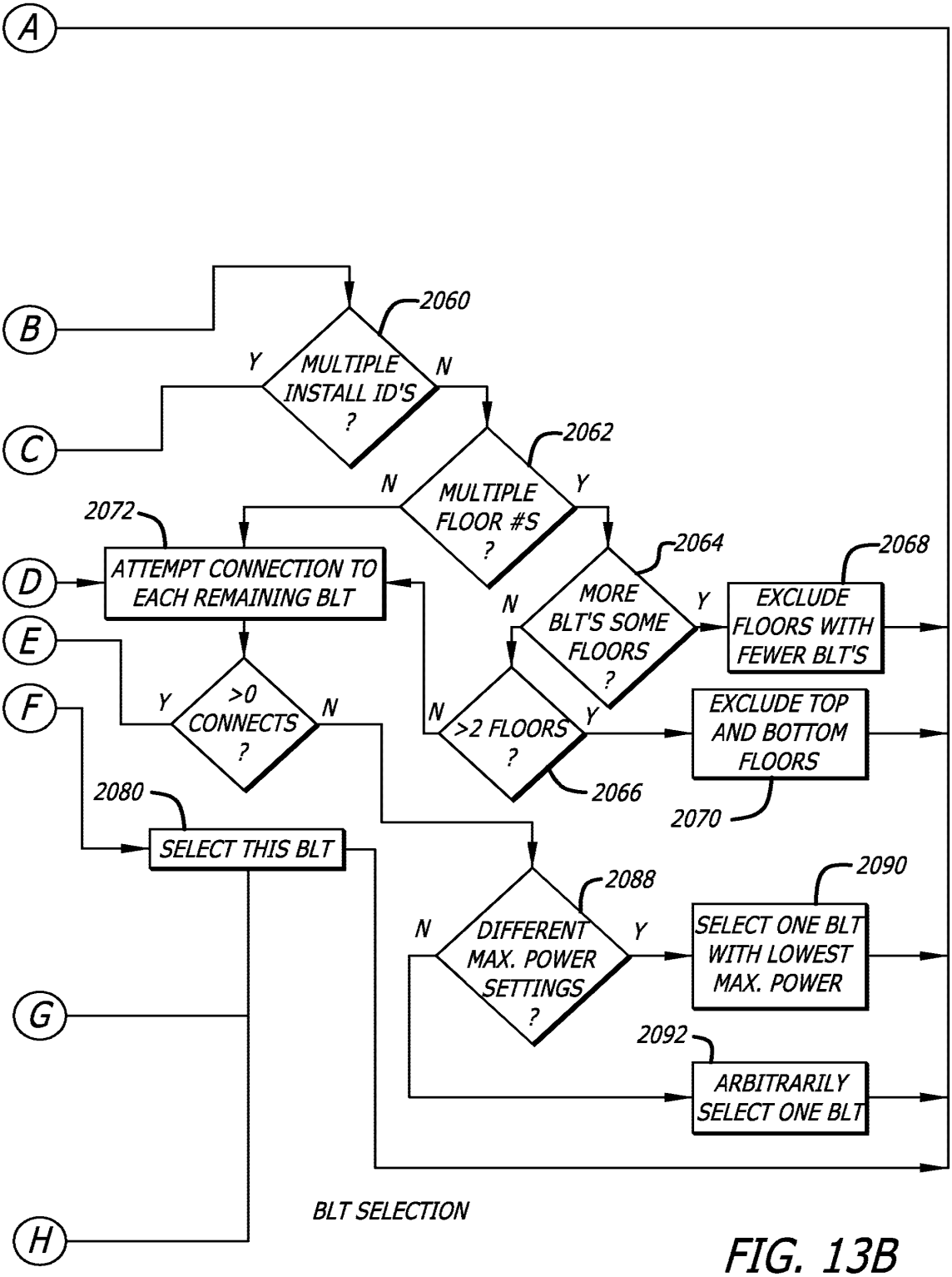

A
B
C
D
E
F
G
H
2060
MULTIPLE INSTALL ID'S ?
Y
N
2062
MULTIPLE FLOOR #S ?
N
Y
2072
ATTEMPT CONNECTION TO EACH REMAINING BLT
2064
MORE BLT'S SOME FLOORS ?
N
Y
2068
EXCLUDE FLOORS WITH FEWER BLT'S
>0 CONNECTS ?
Y
N
>2 FLOORS ?
N
Y
2066
EXCLUDE TOP AND BOTTOM FLOORS
2070
2080
SELECT THIS BLT
2088
DIFFERENT MAX. POWER SETTINGS ?
N
Y
2090
SELECT ONE BLT WITH LOWEST MAX. POWER
2092
ARBITRARILY SELECT ONE BLT
BLT SELECTION

FIG. 13B

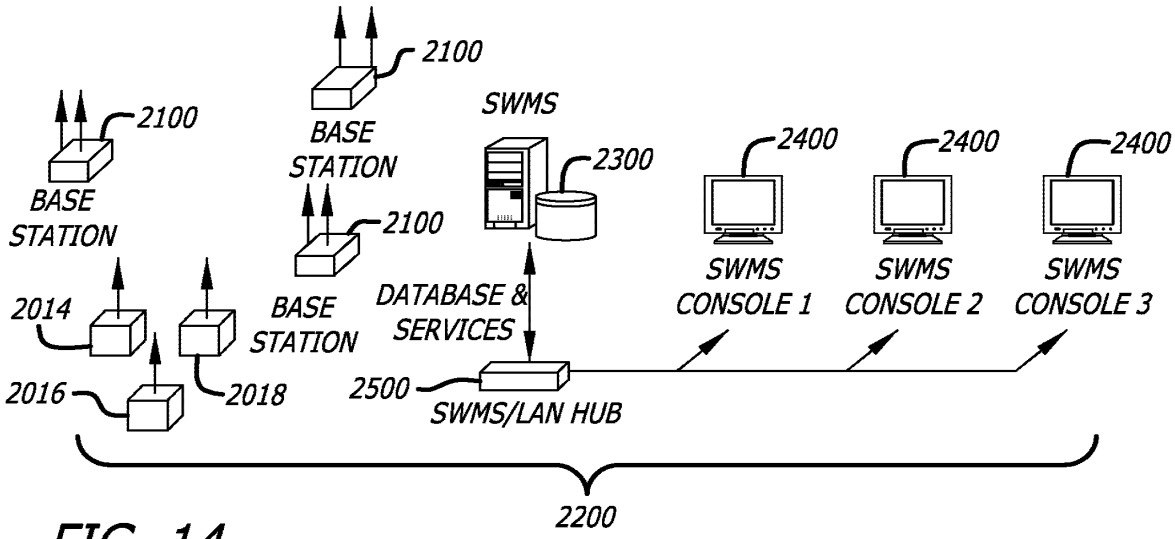

2100
2100
BASE STATION
BASE STATION
2100
BASE STATION
SWMS
2300
2400
2400
2400
SWMS CONSOLE 1
SWMS CONSOLE 2
SWMS CONSOLE 3
2014
2016
2018
DATABASE & SERVICES
2500
SWMS/LAN HUB
2200

FIG. 14

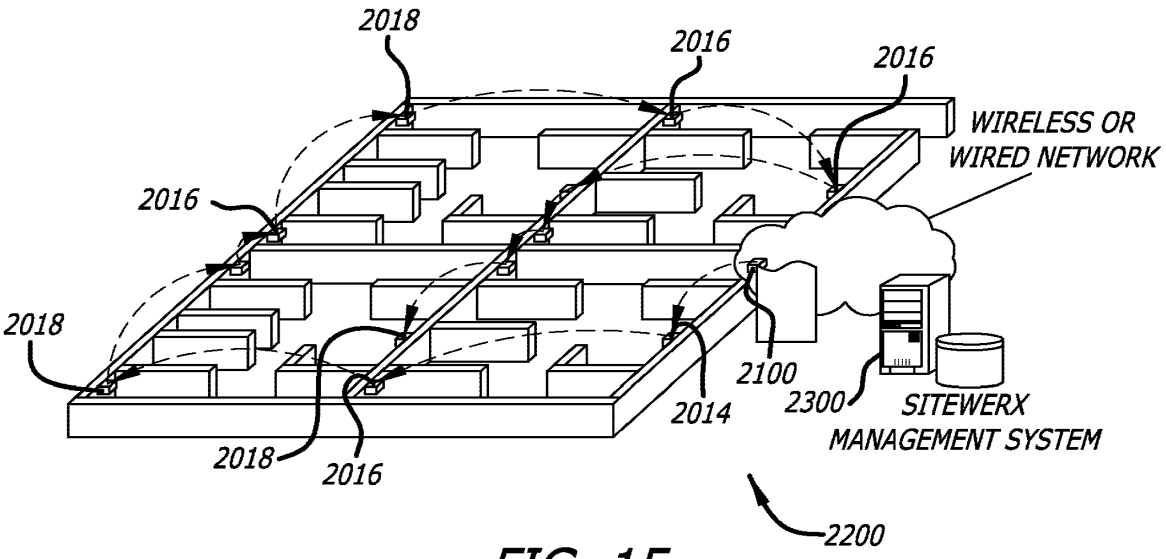

2018
2016
2016
WIRELESS OR WIRED NETWORK
2016
2018
2100
2014
2300
SITEWERX MANAGEMENT SYSTEM
2018
2016
2200

FIG. 15

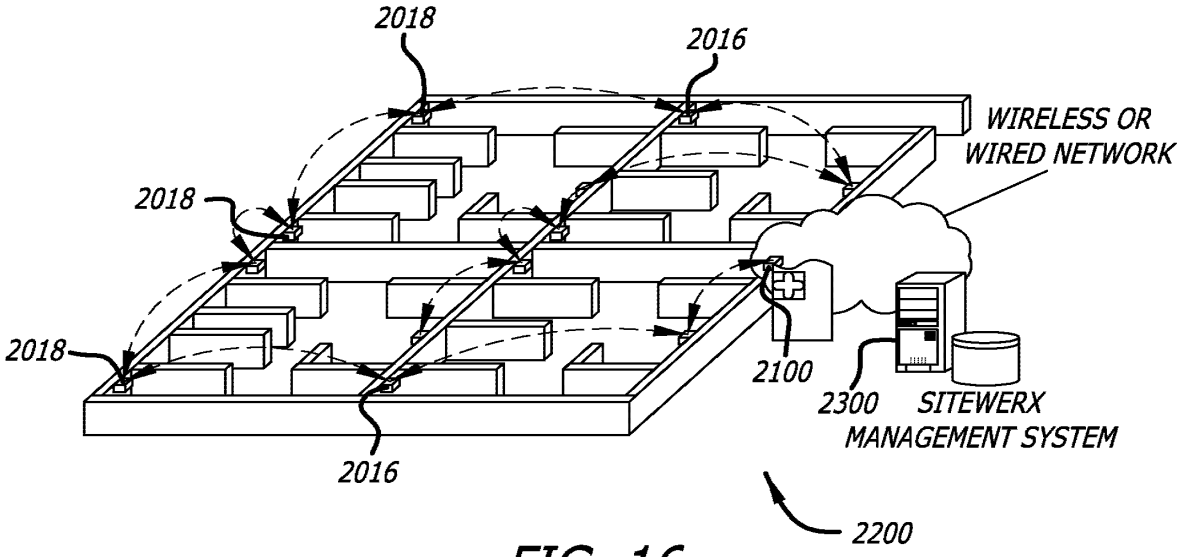

2018
2016
WIRELESS OR
WIRED NETWORK
2018
2018
2100
2300
SITEWERX
MANAGEMENT SYSTEM
2016
2200

FIG. 16

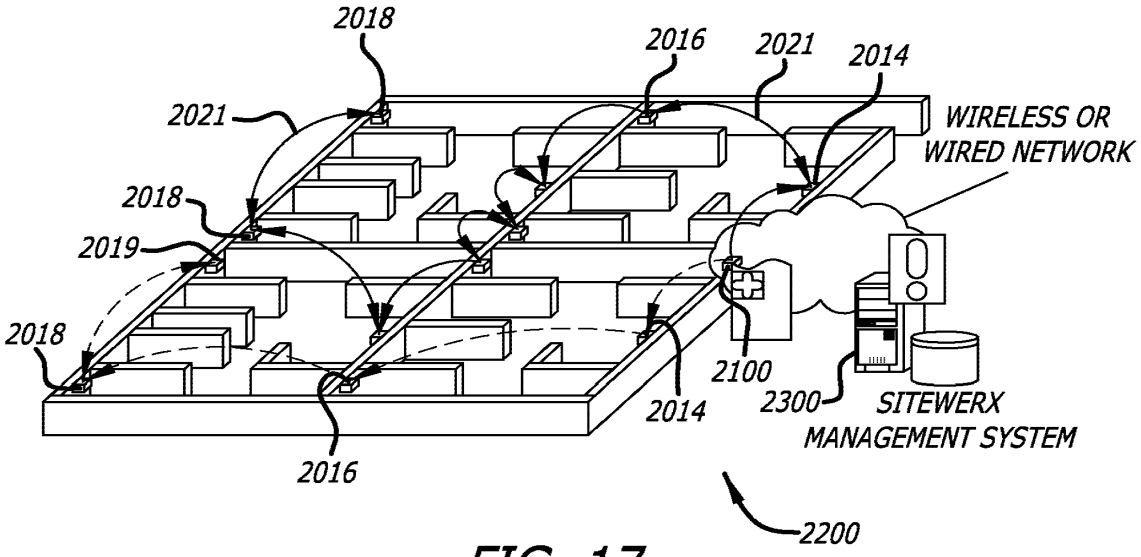

2018
2016
2021
2014
2021
WIRELESS OR
WIRED NETWORK
2018
2019
2018
2100
2300
SITEWERX
MANAGEMENT SYSTEM
2014
2016
2200

FIG. 17

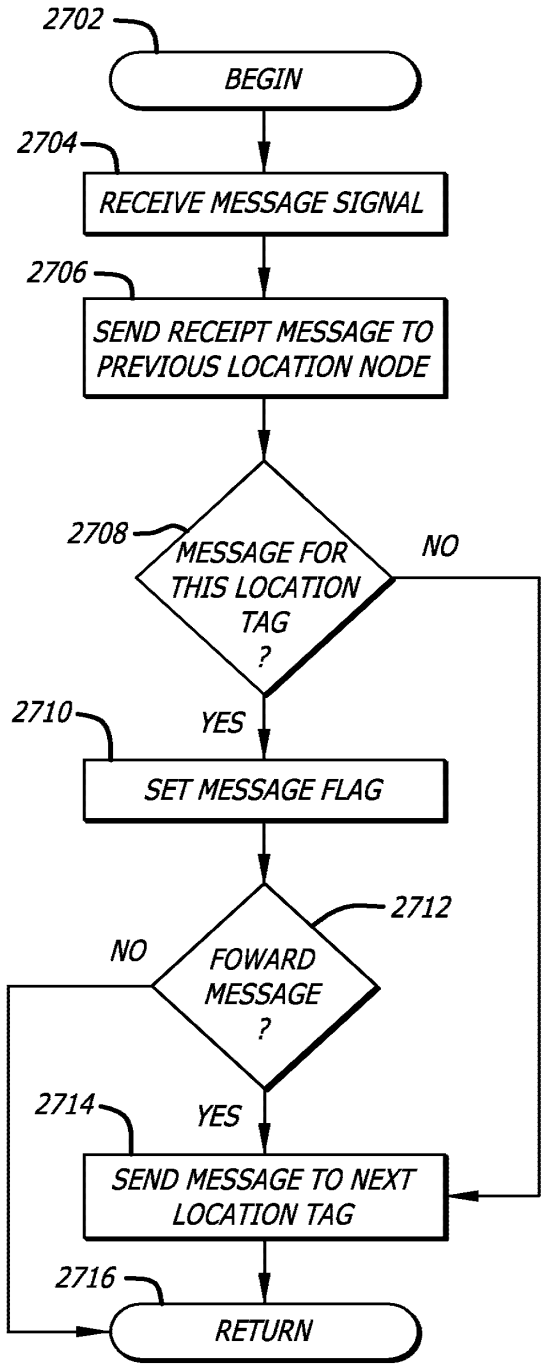

2700
2702
BEGIN
2704
RECEIVE MESSAGE SIGNAL
2706
SEND RECEIPT MESSAGE TO PREVIOUS LOCATION NODE
2708
MESSAGE FOR THIS LOCATION TAG ?
NO
YES
2710
SET MESSAGE FLAG
2712
FOWARD MESSAGE ?
NO
YES
2714
SEND MESSAGE TO NEXT LOCATION TAG
2716
RETURN

FIG. 18

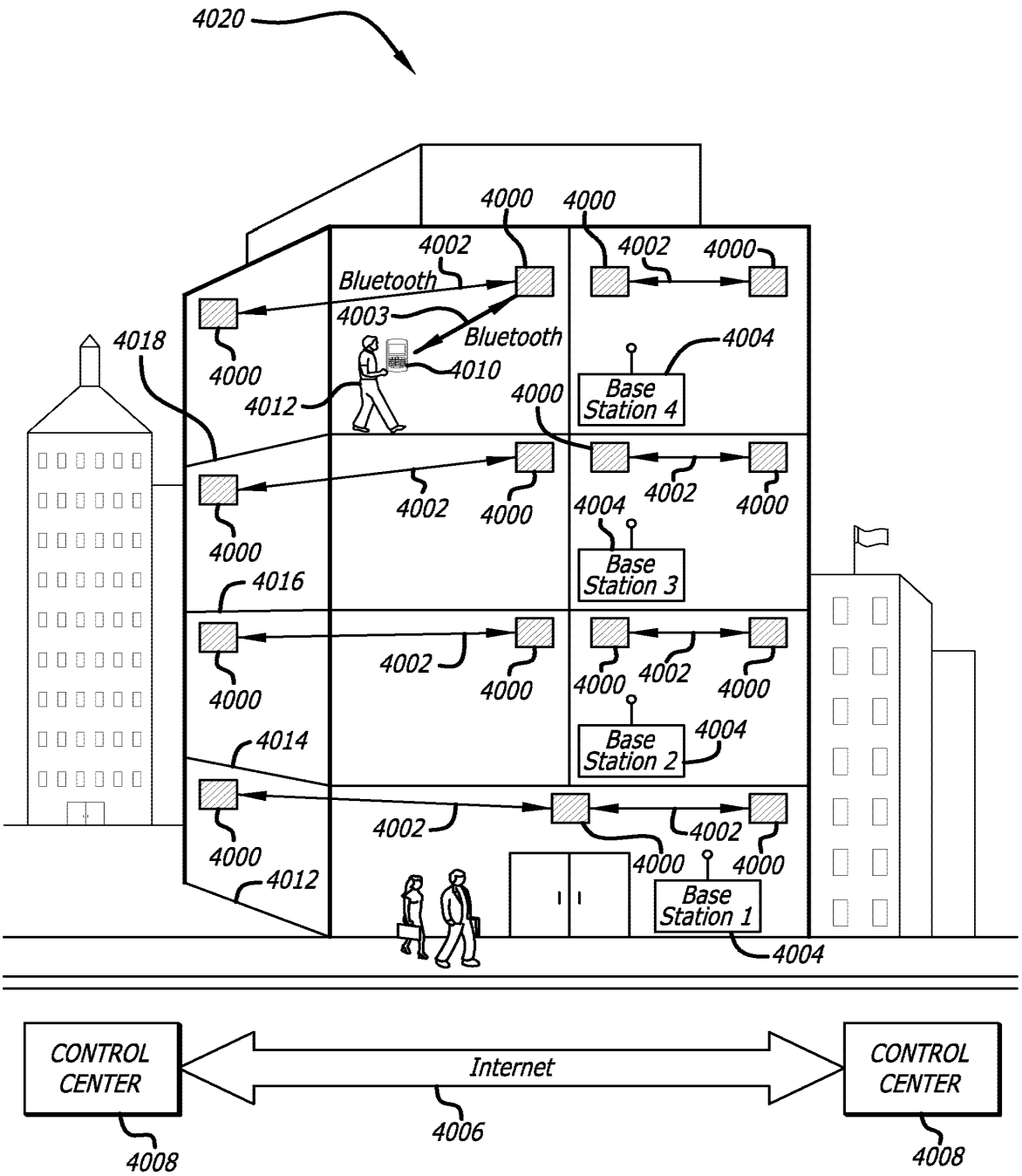

4020
4000
4002
Bluetooth
4003
Bluetooth
4010
4012
4018
4004
Base Station 4
Base Station 3
Base Station 2
Base Station 1
4016
4014
CONTROL CENTER
Internet
4006
4008

FIG. 19A

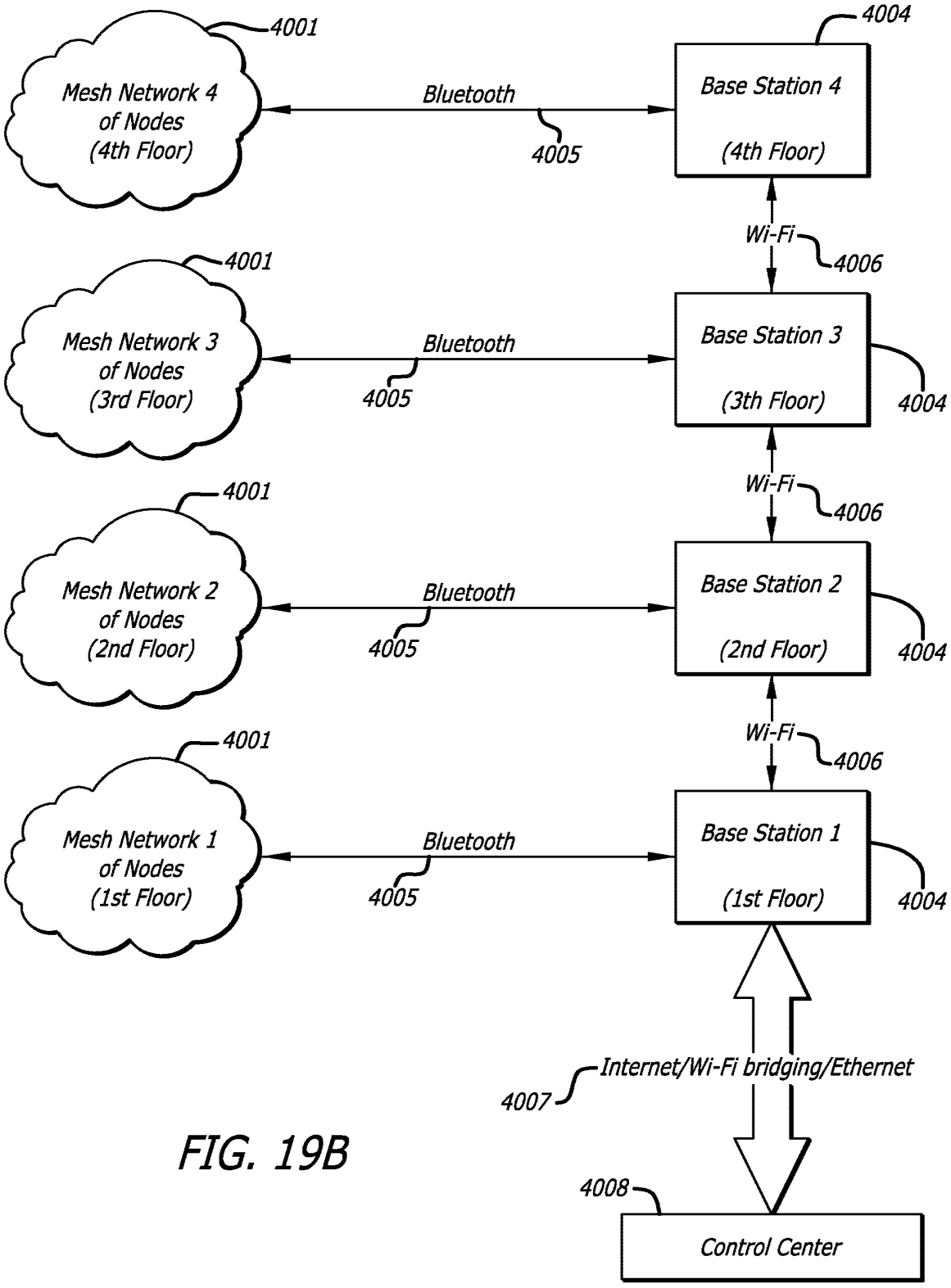

4001
Mesh Network 4 of Nodes (4th Floor)
Bluetooth
4005
4004
Base Station 4 (4th Floor)
Wi-Fi
4006
4001
Mesh Network 3 of Nodes (3rd Floor)
Bluetooth
4005
Base Station 3 (3th Floor)
4004
Wi-Fi
4006
4001
Mesh Network 2 of Nodes (2nd Floor)
Bluetooth
4005
Base Station 2 (2nd Floor)
4004
Wi-Fi
4006
4001
Mesh Network 1 of Nodes (1st Floor)
Bluetooth
4005
Base Station 1 (1st Floor)
4004
Internet/Wi-Fi bridging/Ethernet
4007
4008
Control Center

FIG. 19B

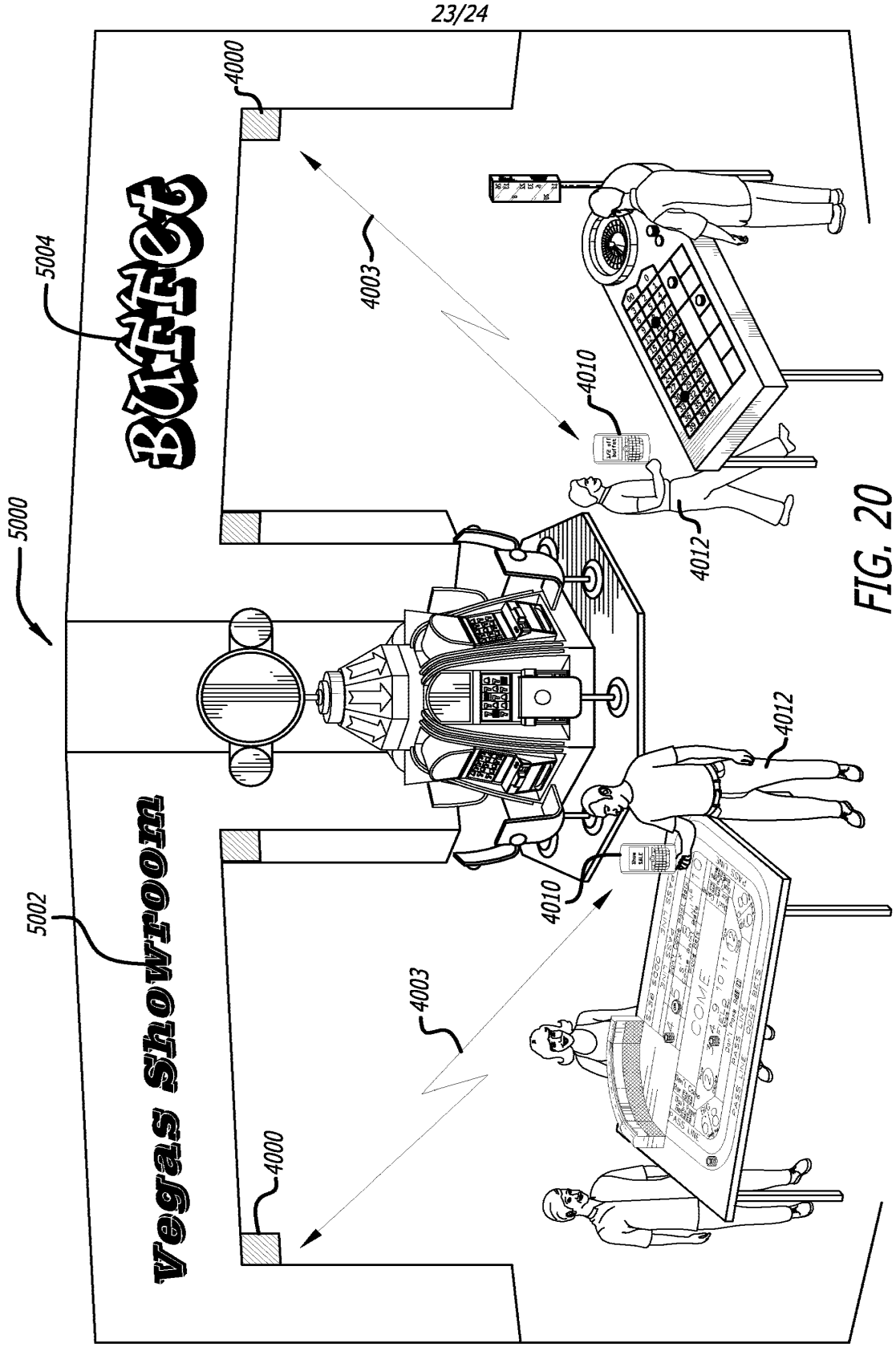

5000
5002
5004
4000
4003
4010
4012
Vegas Showroom
BUFFET
COME
PASS LINE
DON'T PASS BAR 12

FIG. 20

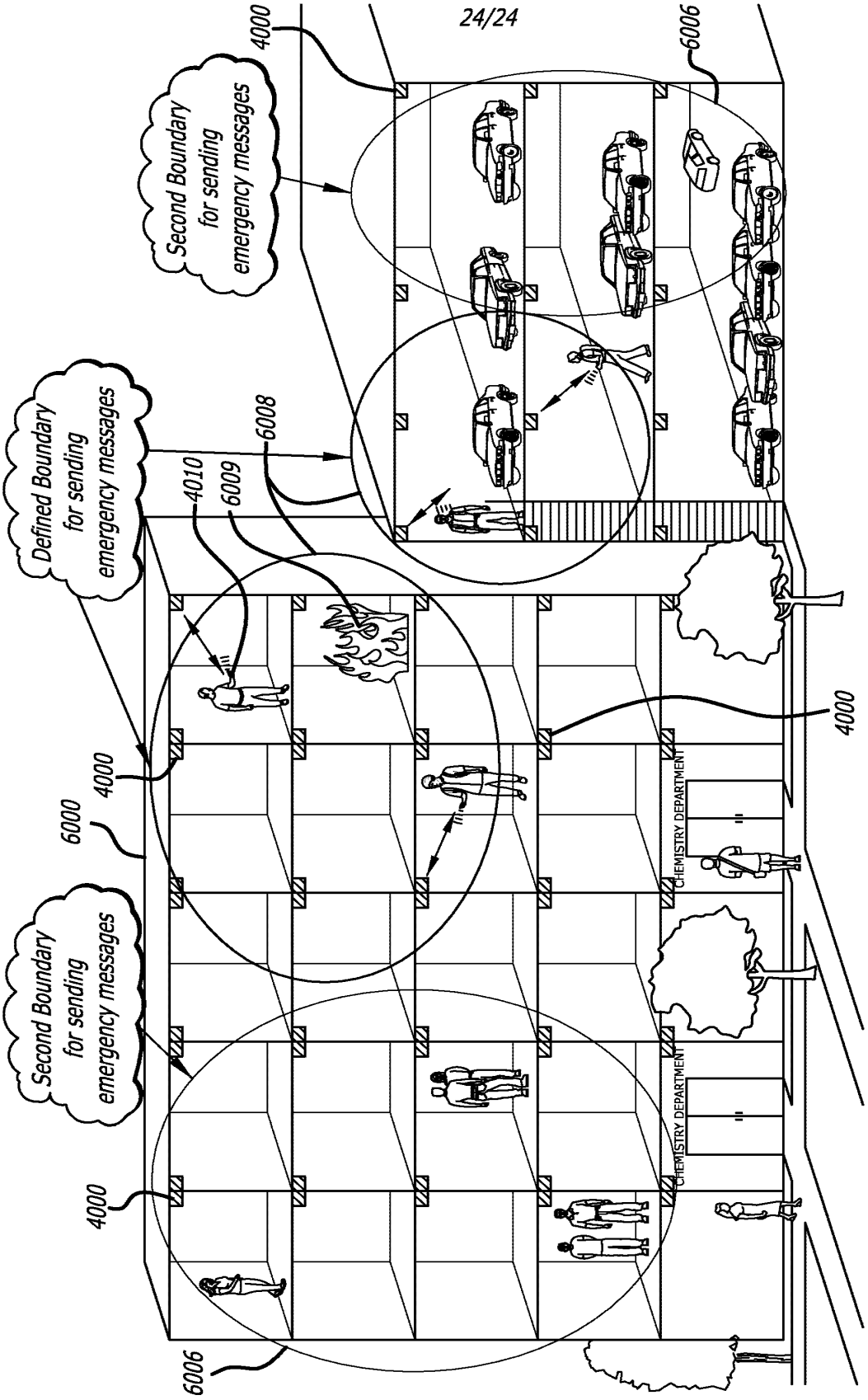

Second Boundary for sending emergency messages
Defined Boundary for sending emergency messages
Second Boundary for sending emergency messages
4000
6000
6006
6008
4010
6009
CHEMISTRY DEPARTMENT
CHEMISTRY DEPARTMENT

FIG. 21

MAPPING IN A MULTI-DIMENSIONAL SPACE

WE CLAIM:

1. 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, 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;

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.

2. The system 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.

3. The system of claim 1, wherein the nodes are enabled selectively to communicate with GPS and with Bluetooth™ protocols.

4. The system of claim 1, wherein 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.

5. The system of claim 1, wherein the nodes are selectively part of a mesh network or other suitable network configuration.

6. The system 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.

7. The system of claim 6, wherein the communication is through a Bluetooth™ protocol.

8. The system 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.

9. The system 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.

10. The system 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.

11. The system of claim 10, wherein a user enters the plurality of coordinates by entering on a computer the longitude, latitude, and elevation.

12. The system 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.

13. The system 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.

14. The system of claim 1, wherein a multi-dimensional shape of a geographical area is the shape of a non-regular geometrical shape.

15. The system 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.

16. The system 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.

17. A system 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;

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.

18. The system 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.

19. A system 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;

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.

20. The system 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.

21. The system of claim 19, wherein the nodes are enabled selectively to communicate with GPS and with Bluetooth™ protocols, and wherein the nodes are selectively part of a mesh network or other suitable network configuration.

22. A map of a multi dimensional space 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;

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™ protocol.

23. The map of claim 22, wherein the geographical space is in three-dimensions.

PTO/SB/06 (12-04)

Filing Date: 01/08/09

Approved for use through 7/31/2006. 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: 12/350,817

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	82		N/A	
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	270		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	110		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	23 minus 20 =	3	x$26	78	OR	x$52	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	4 minus 3 =	* 1	x$110	110		x$220	
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $270 ($135 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR						
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))			195			390	
			TOTAL	650		TOTAL	

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED – PART II

AMENDMENT A		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
	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))					N/A		OR	N/A	
						TOTAL ADD'T FEE		OR	TOTAL ADD'T FEE	

1, 17, 19, 22

AMENDMENT B		(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))					N/A		OR	N/A	
						TOTAL ADD'T FEE		OR	TOTAL ADD'T 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.

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.

Google Exhibit 1004, Page 108 of 1125

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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 NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/350,817	01/08/2009	James Ashley JR.	081221-011500

CONFIRMATION NO. 7586

33717
GREENBERG TRAURIG LLP (LA)
2450 COLORADO AVENUE, SUITE 400E
INTELLECTUAL PROPERTY DEPARTMENT
SANTA MONICA, CA 90404

FORMALITIES LETTER

OC000000034146141

Date Mailed: 01/23/2009

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items and pay any fees required below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The oath or declaration is missing.
  A properly signed oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date, is required.
  Note: If a petition under 37 CFR 1.47 is being filed, an oath or declaration in compliance with 37 CFR 1.63 signed by all available joint inventors, or if no inventor is available by a party with sufficient proprietary interest, is required.

The application is informal since it does not comply with the regulations for the reason(s) indicated below.

The required item(s) identified below must be timely submitted to avoid abandonment:

- Replacement drawings in compliance with 37 CFR 1.84 and 37 CFR 1.121(d) are required. The drawings submitted are not acceptable because:
  - Numbers, letters, and reference characters on the drawings must measure at least 0.32 cm (1/8 inch) in height. See Figure(s) 4A, 7A-10.

Applicant is cautioned that correction of the above items may cause the specification and drawings page count to exceed 100 pages. If the specification and drawings exceed 100 pages, applicant will need to submit the required application size fee.

The applicant needs to satisfy supplemental fees problems indicated below.

The required item(s) identified below must be timely submitted to avoid abandonment:

- To avoid abandonment, a surcharge (for late submission of filing fee, search fee, examination fee or oath or declaration) as set forth in 37 CFR 1.16(f) of $**65** for a small entity in compliance with 37 CFR 1.27, must be submitted with the missing items identified in this notice.

Google Exhibit 1004, Page 109 of 1125

SUMMARY OF FEES DUE:

Total additional fee(s) required for this application is $**65** for a small entity
- $**65** Surcharge.

Replies should be mailed to:

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

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Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

Google Exhibit 1004, Page 110 of 1125

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
12/350,817	01/08/2009	2161	650	081221-011500	23	4

CONFIRMATION NO. 7586

33717
GREENBERG TRAURIG LLP (LA)
2450 COLORADO AVENUE, SUITE 400E
INTELLECTUAL PROPERTY DEPARTMENT
SANTA MONICA, CA 90404

FILING RECEIPT

OC000000034146140

Date Mailed: 01/23/2009

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

James Ashley JR., Norco, CA;
Patrick Mooney, Brea, CA;

Assignment For Published Patent Application

WIRELESSWERX INTERNATIONAL, INC., Urbanizacion Marbella, PANAMA CANAL ZONE

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CIP of 11/848,178 08/30/2007

Foreign Applications

If Required, Foreign Filing License Granted: 01/21/2009

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/350,817**

Projected Publication Date: To Be Determined - pending completion of Missing Parts

Non-Publication Request: No

Early Publication Request: No
** **SMALL ENTITY** **

Google Exhibit 1004, Page 111 of 1125

Title

MAPPING IN A MULTI-DIMENSIONAL SPACE

Preliminary Class

707

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

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Title 37, Code of Federal Regulations, 5.11 & 5.15

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Google Exhibit 1004, Page 112 of 1125

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Google Exhibit 1004, Page 113 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:	Cynthia Anne Dixon/Shaula Stephenson
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:				
Late filing fee for oath or declaration	2051	1	65	65
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
			Total in USD ($)	**65**

PTO/SB/01A (07-07)
Approved for use through 06/30/2010. OMB 0651-0032
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 if displays a valid OMB control number.

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	MAPPING IN A MULTI-DIMENSIONAL SPACE

As the below named inventor(s), I/we declare that:

This declaration is directed to:

☐ The attached application, or

☑ Application No. 12/350,817 filed on January 8, 2009

☐ As amended on _____ (if applicable);

I/we believe that I/we am/are the original and first inventor(s) of the subject matter which is claimed and for which a patent is sought;

I/we have reviewed and understand the contents of the above-identified application, including the claims, as amended by any amendment specifically referred to above;

I/we acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me/us to be material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT International filing date of the continuation-in-part application.

WARNING:

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All statements made herein of my/our own knowledge are true, all statements made herein 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 are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001, and may jeopardize the validity of the application or any patent issuing thereon.

FULL NAME OF INVENTOR(S)

Inventor one: James Ashley, Jr. Date: 1/29/2009

Signature: _____ Citizen of: US

Inventor two: Patrick Mooney Date: 1/29/2009

Signature: _____ Citizen of: US

☐ Additional inventors or a legal representative are being named on _____ additional form(s) attached hereto.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. 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 1 minute 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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Electronic Acknowledgement Receipt	
EFS ID:	4741247
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:	Cynthia Anne Dixon/Shaula Stephenson
Filer Authorized By:	Cynthia Anne Dixon
Attorney Docket Number:	081221-011500
Receipt Date:	05-FEB-2009
Filing Date:	08-JAN-2009
Time Stamp:	15:01:50
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$65
RAM confirmation Number	383
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		115resp.pdf	138432 50de110a1d264d91b6cedaaf2c6b7a05b1a2ffc7	yes	3

	Multipart Description/PDF files in .zip description		
	Document Description	Start	End
	Applicant Response to Pre-Exam Formalities Notice	1	2
	Oath or Declaration filed	3	3

Warnings:

Information:

2	Fee Worksheet (PTO-06)	fee-info.pdf	30066 63b52a29fcaec40a6de1380af9b7f4dc424be576	no	2

Warnings:

Information:

Total Files Size (in bytes):	168498

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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.

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants:	James Ashley, Jr., et al.	Examiner:	*to be assigned*
Serial No.	12/350,817	Group Art Unit:	2161
Filed:	January 8, 2009	Docket No.	081221-011500
Customer No.:	33717	Conf. 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 February 5, 2009.

Name: Shaula Stephenson

RESPONSE TO NOTICE TO FILE MISSING PARTS OF NON-PROVISIONAL APPLICATION

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☒ Copy of Declaration signed by each inventor; and

☒ Late Oath/Declaration Surcharge in the amount of $65.00.

Google Exhibit 1004, Page 119 of 1125

Authorization is hereby given to charge the late oath/declaration surcharge in the amount of $65.00 to Deposit Account No. 50-2638. Further authorization is given 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: February 5, 2009

Cynthia A. Dixon
Reg. No. 58,926

GREENBERG TRAURIG, LLP
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Phone: (310) 586-7700
Fax: (310) 586-7800
E-mail: laipmail@gtlaw.com

Google Exhibit 1004, Page 120 of 1125

Electronic Acknowledgement Receipt

EFS ID:	4752388
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:	Cynthia Anne Dixon/Shaula Stephenson
Filer Authorized By:	Cynthia Anne Dixon
Attorney Docket Number:	081221-011500
Receipt Date:	06-FEB-2009
Filing Date:	08-JAN-2009
Time Stamp:	17:41:33
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	Applicant Response to Pre-Exam Formalities Notice	115supp.pdf	106304 9a9cbc2e8133dd7fab75c9c4370fe1be918fa095	no	3

Warnings:	
Information:	

2	Appendix to the Specification	AppendixA.pdf	2297911 431a0af71d9122e1787654337e64bc2b754938e3	no	37
Warnings:					
Information:					
			Total Files Size (in bytes):	2404215	

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New Applications Under 35 U.S.C. 111
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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.

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants:	James Ashley, Jr., et al.	Examiner:	*to be assigned*
Serial No.	12/350,817	Group Art Unit:	2161
Filed:	January 8, 2009	Docket No.	081221-011500
Customer No.:	33717	Conf. No.:	7586
Title:	MAPPING IN A MULTI-DIMENSIONAL SPACE		

CERTIFICATE OF TRANSMISSION

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Name: Shaula Stephenson

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Commissioner for Patents
Post Office Box 1450
Alexandria, Virginia 22313-1450

Sir/Madam:

This document is responsive to the Notice to File Missing Parts of Nonprovisional Application, mailed January 23, 2009, setting a two-month period for response.

Remarks/Arguments begin on page 2.

Appendix A follows page 3.

Google Exhibit 1004, Page 123 of 1125

REMARKS

Rejection of Drawings

By the Notice, the drawings for Figures 4A and 7A-10 have been rejected because the "[n]umbers, letters, and reference characters of the drawings must measure at least 0.32 cm (1/8 inch) in height." Reconsideration and withdrawal of these rejections is respectfully requested for at least the following reasons.

Turning to the specific language of the Consolidated Patent Rules (CFR), section 37 CFR 1.84(p)(3) states, "[n]umbers, letters, and reference characters must measure at least .32 cm (1/8 inch) in height. They should not be placed in the drawing so as to interfere with its comprehension...When necessary, such as indicating a surface or cross section, a reference character may be underlined and a blank space may be left..." Applicants assert that Figures 4A and 7A-10 do not contain any "numbers, letters, and reference characters", within the meaning of section 37 CFR 1.84(p)(3), that are less than .32 cm.

It is clear from the language of section 1.84(p)(3), that the phrase "numbers, letters, and reference characters" refers to text, not indicia or mere markings. Figures 4A and 7A-10 all depict various screen shots related to the disclosure. These screen shots are presented to show various examples of screen layouts and formats. As such, the small markings contained within these screen shots are not text, but rather merely indicia to the screen shots.

To further support this assertion, please note that related United States Patent No. 7,286,929, issued October 23, 2007, contains the exact same drawings that are contained in Figures 4A and 7A-10 of the present application. For your reference, a copy of United States Patent No. 7,286,929 is contained in Appendix A of this response.

Therefore, since Figures 4A and 7A-10 do not contain any "numbers, letters, and reference characters" that are less than .32 cm in height, withdrawal of the rejections to these drawings is courteously solicited.

Google Exhibit 1004, Page 124 of 1125

Authorization is given 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: February 6, 2009

Cynthia A. Dixon
Reg. No. 58,926

GREENBERG TRAURIG, LLP
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Santa Monica, CA 90404
Phone: (310) 586-7700
Fax: (310) 586-7800
E-mail: laipmail@gtlaw.com

Google Exhibit 1004, Page 125 of 1125

APPENDIX A



US007286929B2

(12) **United States Patent**
Staton et al.

(10) **Patent No.: US 7,286,929 B2**
(45) **Date of Patent: Oct. 23, 2007**

(54) **METHOD AND SYSTEM TO CONFIGURE AND UTILIZE GEOGRAPHICAL ZONES**

(75) Inventors: **Houston Staton**, Paseo Colón (CR); **James Ashley, Sr.**, Anaheim, CA (US); **James Ashley, Jr.**, Norco, CA (US); **Frank Mooney**, Brea, CA (US); **Patrick Mooney**, Brea, CA (US); **Edward Lang**, Diamond Bar, CA (US); **Charles Maggs**, Costa Mesa, CA (US); **German Santos**, Anaheim Hills, CA (US)

(73) Assignee: **Wirelesswerx International, Inc.**, Urbanizacion Marbella (PA)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 220 days.

(21) Appl. No.: **11/105,931**

(22) Filed: **Apr. 13, 2005**

(65) **Prior Publication Data**

US 2006/0100777 A1 May 11, 2006

Related U.S. Application Data

(60) Provisional application No. 60/625,467, filed on Nov. 5, 2004.

(51) **Int. Cl.**
G01C 21/26 (2006.01)
G01C 21/02 (2006.01)

(52) **U.S. Cl.** **701/206**; 701/211; 342/357.07; 340/990; 340/539.13

(58) **Field of Classification Search** ..... None
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,518,674 A 6/1970 Moorhead et al.
3,772,668 A 11/1973 Smith
4,217,588 A 8/1980 Freeny, Jr.
4,224,596 A 9/1980 Knickel
4,688,026 A 8/1987 Scribner et al.
4,884,208 A 11/1989 Marinelli et al.
5,142,281 A 8/1992 Park
5,365,516 A 11/1994 Jandrell
5,627,517 A 5/1997 Theimer et al.
5,917,405 A 6/1999 Joao
6,014,089 A 1/2000 Tracy et al.
6,043,748 A * 3/2000 Touchton et al. 340/573.3
6,236,358 B1 5/2001 Durst et al.
6,421,001 B1 * 7/2002 Durst et al. 342/357.07
6,496,575 B1 12/2002 Vasell et al.
6,509,830 B1 1/2003 Elliot

(Continued)

FOREIGN PATENT DOCUMENTS

DE 19960219 7/2001

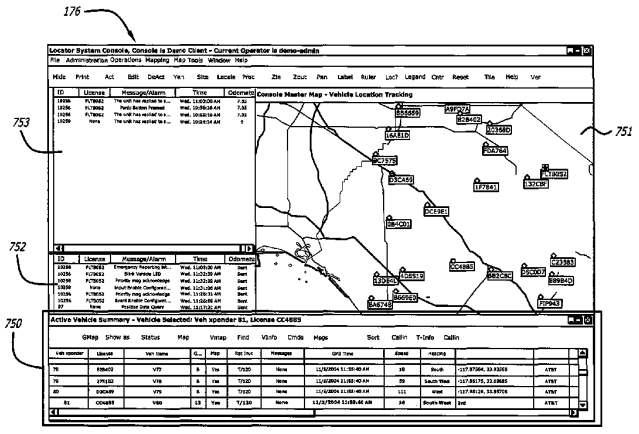
(Continued)

Primary Examiner—Michael J. Zanelli
(74) *Attorney, Agent, or Firm*—Greenberg Traurig LLP

(57) **ABSTRACT**

A method to define a geographical zone is disclosed. The geographical zone can be utilized to regulate a movable entity and the actions within the geographical zone. The geographical zone can be defined by allowing a user to define and load to a transponder a plurality of waypoints, each waypoint defined by a geographical coordinate and a radius originating from the geographical coordinate. The geographical zone can also be defined by selecting a plurality of coordinates that are loaded to a transponder and mapped on a pixilated image.

29 Claims, 21 Drawing Sheets



Google Exhibit 1004, Page 126 of 1125

APPENDIX A

U.S. PATENT DOCUMENTS

6,617,969	B2	9/2003	Tu et al.	
6,665,613	B2 *	12/2003	Duvall	701/213
6,674,368	B2	1/2004	Hawkins et al.	
6,717,513	B1	4/2004	Sandelman et al.	
6,812,824	B1	11/2004	Goldinger et al.	
7,138,916	B2 *	11/2006	Schwartz et al.	340/572.1
2001/0040513	A1	11/2001	McDonald	
2002/0147006	A1	10/2002	Coon et al.	
2002/0196151	A1 *	12/2002	Troxler	340/573.4
2003/0149526	A1	8/2003	Zhou et al.	
2003/0163287	A1	8/2003	Vock et al.	
2004/0201454	A1	10/2004	Waterhouse et al.	
2005/0159883	A1 *	7/2005	Humphries et al.	701/207
2006/0015233	A1 *	1/2006	Olsen et al.	701/50

FOREIGN PATENT DOCUMENTS

EP	0915398	5/1999
EP	1345148	9/2003
GB	2369966	6/2002
WO	WO0041428	7/2000
WO	WO0135190	5/2001
WO	WO0146926	6/2001
WO	WO0163318	8/2001
WO	WO03049060	6/2003

* cited by examiner

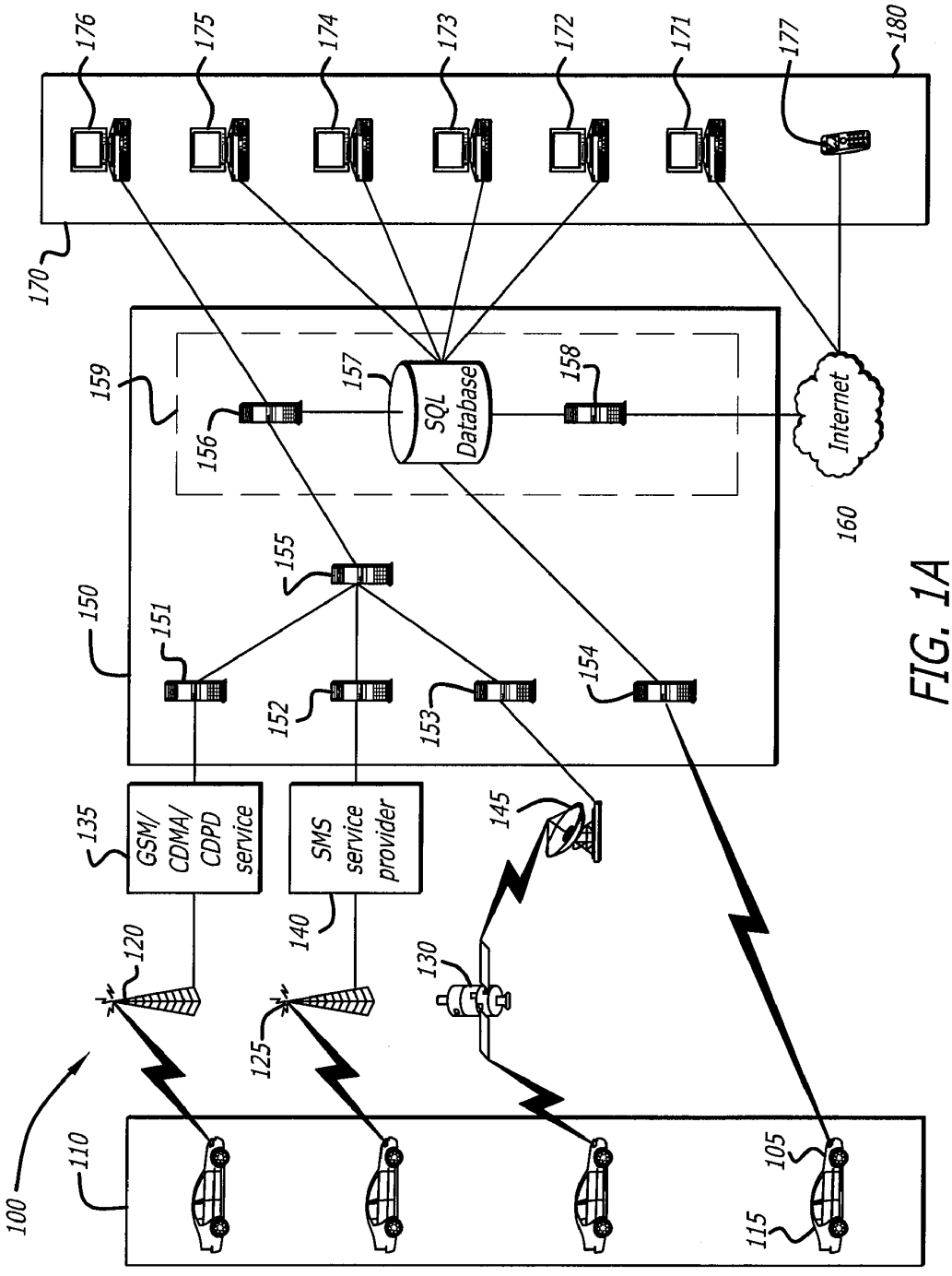

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150
151
154
152
153
135
GSM/ CDMA/ CDPD service
SMS service provider
145
120
140
130
125
110
105
100
115

FIG. 1A

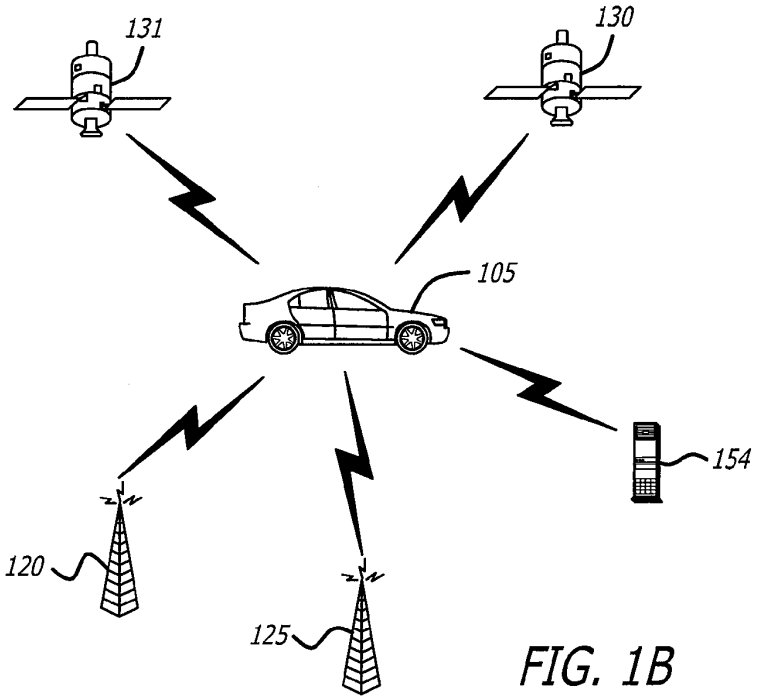

131
130
105
154
120
125

FIG. 1B

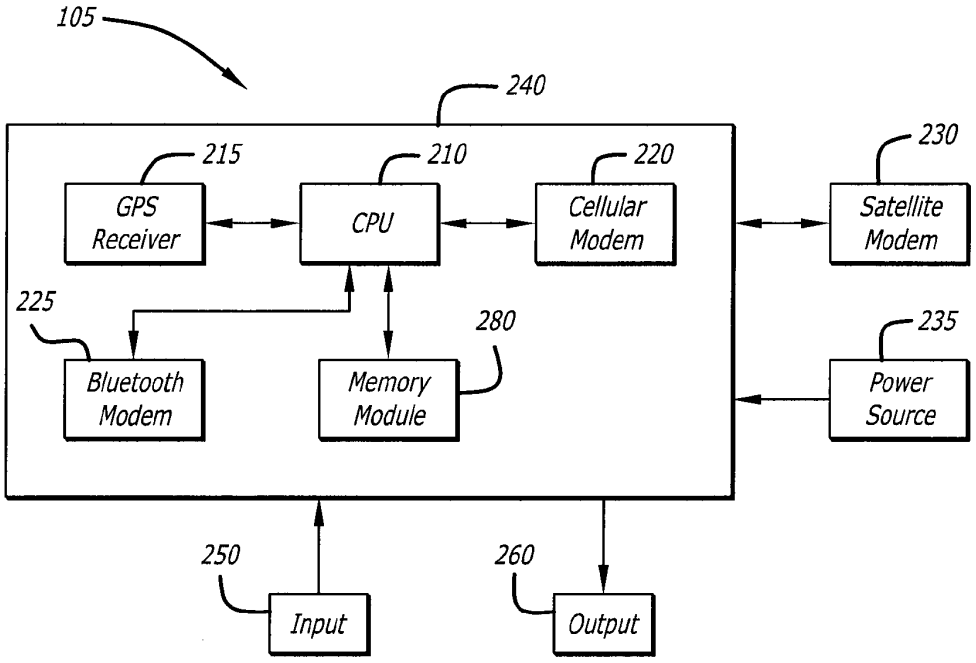

105
240
215
210
220
230
GPS Receiver
CPU
Cellular Modem
Satellite Modem
225
280
235
Bluetooth Modem
Memory Module
Power Source
250
260
Input
Output

FIG. 2

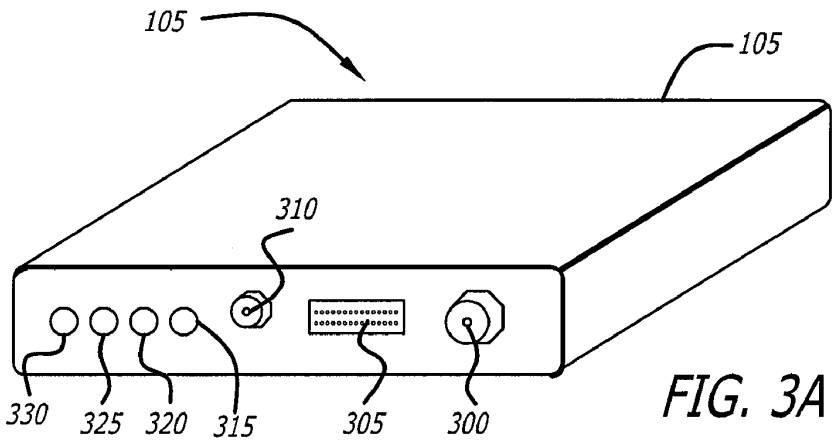


FIG. 3A

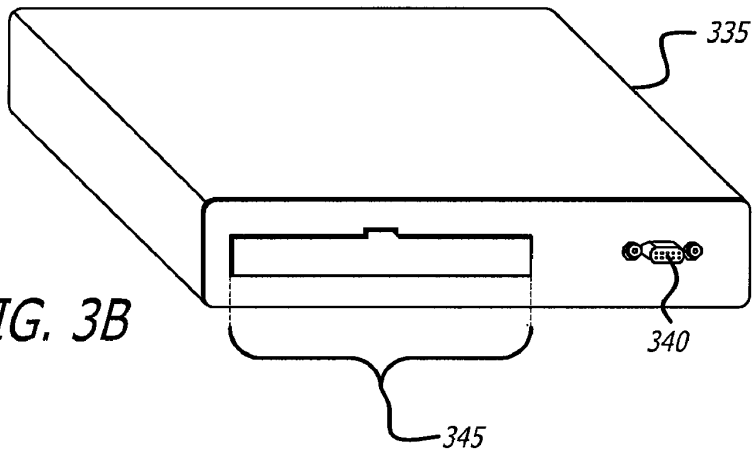


FIG. 3B

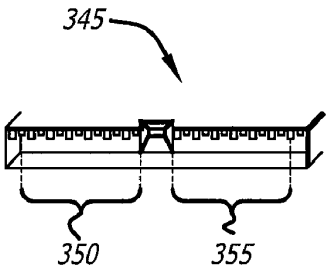


FIG. 3C

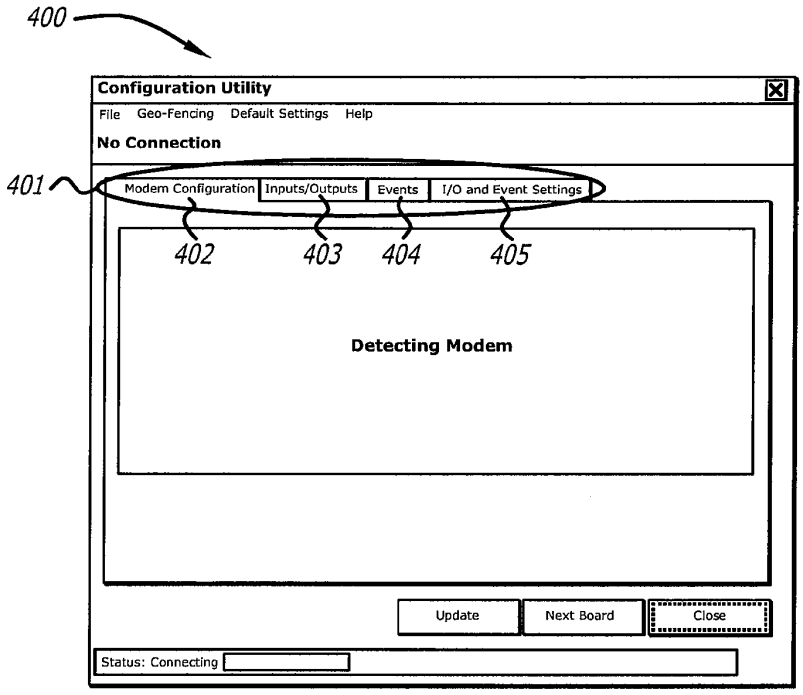

400
Configuration Utility
File Geo-Fencing Default Settings Help
No Connection
401
Modem Configuration
Inputs/Outputs
Events
I/O and Event Settings
402
403
404
405
Detecting Modem
Update
Next Board
Close
Status: Connecting

FIG. 4A

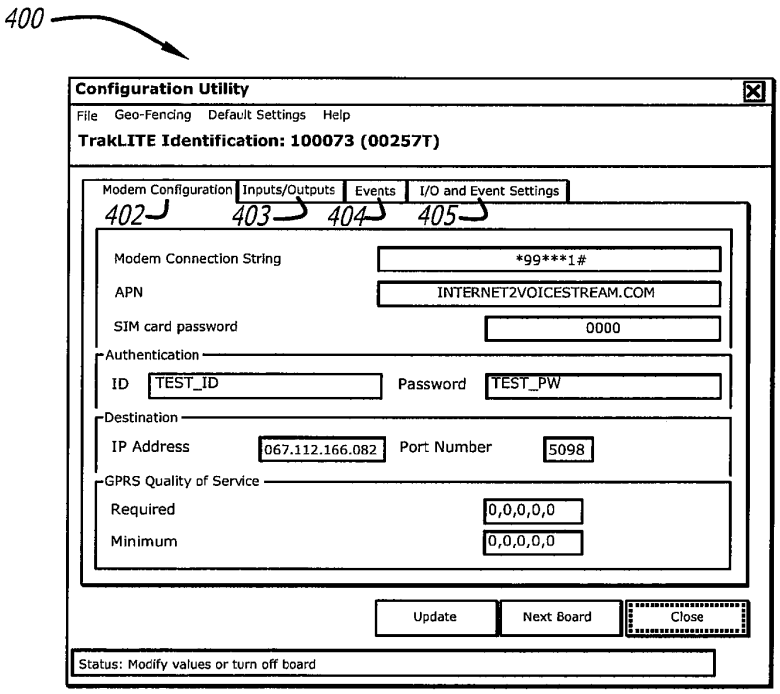

400
Configuration Utility
File Geo-Fencing Default Settings Help
TrakLITE Identification: 100073 (00257T)
Modem Configuration
Inputs/Outputs
Events
I/O and Event Settings
402
403
404
405
Modem Connection String
*99***1#
APN
INTERNET2VOICESTREAM.COM
SIM card password
0000
Authentication
ID
TEST_ID
Password
TEST_PW
Destination
IP Address
067.112.166.082
Port Number
5098
GPRS Quality of Service
Required
0,0,0,0,0
Minimum
0,0,0,0,0
Update
Next Board
Close
Status: Modify values or turn off board

FIG. 4B

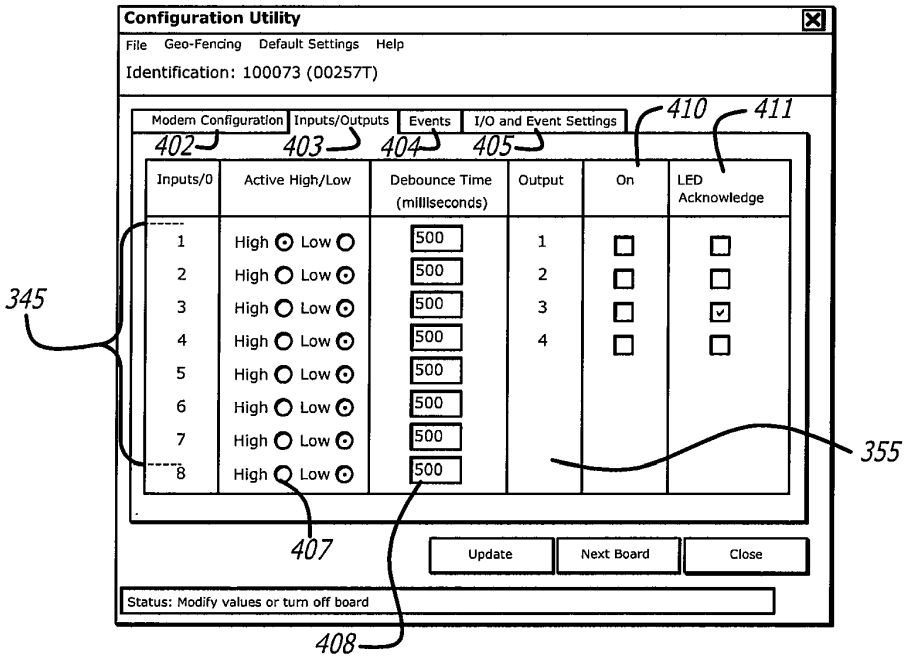

Configuration Utility
File Geo-Fencing Default Settings Help
Identification: 100073 (00257T)
Modem Configuration
Inputs/Outputs
Events
I/O and Event Settings
402
403
404
405
410
411
Inputs/0
Active High/Low
Debounce Time (milliseconds)
Output
On
LED Acknowledge
345
355
407
408
Update
Next Board
Close
Status: Modify values or turn off board

FIG. 4C

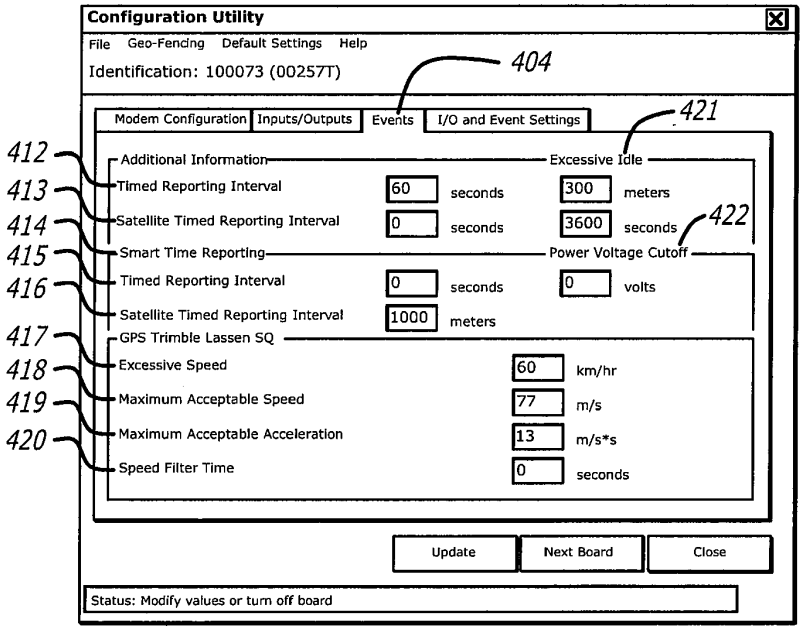

Configuration Utility
File Geo-Fencing Default Settings Help
Identification: 100073 (00257T)
404
421
Modem Configuration
Inputs/Outputs
Events
I/O and Event Settings
412
413
414
415
416
417
418
419
420
422
Additional Information
Excessive Idle
Timed Reporting Interval
Satellite Timed Reporting Interval
Smart Time Reporting
Power Voltage Cutoff
Timed Reporting Interval
Satellite Timed Reporting Interval
GPS Trimble Lassen SQ
Excessive Speed
Maximum Acceptable Speed
Maximum Acceptable Acceleration
Speed Filter Time
Update
Next Board
Close
Status: Modify values or turn off board

FIG. 4D

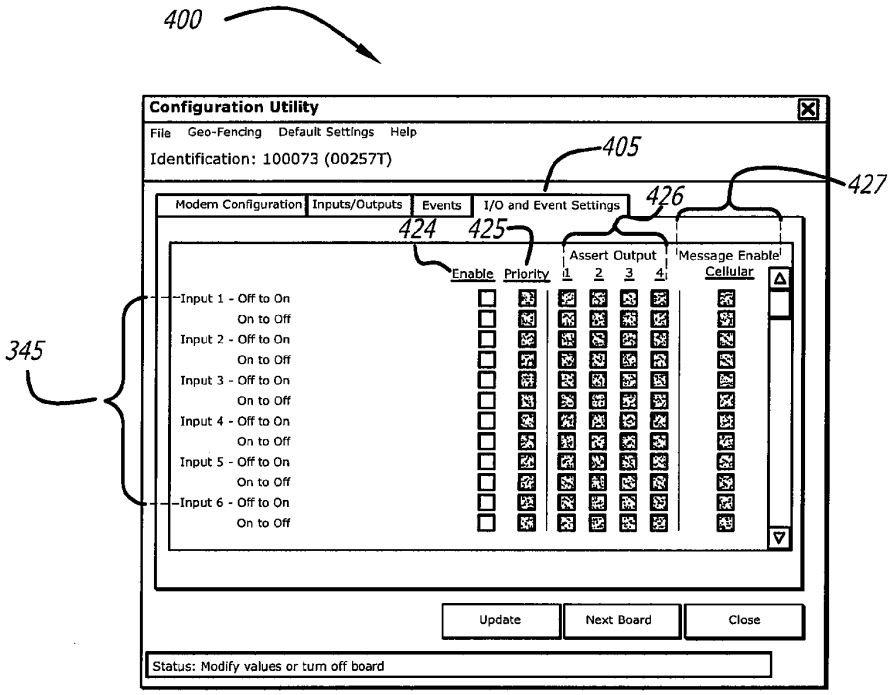

400
Configuration Utility
File Geo-Fencing Default Settings Help
Identification: 100073 (00257T)
405
427
426
Modem Configuration
Inputs/Outputs
Events
I/O and Event Settings
424
425
Enable
Priority
Assert Output
1 2 3 4
Message Enable
Cellular
345
Input 1 - Off to On
On to Off
Input 2 - Off to On
On to Off
Input 3 - Off to On
On to Off
Input 4 - Off to On
On to Off
Input 5 - Off to On
On to Off
Input 6 - Off to On
On to Off
Update
Next Board
Close
Status: Modify values or turn off board

FIG. 4E

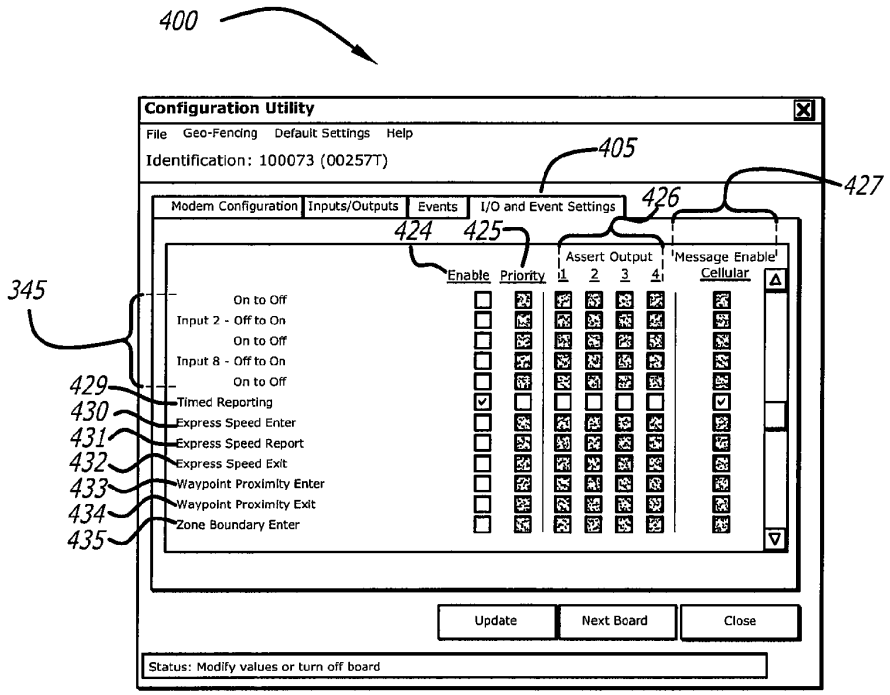

400
Configuration Utility
File Geo-Fencing Default Settings Help
Identification: 100073 (00257T)
405
427
426
Modem Configuration
Inputs/Outputs
Events
I/O and Event Settings
424
425
Enable
Priority
Assert Output
1 2 3 4
Message Enable
Cellular
345
On to Off
Input 2 - Off to On
On to Off
Input 8 - Off to On
On to Off
429
Timed Reporting
430
Express Speed Enter
431
Express Speed Report
432
Express Speed Exit
433
Waypoint Proximity Enter
434
Waypoint Proximity Exit
435
Zone Boundary Enter
Update
Next Board
Close
Status: Modify values or turn off board

FIG. 4F

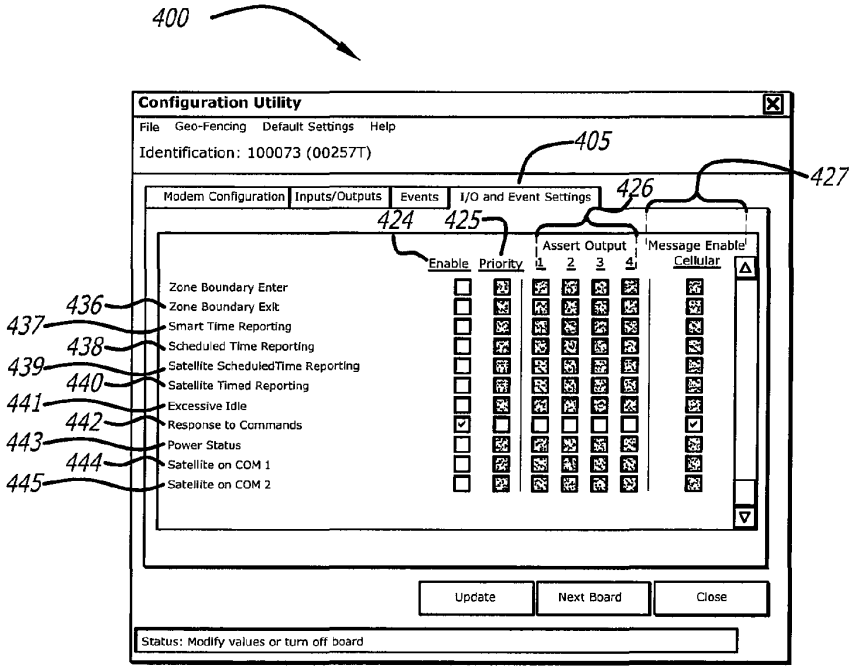

400
Configuration Utility
File Geo-Fencing Default Settings Help
Identification: 100073 (00257T)
405
427
426
Modem Configuration
Inputs/Outputs
Events
I/O and Event Settings
424
425
Assert Output
Message Enable
Enable
Priority
1 2 3 4
Cellular
436
437
438
439
440
441
442
443
444
445
Zone Boundary Enter
Zone Boundary Exit
Smart Time Reporting
Scheduled Time Reporting
Satellite ScheduledTime Reporting
Satellite Timed Reporting
Excessive Idle
Response to Commands
Power Status
Satellite on COM 1
Satellite on COM 2
Update
Next Board
Close
Status: Modify values or turn off board

FIG. 4G

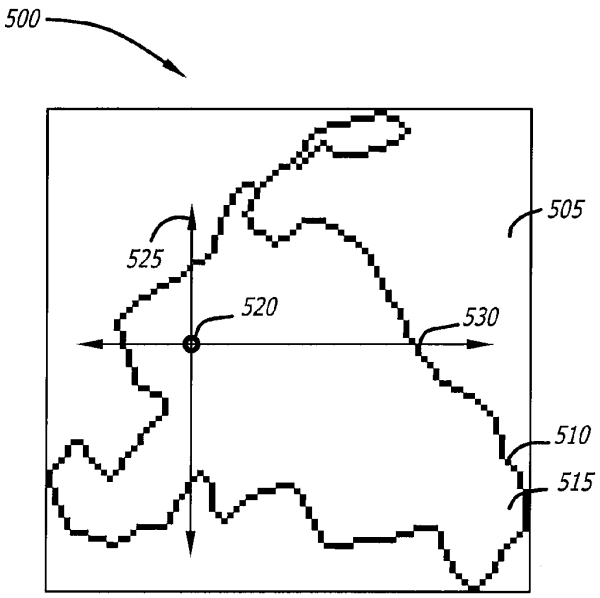


FIG. 5A

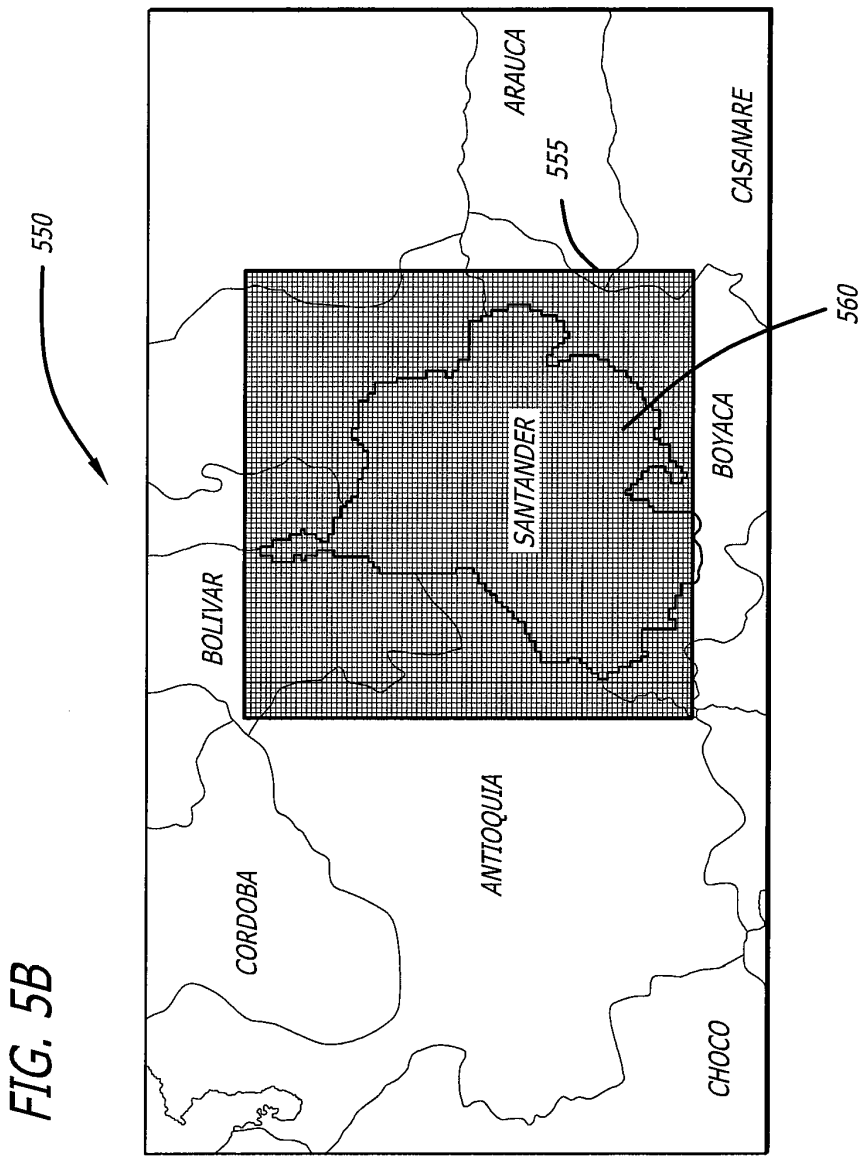

550
555
560
ARAUCA
CASANARE
SANTANDER
BOYACA
BOLIVAR
ANTIOQUIA
CORDOBA
CHOCO

FIG. 5B

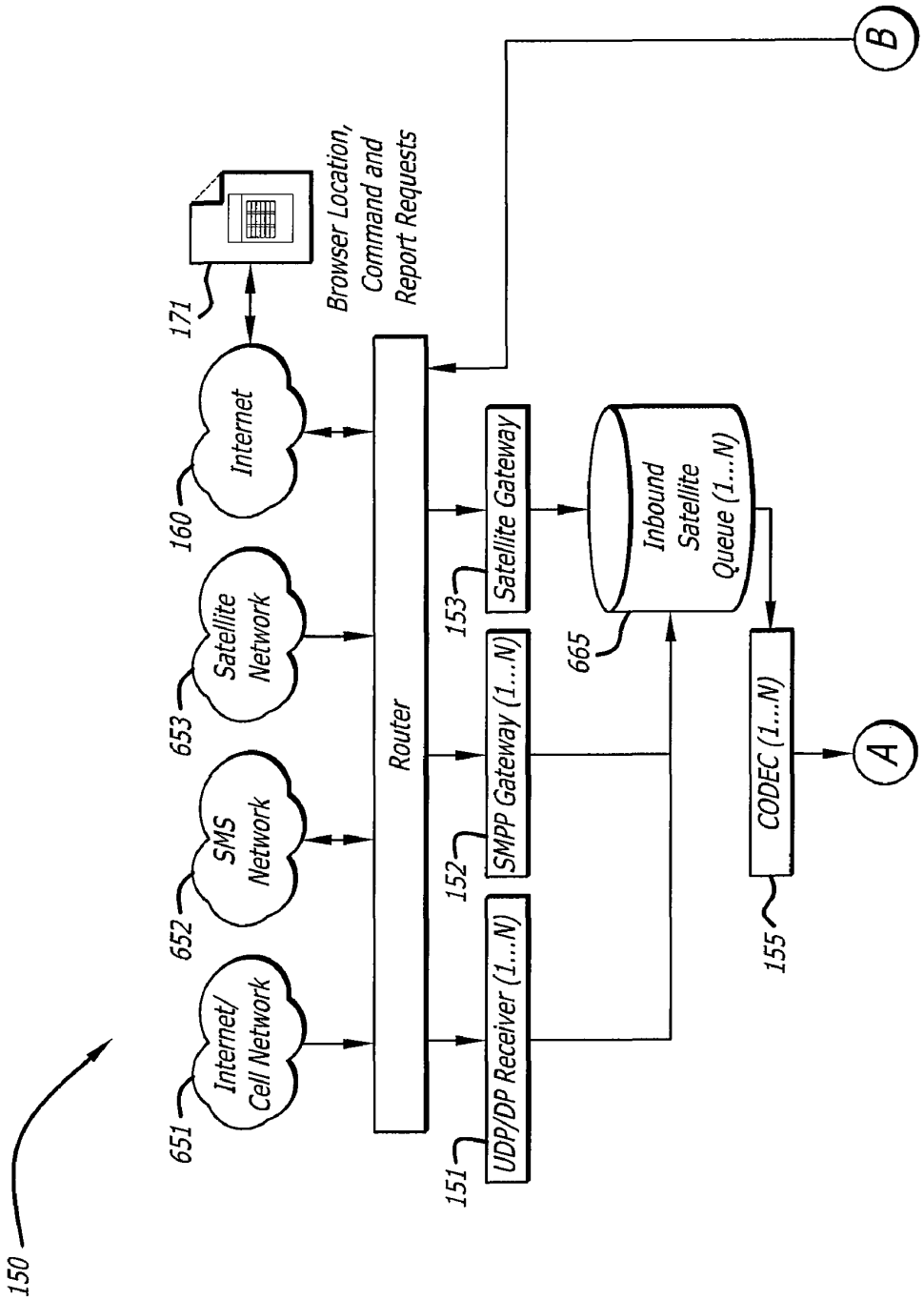

150
651
Internet/ Cell Network
652
SMS Network
653
Satellite Network
160
Internet
171
Browser Location, Command and Report Requests
Router
151
UDP/DP Receiver (1...N)
152
SMPP Gateway (1...N)
153
Satellite Gateway
665
Inbound Satellite Queue (1...N)
155
CODEC (1...N)
A
B

FIG. 6-1

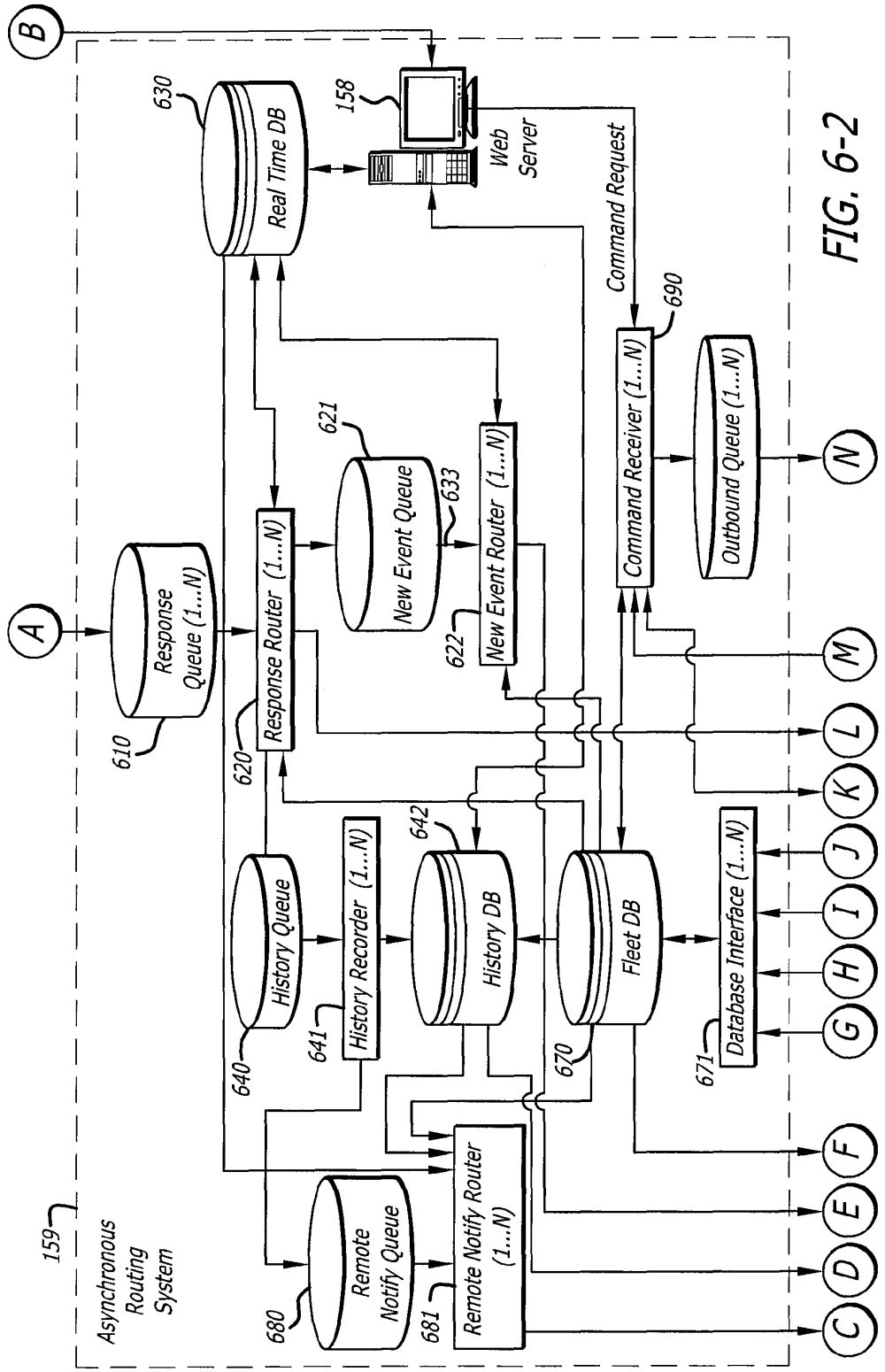

B
630
Real Time DB
158
Web Server
Command Request
690
Command Receiver (1...N)
Outbound Queue (1...N)
N
621
New Event Queue
633
New Event Router (1...N)
622
A
Response Queue (1...N)
610
Response Router (1...N)
620
M
L
K
J
I
H
G
F
E
D
C
642
History Queue
640
History Recorder (1...N)
641
History DB
Fleet DB
670
Database Interface (1...N)
671
Remote Notify Queue
680
Remote Notify Router (1...N)
681
159
Asynchronous Routing System

FIG. 6-2

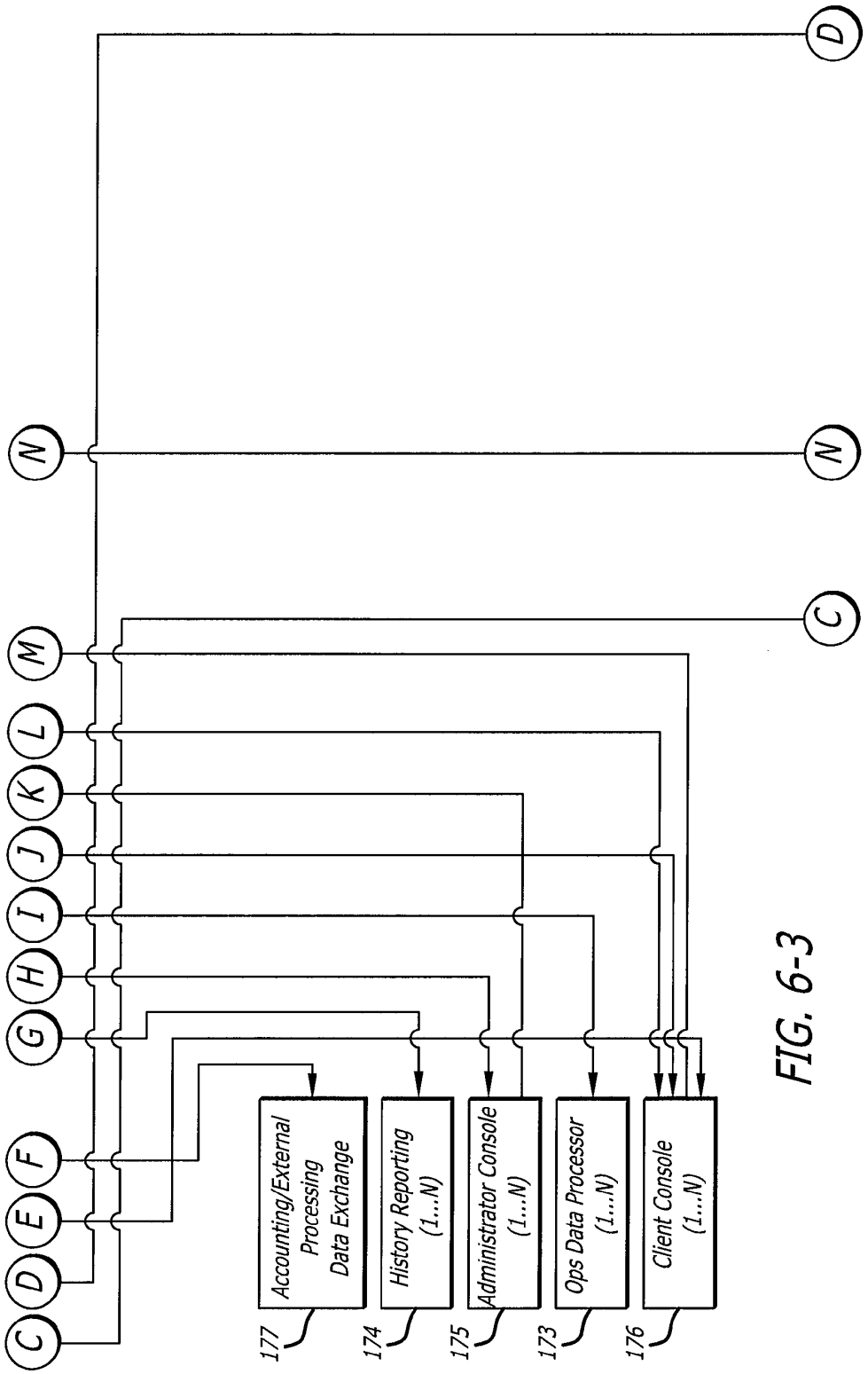

D
N
N
C
M
L
K
J
I
H
G
F
E
D
C
Accounting/External Processing Data Exchange
History Reporting (1...N)
Administrator Console (1...N)
Ops Data Processor (1...N)
Client Console (1...N)
177
174
175
173
176

FIG. 6-3

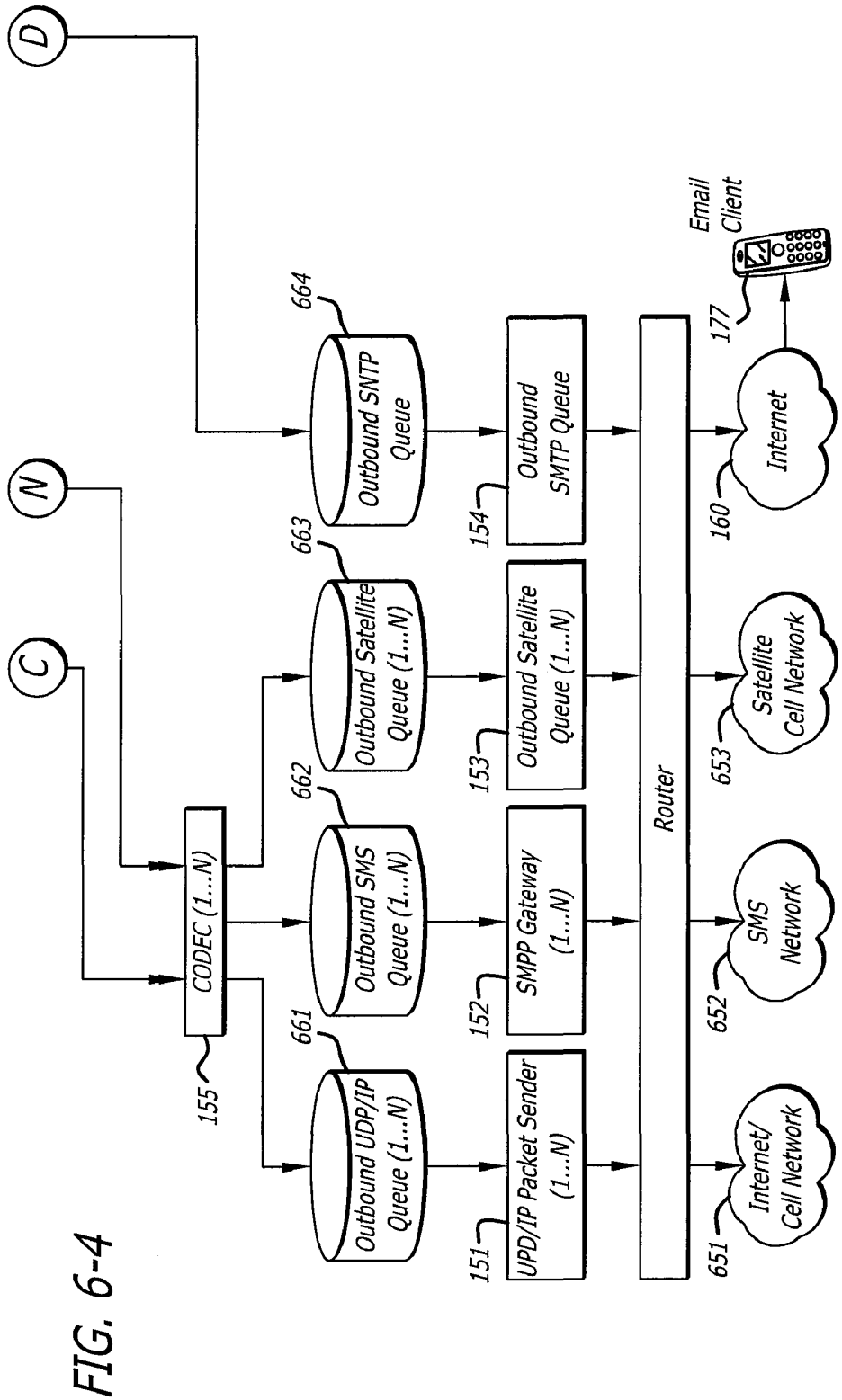

D
N
C
CODEC (1...N)
155
Outbound UDP/IP Queue (1...N)
661
Outbound SMS Queue (1...N)
662
Outbound Satellite Queue (1...N)
663
Outbound SNTP Queue
664
UPD/IP Packet Sender (1...N)
151
SMPP Gateway (1...N)
152
Outbound Satellite Queue (1...N)
153
Outbound SMTP Queue
154
Router
Internet/ Cell Network
651
SMS Network
652
Satellite Cell Network
653
Internet
160
Email Client
177

FIG. 6-4

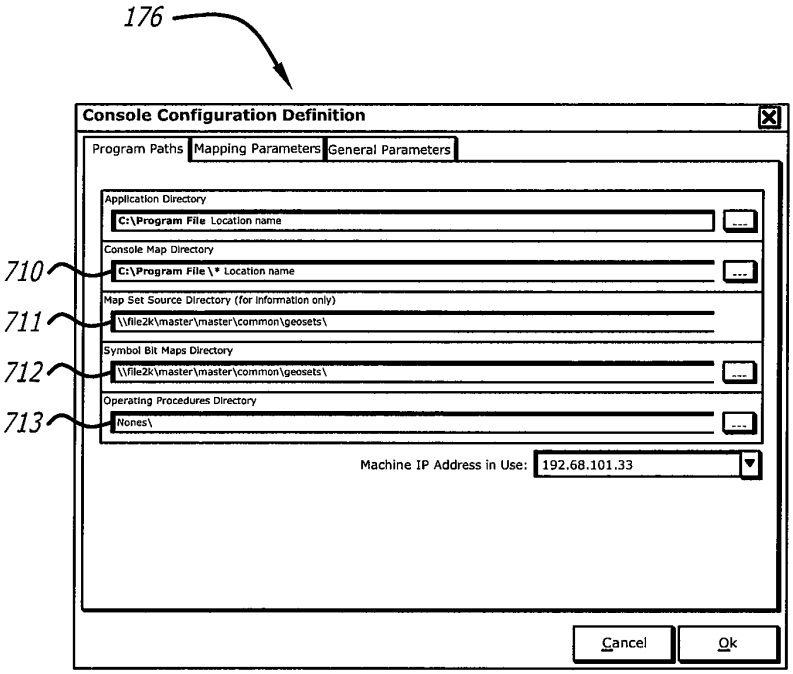

176
Console Configuration Definition
Program Paths
Mapping Parameters
General Parameters
Application Directory
C:\Program File Location name
Console Map Directory
C:\Program File* Location name
Map Set Source Directory (for information only)
\\file2k\master\master\common\geosets\
Symbol Bit Maps Directory
\\file2k\master\master\common\geosets\
Operating Procedures Directory
Nones\
Machine IP Address in Use:
192.68.101.33
Cancel
Ok
710
711
712
713

FIG. 7A

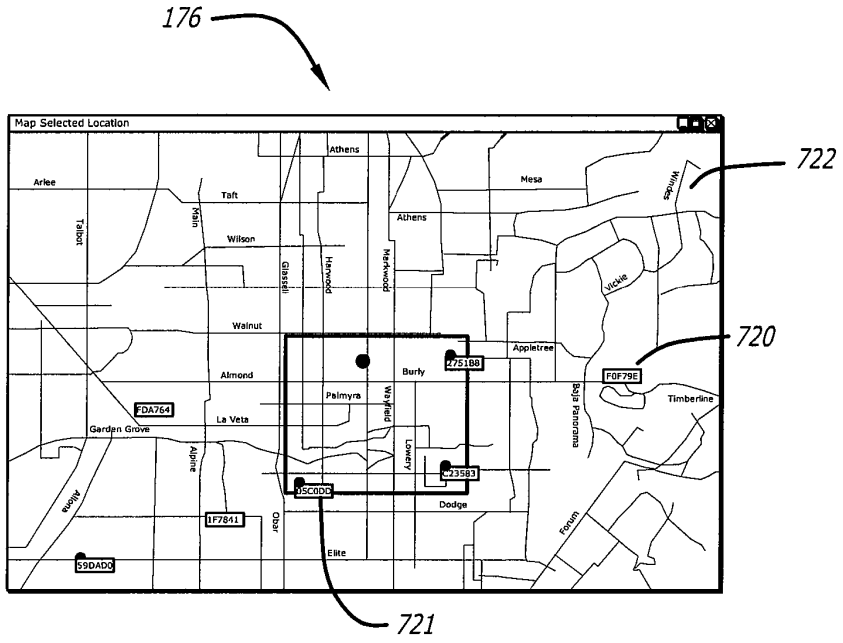
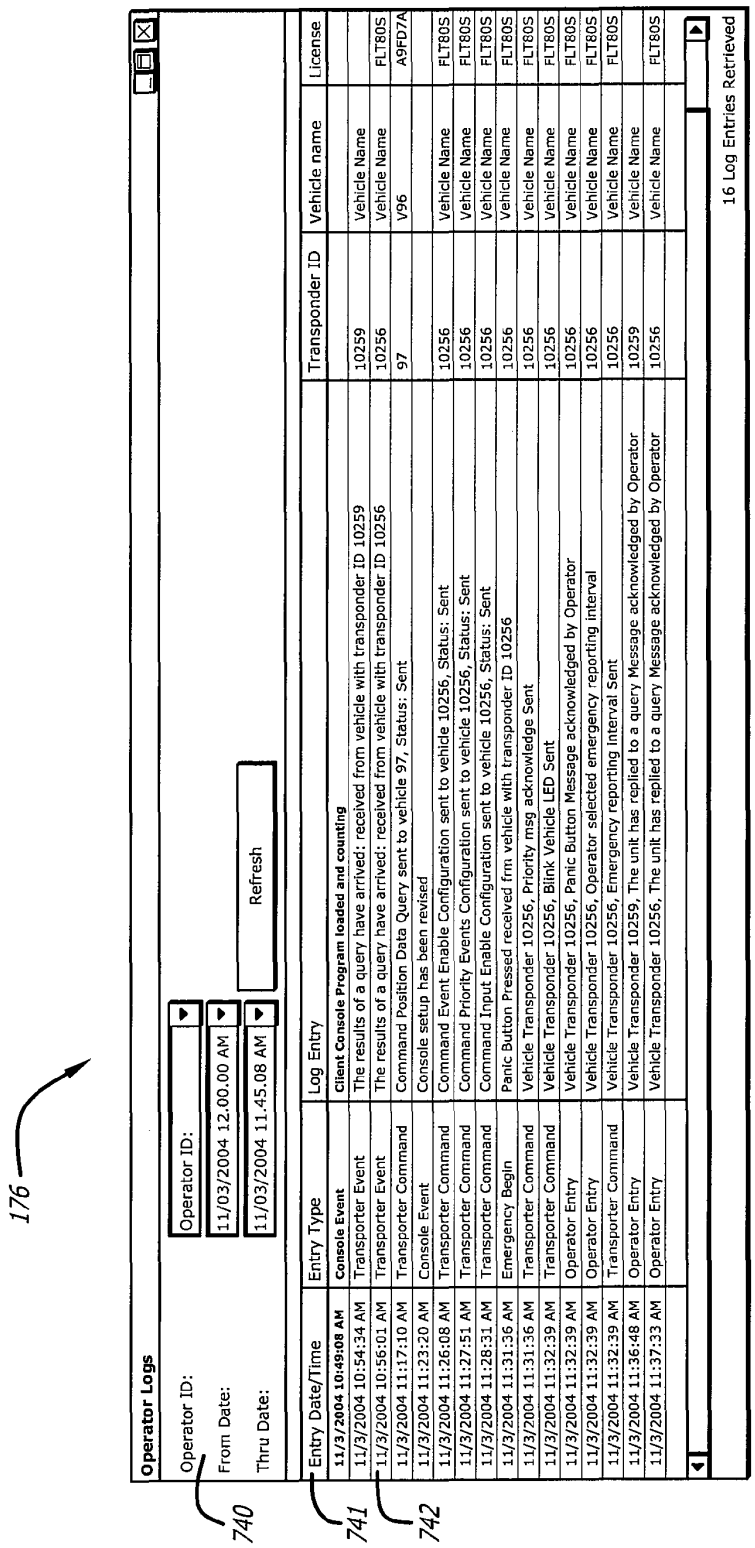

176
Map Selected Location
Athens
Arlee
Taft
Mesa
Wilson
Walnut
Almond
Palmyra
Burly
Appletree
Garden Grove
La Veta
Elite
Dodge
Timberline
FDA764
1F7841
59DAD0
DSC0DD
C23593
275188
F0F79E
722
720
721

FIG. 7B

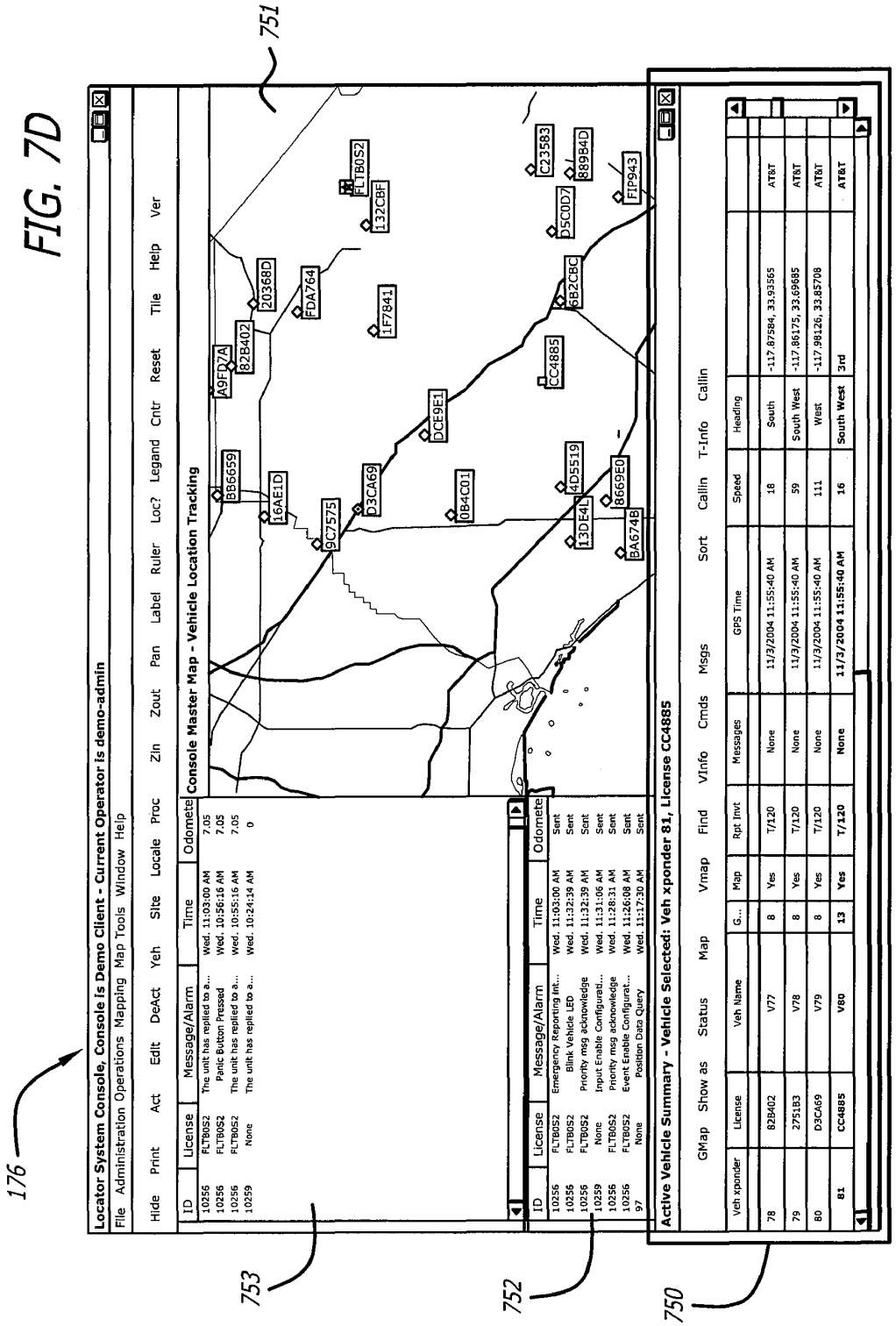


Entry Date/Time	Entry Type	Log Entry	Transponder ID	Vehicle name	License
11/3/2004 10:49:08 AM	**Console Event**	**Client Console Program loaded and counting**			
11/3/2004 10:54:34 AM	Transporter Event	The results of a query have arrived: received from vehicle with transponder ID 10259	10259	Vehicle Name	
11/3/2004 10:56:01 AM	Transporter Event	The results of a query have arrived: received from vehicle with transponder ID 10256	10256	Vehicle Name	FLT80S
11/3/2004 11:17:10 AM	Transporter Command	Command Position Data Query sent to vehicle 97, Status: Sent	97	V96	A9FD7A
11/3/2004 11:23:20 AM	Console Event	Console setup has been revised			
11/3/2004 11:26:08 AM	Transporter Command	Command Event Enable Configuration sent to vehicle 10256, Status: Sent	10256	Vehicle Name	FLT80S
11/3/2004 11:27:51 AM	Transporter Command	Command Priority Events Configuration sent to vehicle 10256, Status: Sent	10256	Vehicle Name	FLT80S
11/3/2004 11:28:31 AM	Transporter Command	Command Input Enable Configuration sent to vehicle 10256, Status: Sent	10256	Vehicle Name	FLT80S
11/3/2004 11:31:36 AM	Emergency Begin	Panic Button Pressed received frm vehicle with transponder ID 10256	10256	Vehicle Name	FLT80S
11/3/2004 11:31:36 AM	Transporter Command	Vehicle Transponder 10256, Priority msg acknowledge Sent	10256	Vehicle Name	FLT80S
11/3/2004 11:32:39 AM	Transporter Command	Vehicle Transponder 10256, Blink Vehicle LED Sent	10256	Vehicle Name	FLT80S
11/3/2004 11:32:39 AM	Operator Entry	Vehicle Transponder 10256, Panic Button Message acknowledged by Operator	10256	Vehicle Name	FLT80S
11/3/2004 11:32:39 AM	Operator Entry	Vehicle Transponder 10256, Operator selected emergency reporting interval	10256	Vehicle Name	FLT80S
11/3/2004 11:32:39 AM	Transporter Command	Vehicle Transponder 10256, Emergency reporting interval Sent	10256	Vehicle Name	FLT80S
11/3/2004 11:36:48 AM	Operator Entry	Vehicle Transponder 10259, The unit has replied to a query Message acknowledged by Operator	10259	Vehicle Name	
11/3/2004 11:37:33 AM	Operator Entry	Vehicle Transponder 10256, The unit has replied to a query Message acknowledged by Operator	10256	Vehicle Name	FLT80S

FIG. 7C

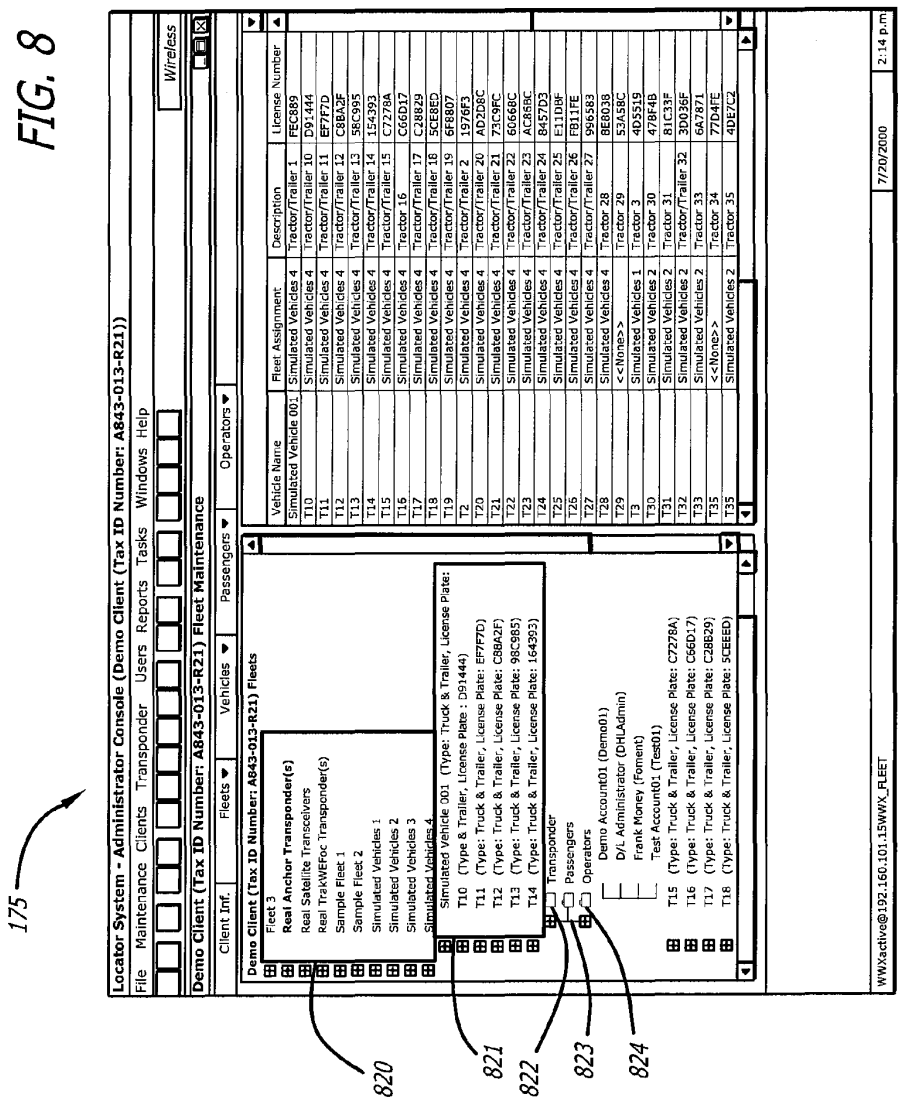
APPENDIX A

FIG. 7D



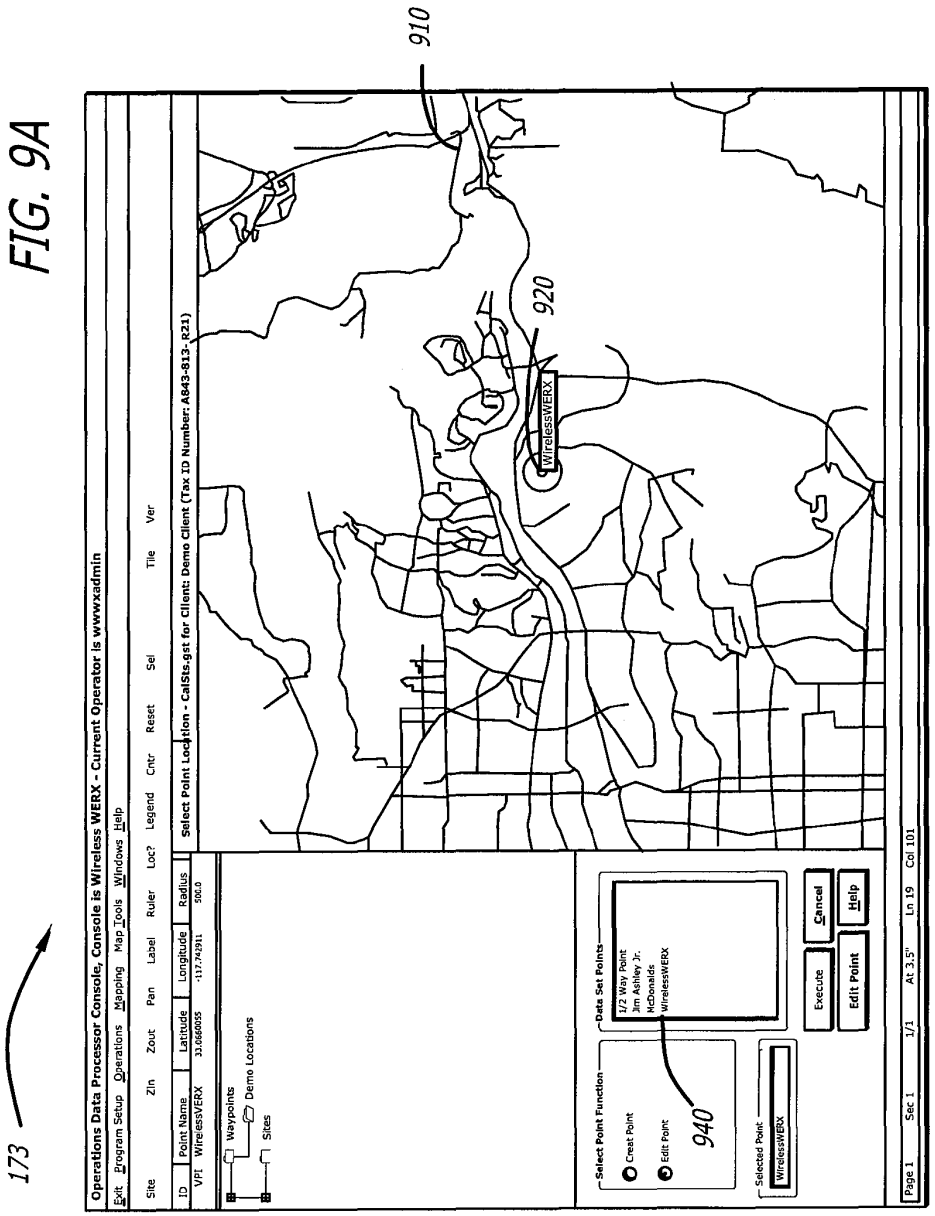
APPENDIX A

FIG. 8



APPENDIX A

FIG. 9A



APPENDIX A

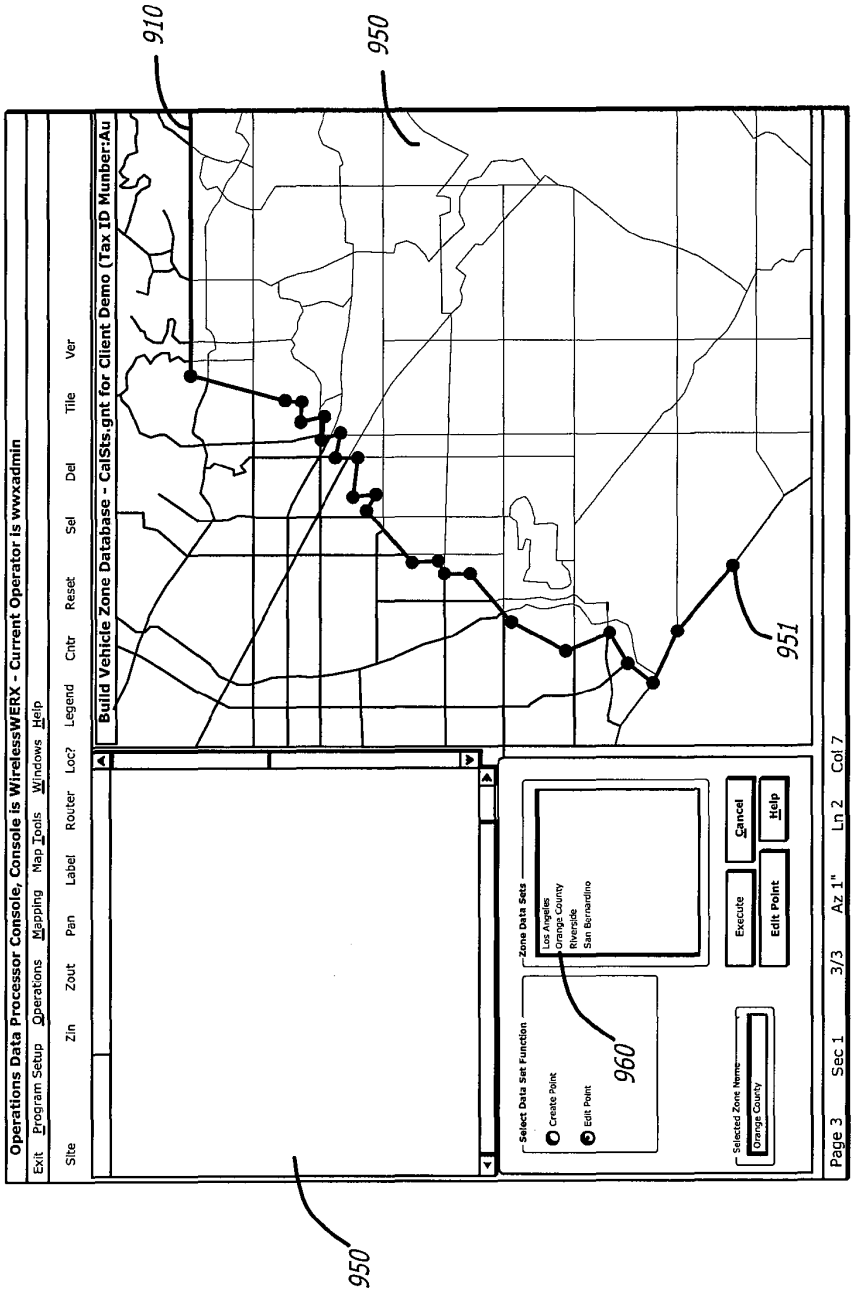


FIG. 9B

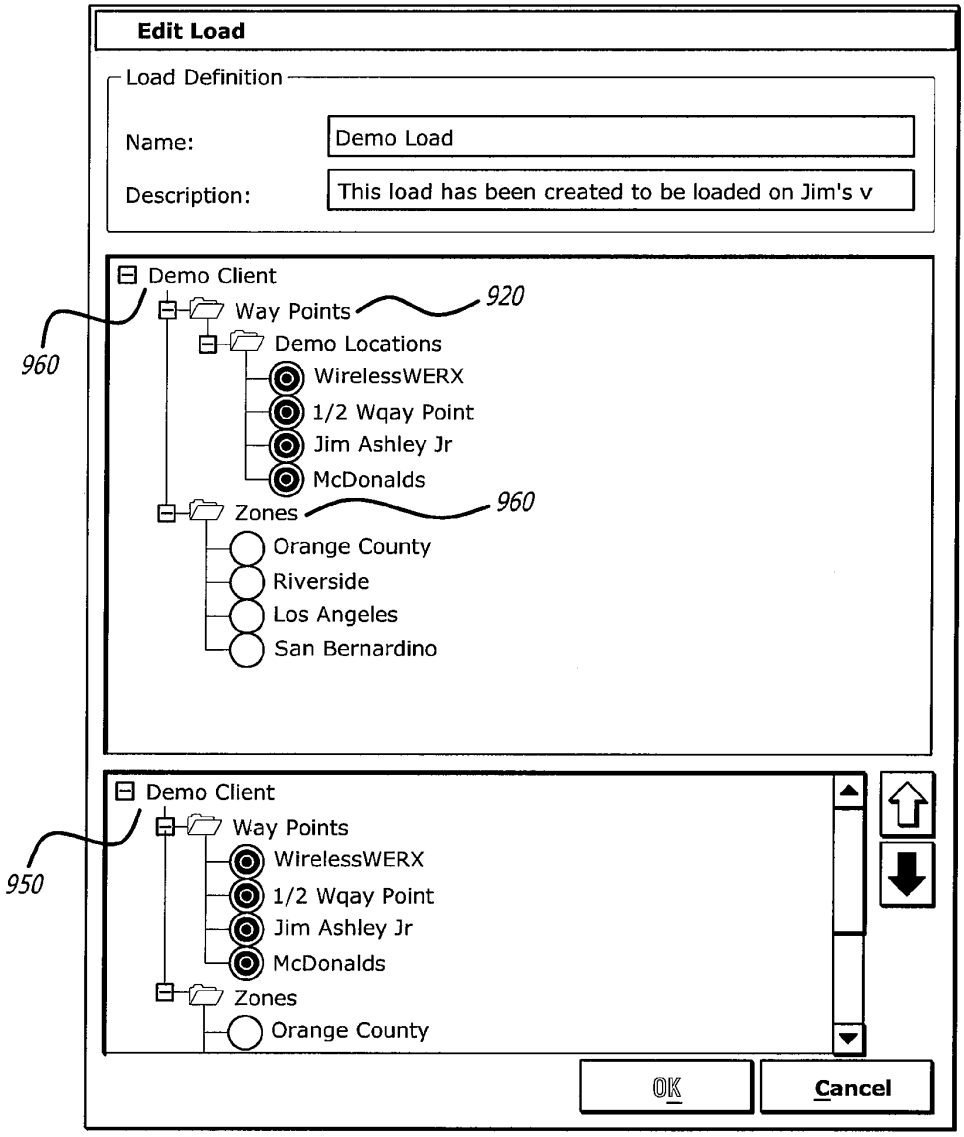

Edit Load
Load Definition
Name:
Demo Load
Description:
This load has been created to be loaded on Jim's v
Demo Client
Way Points
920
Demo Locations
WirelessWERX
1/2 Wqay Point
Jim Ashley Jr
McDonalds
960
Zones
960
Orange County
Riverside
Los Angeles
San Bernardino
Demo Client
Way Points
WirelessWERX
1/2 Wqay Point
Jim Ashley Jr
McDonalds
Zones
Orange County
950
OK
Cancel

FIG. 9C

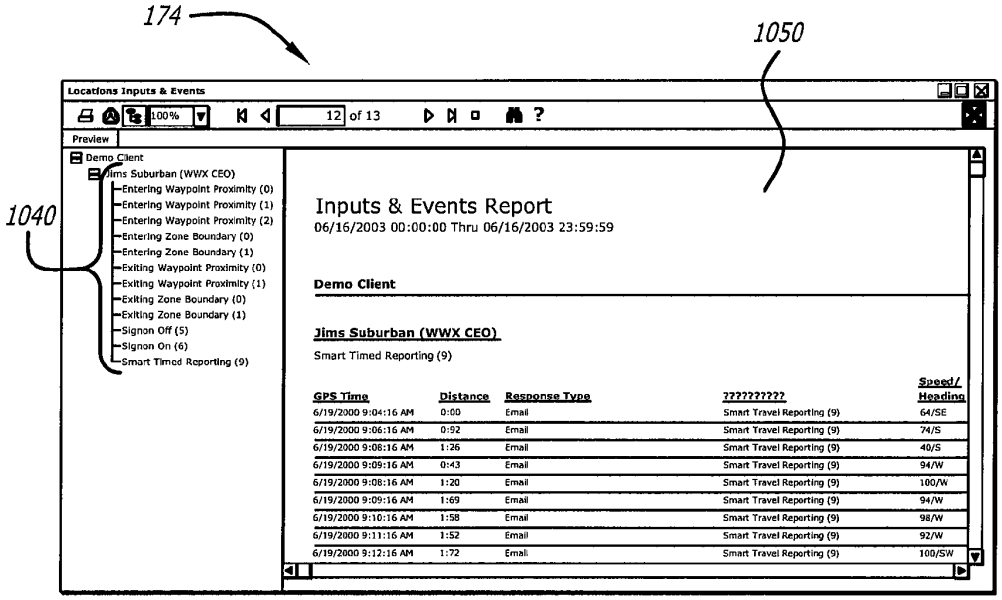

174
1050
1040
Locations Inputs & Events
100%
12 of 13
Preview
Demo Client
Jims Suburban (WWX CEO)
Entering Waypoint Proximity (0)
Entering Waypoint Proximity (1)
Entering Waypoint Proximity (2)
Entering Zone Boundary (0)
Entering Zone Boundary (1)
Exiting Waypoint Proximity (0)
Exiting Waypoint Proximity (1)
Exiting Zone Boundary (0)
Exiting Zone Boundary (1)
Signon Off (5)
Signon On (6)
Smart Timed Reporting (9)
Inputs & Events Report
06/16/2003 00:00:00 Thru 06/16/2003 23:59:59
Demo Client
Jims Suburban (WWX CEO)
Smart Timed Reporting (9)
GPS Time | Distance | Response Type | ????????? | Speed/ Heading
6/19/2000 9:04:16 AM | 0:00 | Email | Smart Travel Reporting (9) | 64/SE
6/19/2000 9:06:16 AM | 0:52 | Email | Smart Travel Reporting (9) | 74/S
6/19/2000 9:08:16 AM | 1:26 | Email | Smart Travel Reporting (9) | 40/S
6/19/2000 9:09:16 AM | 0:43 | Email | Smart Travel Reporting (9) | 94/W
6/19/2000 9:08:16 AM | 1:20 | Email | Smart Travel Reporting (9) | 100/W
6/19/2000 9:09:16 AM | 1:69 | Email | Smart Travel Reporting (9) | 94/W
6/19/2000 9:10:16 AM | 1:58 | Email | Smart Travel Reporting (9) | 98/W
6/19/2000 9:11:16 AM | 1:52 | Email | Smart Travel Reporting (9) | 92/W
6/19/2000 9:12:16 AM | 1:72 | Email | Smart Travel Reporting (9) | 100/SW

FIG. 10

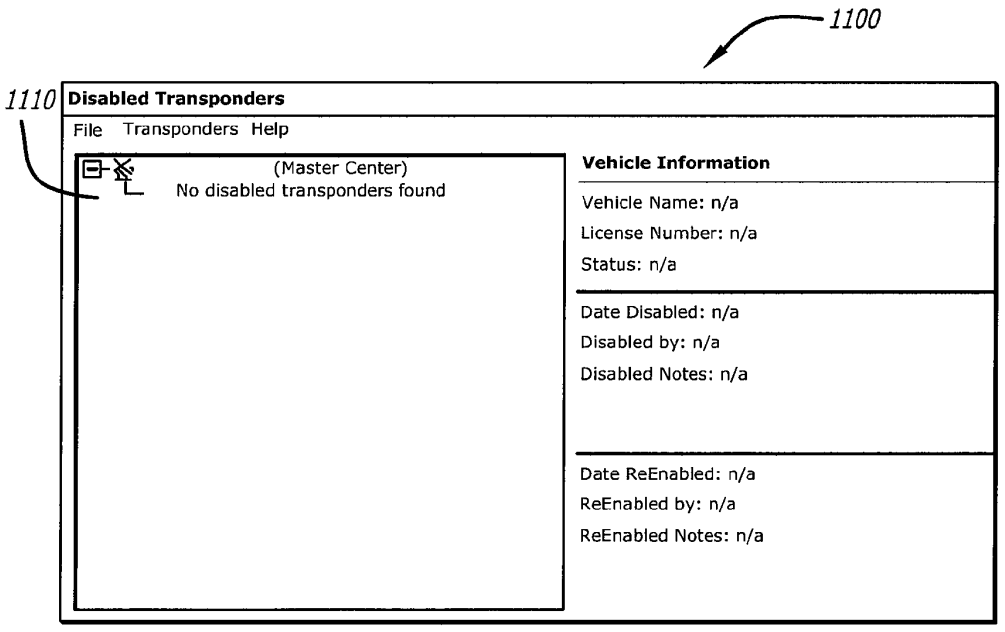

1100
1110
Disabled Transponders
File Transponders Help
(Master Center)
No disabled transponders found
Vehicle Information
Vehicle Name: n/a
License Number: n/a
Status: n/a
Date Disabled: n/a
Disabled by: n/a
Disabled Notes: n/a
Date ReEnabled: n/a
ReEnabled by: n/a
ReEnabled Notes: n/a

FIG. 11

APPENDIX A

METHOD AND SYSTEM TO CONFIGURE AND UTILIZE GEOGRAPHICAL ZONES

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of the prior filing date of U.S. provisional patent application No. 60/625,467, filed Nov. 5, 2004, herein incorporated by reference in its entirety. This application is related to U.S. Utility Patent Application filed on Apr. 13, 2005, U.S. patent application Ser. No. 11/105,621, entitled "METHOD AND SYSTEM TO MONITOR MOVABLE ENTITIES" and U.S. Utility Patent Application filed on Apr. 13, 2005, U.S. patent application Ser. No. 11/105,932, entitled "METHOD AND SYSTEM TO CONTROL MOVABLE ENTITIES" both of which have been filed concurrently and are incorporated by reference in its entirety.

FIELD OF THE DISCLOSURE

The disclosure relates to configuring and using geographical zones. In particular, it relates to systems and methods to remotely control and monitor movable entities functions and positioning data in relation to pre-configured geographical zones.

BACKGROUND OF THE DISCLOSURE

Vehicle tracking systems have become increasingly popular and more economically accessible to businesses and individuals. Most tracking locator systems utilize ground positioning system (GPS) technology. GPS vehicle tracking systems have diverse applications such as cargo transportation, public transportation, personal tracking, investigations of enforcement agencies, and others.

In fleet management, GPS vehicle tracking systems allow increasing fleet efficiency, reducing operating costs such as fuel costs, and supervising the correct operation of deliveries, pick-ups, and routes associated with fleet operation.

In personal tracking, individuals use GPS vehicle tracking information to obtain the shortest or fastest path to a destination, their current location in relation to another location, etc. Furthermore, personal tracking systems allow users to track vehicles that have been entrusted to another person. Likewise, enforcement agencies may use GPS vehicle tracking systems to locate patrol vehicles as well as to recover stolen vehicles.

While current GPS vehicle tracking systems provide benefits such as increased productivity and safety, these benefits are yet to be maximized. Current systems are limited to relaying the GPS information to a control center or a web server and plotting the position of the vehicle on a computer map.

SUMMARY OF THE DISCLOSURE

The present disclosure provides a system and method that allows a user to control and monitor vehicles and other moving entities by using preconfigured geographical zones.

In one aspect, there is a method to define a geographical zone utilized to regulate a movable entity that has an attached transponder. The method comprises loading from a computing device to a memory in a transponder a plurality of coordinates, mapping the coordinates on a pixilated image so as to assign one pixel to each coordinate of the plurality of coordinates, wherein the distance between each assigned pixel is configurable, connecting the plurality of assigned pixels with lines forming a contiguous and connected line that encloses an area in the pixilated image, and activating the pixels that lie on the lines in order to form a contiguous array of pixels that enclose a shape in the pixilated image. In another aspect, the method to define a geographical zone allows to regulate the entity by monitoring, controlling and visualizing the status of the entity. The status of the entity may be movement, non-movement, and position of the entity. The movable entity being controlled and monitored depending on the location of the movable entity relative to said geographical zone.

In another aspect, the plurality of coordinates are entered by a user of a computer device and transmitted to the transponder. The user being allowed to enter geographical coordinates by allowing a user to select points in a map in a computer by clicking on -the map and calculating the geographical coordinates of each selected point in the map. In another aspect, the user is allowed to enter geographical coordinates by typing on the computer the longitude and latitude. The plurality of geographical coordinates is defined either by the Mercator system or by a latitude and longitude system.

In yet another aspect, the position of the entity in relation to the geographical zone as described in the method to define a geographical zone is determined by the steps of locating the transponder within the pixilated image by activating a pixel corresponding to the geographical coordinates where the transponder is located, extending two vertical lines in opposite direction and originating from the pixel, extending two horizontal lines in opposite direction and originating from the pixel, determining the number of times each line crosses the boundary of the geographical zone, assigning an outside status to each line that crosses the boundary a even number of times, assigning an inside status to each line that crosses the boundary a odd number of times, and identifying the transponder as being inside the boundary if the status of three out of four lines indicate an inside status.

In another aspect, the transponder has ground positioning system receiver that calculates the transponder coordinates, and allows to identify the location of the entity in the pixilated image as one pixel in the computer image.

In another aspect, the geographical area is a geometrical shape such as a square, rectangle, triangle, circle, oval, or trapezoid. The shape of the geographical area can also be the shape of a non-geometrical shape such as the shape of the border delimiting a street route, a state, a city, a county, or a country.

In one aspect, there is a method to define a geographical zone utilized to regulate a movable entity having an attached transponder. The method comprises allowing a user to enter a plurality of waypoints, each waypoint in the plurality of waypoints being defined by a geographical coordinate and a radius; wherein the geographical coordinate is represented by a latitude and longitude, and the radius is represented by a distance magnitude; and loading plurality of waypoints on a transponder.

In another aspect, the transponder can determine whether the transponder is inside or outside the geographical zone by obtaining global positioning coordinates, and calculating whether the global positioning coordinates are inside at least one waypoint of the plurality of waypoints. The shape of the geographical area is the shape of a non-geometrical shape.

In another aspect, all waypoints in the plurality of waypoints have the same coordinate but different radii, such that all the waypoints in the plurality of waypoints are concentric.

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In one aspect, there is a method to identify a geographical area for regulating an entity. The method comprises allowing a user to identify a geometrical area in a computer map, the geometrical area using two coordinate attributes, dividing the identified geometrical area into a grid, allowing a user to select at least one section from within the grid in order to define a geographical area, associating the at least one section to a pixel in a pixilated computer image such that the pixels selected by the user in the identified geometrical area are identified as being in the geographical area; and loading the pixilated computer image to a memory in a transponder.

In another aspect, the pixilated computer image has a directly proportional number of columns and rows as the identified geometrical area. Alternatively, the pixilated computer image has the same number of columns and rows as the identified geometrical area. In another aspect, the geometrical area is rectangular or circular. In yet another aspect, a second geographical area is defined by a plurality of geographical areas.

In yet another aspect the entity having attached the transponder may be located in the geographical area by obtaining a position of the transponder from a ground positioning unit operably connected to the transponder, correlating the position of the transponder in the geographical area to a representative position of the transponder in the pixilated computer image, and determining whether the representative position of the transponder in the pixilated computer image falls on a pixel that is flagged as being in the geographical area.

BRIEF DESCRIPTION OF THE DRAWINGS

By way of example, reference will now be made to the accompanying drawings.

FIG. **1** illustrates the high-level architecture of a computer system for controlling and monitoring vehicles.

FIG. **2** illustrates a component layout of a transponder used in a system for controlling and monitoring vehicles.

FIG. **3**A illustrates a view of the front exterior of the transponder used in a system for controlling and monitoring vehicles.

FIG. **3**B illustrates a view of the back exterior of the transponder used in a system for controlling and monitoring vehicles.

FIG. **3**C illustrates a multiple pin connector included on the transponder.

FIG. **4**A illustrates a window of the transponder configuration application where the modem is being detected.

FIG. **4**B illustrates a window of the transponder configuration application where the user may select parameters to configure the modem.

FIG. **4**C illustrates a window of the transponder configuration application where the user may select parameters to configure multiple inputs and outputs.

FIG. **4**D illustrates a window of the transponder configuration application where the user may select parameters to configure multiple logical and physical events.

FIG. **4**E illustrates a window of the transponder configuration application where the user may select parameters to configure multiple inputs and features.

FIG. **4**F illustrates a window of the transponder configuration application where the user may select parameters to configure multiple inputs and features.

FIG. **4**G illustrates a window of the transponder configuration application where the user may select parameters to configure multiple inputs and features.

FIG. **5**A illustrates a pixel map of a zone.

FIG. **5**B illustrates a pixel map of a geographical zone.

FIG. **6** illustrates a component diagram of a backend control system.

FIG. **7**A illustrates a screenshot of an instance of a client console.

FIG. **7**B illustrates a screenshot of an instance of a client console.

FIG. **7**C illustrates a screenshot of an instance of a client console.

FIG. **7**D illustrates a screenshot of an instance of a client console.

FIG. **8** illustrates a screenshot of an instance of the administrator console.

FIG. **9**A illustrates a screenshot of an instance of the operations data processor.

FIG. **9**B illustrates a screenshot of an instance of the operations data processor.

FIG. **9**C illustrates a screenshot of an instance of the operations data processor.

FIG. **10** illustrates a screenshot of an instance of the history data processor.

FIG. **11** illustrates a screenshot of an instance of a disable transponder processor.

DETAILED DESCRIPTION

Asset management and monitoring devices that use ground positioning systems allow users to track the position of vehicles and cargo and other entities. The method and system described below utilizes a transponder that communicates over cellular and satellite communication networks in combination with GPS positioning satellites capable of providing position and status information on a global scale. The transponder allows interaction with and control of a wide range of peripheral devices, including operating according to preconfigured geographical zones and events.

A transponder can be mounted, attached, manufactured, or otherwise included upon/in various articles or entities. Such articles or entities may include vehicles, aircraft, cargo, persons, animals, or any other item where tracking its movement and/or location is beneficial. Within the context of the tracking system, the transponder works to collect, process, and communicate information about the article or entity to which the transponder is attached. Furthermore, when requested, the transponder can issue various commands and instructions to the local article or entity.

The transponder has the features, flexibility, and capability of an intelligent device. The transponder contains an at least 32-bit processor which can interface with at least one modem (cellular, satellite, and others), at least one Global Positioning System (GPS) receiver, at least one memory module, and other peripheral devices. Other components of the transponder may include, but are not limited is at least one GPS antenna, at least one modem antenna, at least one serial port for communication and configuration, at lest one multiple connector pin which contains at least one input and at least one output. These inputs and outputs are configurable to be associated with a configurable event or configurable operation.

The transponder can include many different combinations of the components listed above and similar components. For example, a transponder may have two modems wherein one modem is a satellite modem and one modem is a cellular modem. Additionally, a transponder could also contain a Bluetooth receiver in combination with the other components. The components of the transponder depend upon which capabilities the user requires.

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Among its many capabilities, the central processing unit of the transponder can be configured to manage configurable events or configurable operations. Managing events means that among other capabilities, the transponder can report, observe, recognize, process, and analyze numerous configurable events or configurable operations , give and respond to various commands, effectuate numerous events in its local installation, and contain a history recording component.

The event message triggered by physical and logical events include the event message itself and such information includes latitude, longitude, speed, direction, time, state of all the inputs, state of all outputs, odometer, event reason or source, and any other relevant information concerning the entity.

The transponder is configurable to include as few or as many configurable logical events or physical events as the user desires. Events may be physical or logical. Logical events may be based on rules using a combination of the GPS position and one other factor such as time or speed. However, Logical events can be based upon a combination of factors. Physical events are those events which are physically manifested in the vehicle or object.

Configurable events or configurable operations refer to those actions that the CPU in the transponder will execute. Configurable events or configurable operations include, but are not limited to, the turning on or off of an ignition to a vehicle; the temperature level or change thereof; the fuel tank level or change thereof; the pressing of a button or level within a vehicle, wherein the button is associated with an emergency event; locking or unlocking of a door or latch, the opening or closing of a window, turning on or off of a LED signal light, the turning or off of various relays, the turning on or off of an alarm; the change of the power level of the battery; a bar code scanned by a connected scanner; passenger loading or unloading; cargo loading or unloading; vehicle part malfunction; vehicle diagnostics code received; impact detected; airbag deployed; seatbelts latched/unlatched; tire air pressure high/low; and other mechanisms in the vehicle or object.

Other configurable events or configurable operations include the location of the vehicle or object in terms of latitude, longitude, and/or altitude; the time and corresponding location of the last configurable event reported; the speed and direction of the vehicle or object, the state of any assigned inputs or outputs or change thereof; a pre-selected distance; a pre-selected time interval; pre-selected intervals based upon date and time reference; a pre-selected schedule for reporting and recording any of the configurable events or configurable operations; a pre-selected maximum speed; maximum acceleration; length of idle for a vehicle; length of non movement for an object.

Additional configurable events or configurable operations include the entering or exiting of a pre-set waypoint or a pre-set zone. A waypoint is a circular area defined by a geographical center point and radius. The area defined by the waypoint is configurable by changing the radius and the position of the geographical center point. A zone is an irregular region defined by a series of line segments enclosing an area.

The configurable events or configurable operations or combinations thereof can be processed in order to transmit a specific message, respond to a specific query or command, enable or disable a specific mechanism, or recognize a specific event. For example, the CPU can be configured to process that at if at a pre-selected time the vehicle or object has not moved a pre-selected distance, then the transponder is sent a command to turn off the ignition of the vehicle or otherwise alter the article.

The configurable events or configurable operations occur in many situations. These situations include, but are not limited to where configurable events or configurable operations occur in response to a command; where configurable events or configurable operations occur in response to a query, or where configurable or configurable operations events occur upon recognition of pre-selected conditions.

Configurable boundaries or geographical zones can also be used and are configurable to any shape the user desires. For example, the boundary or zone can trace the border of a state line or trace the route of a selected highway or path. The boundary or zone can trace the border of the premises of a school zone, a no-fly zone, a city, etc. The boundary or zone can also be a geometric shape or non-geometric shape. A further benefit of the present disclosure is that the transponder can be updated and configured locally or over-the-air.

FIG. **1**A illustrates the high-level architecture of a computer system for controlling and monitoring vehicles. A plurality of vehicles **110** has at least one transponder **105** that can be tracked and allows the functionality to remotely control functionality of the vehicle **115**.

The transponder **105** connects with a plurality and any combination of communication networks. In one embodiment, such communications network is a cellular network including multiple cellular base stations **120** and service providers **135**. In another embodiment, such communications network is a cellular network including multiple cellular base stations with SMS receivers **125** and service providers **140**. In another embodiment, such communications network is a satellite network including multiple satellite receivers and transmitters **130** and satellite ground stations **145**. In yet another embodiment, such communications network is a short radio communications network.

The communications network permits the transponder **105** to communicate with a backend control system **150**. The transponder **105** sends event information to backend control system **150** and responds to commands sent to the transponder **105** by the backend control system **150** through the communications network. The backend control system **150** includes a plurality of gateways **151**, **152**, **153** and **154** which interact with a codec **155**. The codec **155** is the central codifier and decodifier of the backend control system **150** and allows the backend control system to adapt and communicate with any communications network. The modular design enables the introduction of new hardware and network protocols without having to change monitoring and reporting software. The backend control system **150** also includes an asynchronous routing system **159** that allows incoming and outgoing communications to be handled asynchronously and efficiently. In one embodiment, the asynchronous routing system **159** includes a plurality of routing services **156**, at least one database **157** and a web server **158**. The messages routed by the routing services **156** are directly communicated to a client console **176**. The client console **176** presents vehicle **115** and transponder **105** information to the operator. The client console **176** sends to commands to the transponder **105** through the backend control system **150** and a communication network.

Multiple applications may connect to the central database **157** to provide further system functionality. An administrator console **175** permits operators to add, edit or delete transponder **105** information, vehicle **115** information, user information, etc. A history processor console **174** allows an

operator to view reports and replay event data. An operations data processor **173** permits an operator to define geographical zones and waypoints for operation of the transponder **105**. A configuration utility **172** permits operators to easily configure transponder **105** features and functionality.

Vehicle information can be presented to the operator through alternative mediums besides a client console **176**. In one embodiment, vehicle information can be presented to an operator through a website or an email by transmitting such information from a web server **158** to a web client **171**. In another embodiment, vehicle information can be presented to the operator by sending a text or voice messages to a predetermined wireless device **180**.

FIG. **1**B illustrates the wireless connectivity of the transponder **105**. The transponder **105** receives radio signals from a GPS constellation **131** allowing the transponder **105** to process positioning information. The transponder **105** can communicate wirelessly to various networks through multiple wireless devices integrated in the transponder's **105** hardware such as short range radio **154**, a cellular receiver **120** and **125**, and a satellite **130**.

Transponder Hardware Configuration

FIG. **2** illustrates the internal board **240** of the transponder **105**. The transponder board **240** contains at least one GPS receiver **215**, at least one CPU **210**, at least one cellular modem **220**, and at least one memory module **280**. At least one Bluetooth receiver can be included in the internal board **240**. In one embodiment, the tracking system uses utilizes both cellular and satellite networks to provide the most affordable and complete global coverage.

The global positioning (GPS) receiver **215** is a capable of positioning accuracy to within a few feet or less. For example, a 12-Channel Trimble SQ, Lapaic UV40, or small-range accurate receivers are contemplated.

The processor **210** is at least a 32-bit processor. The processor **210** includes at least 32 Kilo-bytes of RAM. For example, a Motorola MMC2114 32-Bit RISC processor with two built-in UART's is contemplated. However, a similar or more advanced processor is also contemplated. The memory module **280** includes at least two additional memory chips, wherein each additional memory chip is at least 128 K.

In one embodiment, the cellular receiver or cellular modem **220** is the primary means for communication. The cellular modem **220** interfaces with at least one on board processor **110**'s built-in serial ports **345** or **340** as illustrated in FIG. **3**B. The cellular modem **220** may be a GSM, CDMA or similar modem. The satellite modem or transceiver **230** is external to the transponder **105** and is connected by a serial port **340**. In one embodiment, the satellite modem **230** is located under fiberglass or any other non-metal material in order to provide maximum coverage. The satellite modem **230** is primarily used only when there is little or no cellular coverage or when the user specifies use of the satellite modem **230**. The efficient use of the satellite modem **230** functions to lower the cost of the tracking system to the user. One embodiment contemplates a satellite modem **230** such as a Sky Wave DMR-200 satellite modem. Similar contemplated satellite modems include features such as a built-in omni-directional antenna, provide worldwide coverage, and efficiently interfaces with the transponder's processor **210**.

The Bluetooth receiver **215** has a range of at least 20 meters. For example, in one embodiment, a National Semiconductor Simply Blue LMX9820 Class 2 Bluetooth module is contemplated. However, similar or more advanced Bluetooth receivers are contemplated any other radio connectivity which does not require a line of sight. Preferably, the Bluetooth receiver **215** is installed to utilize different capabilities such as integrating and supporting multiple wireless peripherals, acting as a short-range radio to download data, or to serve as a local, traveling wireless "hotspot."

In one embodiment, the power source **135**, is a fused main power-in source with a recommended operating voltage range between 12 and 24 volts. One embodiment contemplates low power consumption (65 mA or less) during normal operation. Furthermore, the transponder **105** includes a circuitry for charging an optional backup battery. If the primary power source **135** supply reaches a minimum acceptable voltage, the transponder **105** will automatically switch to backup power as well transmit a message identifying that the power source **135** is a critical level.

The transponder **105** is a small and affordable unit with numerous features. The external view of the transponder is illustrated in FIGS. **3**A and **3**B. In one embodiment, the housing **335** of the transponder **105** is metal or made from a material that functions to protect the inner components from external events such as physical damage, dust, water, excessive temperatures or any other event which could affect the integrity of the transponder. As illustrated in FIG. **3**A, **3**B, and **3**C, the transponder **105** contains at least two external communication ports **305** and **340**, a multiple pin connector **345** with at least nine sensor inputs **350**, at least four control outputs **355**, a modem antenna connector **300**, several indicators **315**, **320**, **325**, **330**, and a GPS antenna connector **310**. In another embodiment, a Bluetooth antenna (not depicted) is an optional feature.

The multiple pin connection **345** of one embodiment contains 20 pins. The number of pins within the transponder **105** is variable ranging from zero to as many pins as appropriate for its intended use.

At least nine of the pins function as inputs **345**. The inputs **345** function to gather information concerning the status of the article in which the transponder **105** is mounted upon. Each input can be assigned to a corresponding specific configurable event or operation. The input signal may be analog or digital. In one embodiment, each input **345** is optically isolated and protected against over-voltage/under-voltage current surges. Furthermore, each input **345** can be individually enabled or disabled either locally via a serial cable or over the air. Additionally, each input **345** is configurable over the air and locally. These inputs **345** are configurable to the specific desires and uses of the user. These capabilities are later discussed in further detail.

In one embodiment, at least one input **345** is a digital input dedicated to the ignition circuit path of a vehicle. If the input **345** is enabled, a message is transmitted when the vehicle is turned on. A second message is transmitted when the vehicle is turned off. Analog inputs are also useful in functioning with ranges. For example, an analog input can function with temperature and fuel tank levels. In one embodiment, the remaining inputs function to monitor different features of the vehicle.

Other inputs **345** may include a panic input which may be connected to an emergency button installed discreetly inside the vehicle. If the panic input is enabled and the emergency button is pressed for pre-selected, configurable amount of time, a message is transmitted relating the panic event. Similar inputs may include a medical assistance input, roadside assistance input or any other inputs which the operator may use for immediately communicating an event. These messages can be continually transmitted for a determined period of time until the message is acknowledged by the proper party or monitoring entity.

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At least four of the pins in the pin connector **345** function as outputs **355**. The outputs **355** function to control mechanisms or enact functions upon the article or vehicle where the transponder **105** is mounted. Each output **355** is fused and capable of providing at least 0.5 amps per channel. However, if more than one output **355** channel is utilized the sum total of all used output channels should not exceed one amp. Each output **355** can be set high or low utilizing an over-the-air command. In one embodiment, the outputs **355** control various apparatus and objects within the vehicle itself. For example purposes only, the outputs can control the door locks, the vehicle windows, a LED signal light, the fuel tanks or valves, various relays, and other mechanisms in the vehicle. The LED signal light can function as an acknowledgement tool. For example, in the case of medical, roadside, or safety assistance is needed, the occupier or passenger of the vehicle can press a button to alert the client console **176**. When the operator or appropriate entity receives and acknowledges the event, a command is sent back to the transponder **105** that will turn on an intermittent light for a determined amount of time so that the occupier or passenger is assured the message was received and assistance is on the way. In other embodiments, such as a cargo, the outputs **355** can control various features of the cargo such as a locking mechanism, a signal light, or temperature control.

The serial ports **305** and **340** in FIGS. **3**A and **3**B illustrate at least one 9-pin serial port **340** for the purpose of interacting with, and controlling peripheral devices and at least one 4-pin serial interface **305** consisting of data in/out and two flow control lines. The external serial port **340** can support various peripheral devices such as a MDT (mobile data terminal), satellite modem, bar code scanner, short-range radio, or PDA. For example, the external serial port **340** can support a passenger counter which interfaces several door infrared motion sensors for the purpose of the counting the number of people entering or exiting from the one to four doors. The serial port **305** can also be used to test and configure applications within the transponder **105**. In one embodiment, the port **305** functions as a programming port which is used when programming the unit for the first time or re-programming the unit's core program.

The indicators **330**, **325**, **320**, **315** in FIG. **3**A can be associated with any type of connection, signal, power level, status, and any other similar communications. In one embodiment and in FIG. **3**A, indicator **330** is a LED that appears red when the transponder has power connected to it. Indicator **325** is a LED which blinks green at a rapid pace when the GPS receiver is establishing a connection and slowly blinks green when a connection is established. Indicator **320** is a LED light which blinks green for every message received and red for every message sent. Finally, indicator **315** is a LED which is red when the cellular modem is roaming and is green when it is at home.

TRANSPONDER FIRMWARE CONFIGURATION

The transponder **105** has numerous features, functions, and capabilities described below. The transponder **105** is an intelligent device controlled by an at least **32**-bit processor **110**. FIG. **2** depicts one embodiment where the processor **105** has the capability to interface with a GPS receiver **215**, a cellular modem **220**, a Bluetooth modem **225**, a memory module **280**, and a satellite modem **230**.

The transponder **105** can be configured to report, observe, and analyze numerous logical events. The transponder is also configurable to give and respond to various commands, and contains a configurable history-recording component. A further benefit of the present disclosure is that all the configurations to the transponder **105** can be done locally or over-the-air. Thus, the user is able to configure any features including the entire operating system of the transponder over the air. This over-the-air configuration can be accomplished through use of the cellular modem **220**, the Bluetooth modem **225**, or any other wireless means.

Moreover, the transponder **105** can be configured locally through connecting to a serial port **305** or **340**. Another benefit of the present disclosure is that during over-the-air or local configuration, the transponder **105** continues to operate normally. This means the transponder **105** can be configured with losing little to no operability. Over-the-air configuration commands change the parameters used for processing physical and logical events on the fly. Over-the-air operating system updates are achieved using two executable code spaces, and a temporary code space for loading new code. Once the uploading of new code into the temporary code space is completed, the transponder reboots, copies the new code into the secondary executable code space and resumes execution with the most recent update.

FIGS. **4**A-**4**G are exemplary screen shots of the user interface for configuring the physical and logical events within the transponder in one embodiment. FIGS. **4**A-**4**G serve only as examples of a general interface which the user can interact with to configure the transponder **105**. One important feature of the present disclosure is that configuring the transponder does not require the user to know scripts or hard-coded parameters. Instead, the present disclosure includes a software application which the user can easily interface with logical windows, tabs, fields, checkboxes and radio buttons to configure the transponder.

FIG. **4**A is a screen shot of a window that interfaces with the user to configure the transponder **105**. The window **400** has at least four tabs **401** from which the user can choose. The first tab **402** directs the user to a window **400** for configuring the modem of the transponder **105**.

The second tab **403** directs the user to a window **400** where the user can configure at least 8 Inputs **345** and at least 4 outputs **355**. FIG. **4**C depicts the interface when the second tab **403** is selected. The activity level **407** of the inputs **345** can be configured to be either high or low. The outputs **355** can be configured to default to an active or inactive state at startup using the "On" field box **410**. The outputs **355** can be further configured to be associated with a LED acknowledgment **411**. The outputs **355** can be assigned to any type of control mechanism or function within the vehicle or article where the transponder **105** is mounted. For example, the outputs **355** can be assigned with a door locking mechanism in a vehicle. In this example, if Output **1** **355** in FIG. **4**C is associated with a door locking mechanism, the user could check the "On" **410** field box. When the transponder first boots, the door locks connected to output **1** would automatically lock, and would remain locked until unlocked by an over-the-air command. When an output is selected as an LED acknowledge, that output will change to an active state during an acknowledgeable priority event, and blink to off when that priority event is acknowledged by the Response Center.

The third tab **404** directs the user to a window **400** where the user can configure certain logical events. FIG. **4**D depicts the interface when the third tab **404** is selected. The logical events **412**-**420** in FIG. **4**D are exemplary only. Moreover, the present disclosure contemplates a variety of configurable logical events not depicted in FIG. **4**D. The logical events **412**-**420** selected in FIG. **4**D are individually

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discussed below. Each event has a corresponding field box in which the user can fill in the appropriate value.

The fourth tab **405** directs the user to a window **400** where the user can configure the inputs **345** and specific features of the transponder **105**. FIG. **4**E, **4**F, and **4**G depict the interface when the third tab **404** is selected. As stated above, each input can be assigned a corresponding event. For example, an input **345** can be assigned to the ignition of a vehicle. Thus, occurrences associated with the ignition of the vehicle are communicated and displaced as a specific Input **345**. The user has the ability to configure each input **345** and each feature **429-445** by enabling the input or feature **424**, assigning the events as a priority event **425**, assigning one or more outputs **426** to the events, or link the occurrence of the events to a messaging sent via the cellular network **427**.

Events can be physical or logical. Physical and logical events trigger the sending of a message over the air when certain conditions are met. Most logical events are based on rules using a combination of the GPS position and one other factor such as time or speed. The event message triggered by physical and logical events includes the event message itself and such information includes latitude, longitude, speed, direction, time, state of all the inputs **345**, odometer, event reason or source, and any other relevant information. The logical events are usually software driven, calculation based, and typically draw from GPS positions. The transponder **105** is configurable to include as few or as many logical events as the user desires. One embodiment includes at least six different configurable logical events.

The first logical event of one embodiment is a feature that reports the last known location of the transponder for a specified interval of time. This time reporting **412** features is depicted in FIG. **4**D. The status report to the user may consist of other parameters such as latitude, longitude, speed, direction, time and the state of the inputs **345**. For example, FIG. **4**D shows an example where the user configured the time reporting **412** interval for 60 seconds. This means that in this scenario, the last known location status and applicable parameters are reported every 60 seconds. This time reporting feature **412** gives the user flexibility and the option to lower the cost of data transmission. FIG. **4**D also depicts an entry for Satellite Timed Reporting Interval **413**, where the same time reporting feature is applicable, only the message is transmitted via an optional satellite modem. Again, due to the typically higher costs of satellite communication, the user has the flexibility to determine how often he or she wishes to incur the cost of satellite reporting on a fixed time period.

The second logical event of one embodiment is a feature that further refines the reporting capabilities of the time reporting feature **412**. This event is depicted as Smart Time Reporting **414** on FIG. **4**D. The Smart Time Reporting **414** feature functions to transmit a report only when the vehicle has moved a pre-selected distance since the last transmitted report. FIG. **4**D shows that the Smart Time Reporting **414** feature is configurable in terms of a time interval **415** and distance **416**. Thus, a user could configure the transponder **105** to report its location and applicable parameters by selecting a timed reporting interval **415** in terms of seconds and a distance **416** in terms of meters. For example, a user could select the time reporting interval **415** for 60 seconds and the distance **416** for 1000 meters. This would mean that every 60 seconds the transponder would send a report unless the transponder **105** has not moved at least 1000 meters since the last report. This smart time reporting **414** feature allows the user to tailor the amount of reporting and the cost of data transmission.

Another contemplated reporting feature, not depicted, is a scheduled reporting features. This feature sets the transponder's reporting feature on an interval based upon a date and time reference. Thus, the user can configure the transponder to report location and the other parameters on pre-selected days and hours of the week. For example, a user could use the scheduled reporting feature to configure the transponder to only report at 8 am, 12 pm and 4 pm on weekdays and only once per weekend day. Also not depicted is satellite scheduled reporting where the same scheduled reporting capabilities are applicable, only the message is transmitted via an optional satellite modem

A third logical event of the one embodiment is a speeding feature. The transponder **105** can be configured to send reports dependent on the speed of the vehicle or article the transponder **105** is mounted to. FIG. **4**D shows that the user can configure the transponder **105** for at least 2 different settings concerning speed. Specifically, the user can select the excessive speed **417** and a speed filter time **420**. The excessive speed **417** is configurable for the user to select a maximum speed threshold for the vehicle or article. Thus, each time the speed threshold is exceeded, events are generated, recording when the threshold was exceed, the maximum speed reached when above the threshold and when the unit crossed below the threshold. When the transponder **105** crosses back below the threshold, the event message indicating this occurrence as well as a third message indicating the maximum speed reached during the period when the transponder **105** was above the speed threshold is transmitted. The speed time filter **420** gives the user the option to set a time period in terms of seconds to allow the vehicle or article to cross the speed threshold without sending a message. This filter also acts to make data transmission efficient. For example, the user can set the speed time filter **420** for 15 seconds which allows the vehicle to speed for 15 seconds without sending a report. This scenario is beneficial for instances when the vehicle is speeding to pass another vehicle or accelerating to merge into traffic. Similar to the other logical events, the event message also includes information such as the latitude, longitude, speed, direction, time, and state of the inputs.

A fourth logical event of one embodiment is an excessive idle feature **421**. The transponder **105** can be configured to send reports dependent on the amount of time the vehicle or article has been idle. FIG. **4**G shows that the user can configure the excessive idle **421** feature to be enabled **422**, considered a priority event **425**, assigned an output **426**, or linked to a messaging system for cellular phones **427**. The excessive idle **421** feature generates an event message whenever the maximum excessive idle time is reached. The event message records the time and location corresponding to when the threshold was exceeded. This feature is helpful to users who wish to monitor or reduce the number of vehicles which have the ignition turned on (using gasoline), but are not moving.

GEOFENCING

The next logical event of one embodiment is a "geofencing" or creating configurable boundaries or geographical zones feature. This feature consists of generating events when the transponder travels through waypoints and zones. A configurable boundary or geographical zone may be constructed through a combination of waypoints and/or zones. Because of this combination, the configurable boundary or geographical zone can be constructed in a very specific shape and outline specific borders or routes. A

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waypoint is a circular area defined by a geographical center point and radius. The area defined by the waypoint is configurable by changing the radius and the position of the geographical center point. Thus, the boundary created by the waypoints and zones is configurable.

In one embodiment, the transponder **105** is loaded with a plurality of waypoints, each waypoint defined by a coordinate and a radius. A zone can be defined by a plurality of waypoints. Thus, for example, a city can be defined by two waypoints. Using GPS data, the transponder will calculate whether it is in any of the two waypoints defining the city. If the transponder determines that it is inside one of the two waypoints, then the transponder **105** assumes that it is within the limits of the city.

A zone is an irregular region defined by a series of line segments enclosing an area. In one embodiment, each zone contains 3 to 256 or more deflection points for creating the line segments defining this irregular area. In one embodiment, this irregular area can create a configurable boundary or a geographical zone. The properties of a zone include a name, description and a flag determining if the zone is an off-limits zone or an enclosed zone.

In one embodiment, a geographical zone may be created selecting a plurality of coordinates and downloading the coordinates to the transponder **105**. The plurality of coordinates may be in the Mercator system. Next, the transponder **105** assigns each coordinate to a pixel in a pixilated image that is loaded in the transponder **105**. In order to perform the assignment, the transponder **105** utilizes logic to define a "bounding" square or box around the plurality of coordinates. Then the bounding box is pixilated and the pixels where the coordinates falls are marked as activated. Once the pixels for each coordinate are assigned, lines are extended from one pixel to the next so as to form an enclosed area in the pixilated image. The pixels the lie in the path of the lines between the activated pixels are also activated. Thus an enclosed and contiguous line of pixels is formed.

Waypoints and zones are built by the operations data processor **173**. Once a waypoint has been built, it can be used in transponder loads. Transponder loads are a collection of zones and waypoints slated to be loaded on a transponder **105**. These loads are loaded on to the transponders with the configuration utility **172**.

FIG. **4**F illustrates a screenshot of the configuration utility **172** for configuring waypoint and zone events. The configuration utility **172** allows the operator to configure the Waypoint Proximity enter feature **433**, the Waypoint exit feature **434**, the Zone Boundary enter feature **435**, and the Zone Boundary Exit feature **436**. The Waypoint Proximity enter feature **433** monitors when a waypoint has been entered, the Waypoint exit feature **434** monitors when a waypoint has been exited, the Zone Boundary enter feature **435** monitors when a zone has been entered, and the Zone Boundary Exit feature **436** monitors when a zone has been exited. FIG. **4**F and **4**G show the user interface of one embodiment where the user may enable the waypoint and zone features, assign the events as a priority event **425**, assign an output **426** to the events, or link the occurrence of the events to a messaging system for cellular phones **427**.

FIG. **5**A illustrates a pixel map **500** of a zone. After all the deflection points for a given zone are uploaded, the zone is saved in the memory module **280** of the transponder **105** in the form of a pixel map **500**. The pixel map **500** is created by first drawing a square around the entire area of the zone. The square is then divided into an 80/80-pixel map. Each pixel **505** is a square. These squares are then used to draw the outline shape **510** of the zone **515**. A geographical area is then mapped to each pixel **505** of the pixel map **500**. A position fix **520** in the pixel map **500** is mapped from the current geographical location of the vehicle.

A test is performed to for each zone for each position fix **520** in order to determine if the transponder **105** is inside the zone **515** or outside the zone **515**. Thus, for each zone **515**, the test starts with a simple check if the position fix **520** is inside or outside the pixel map **500**. If the current position fix **520** is inside the pixel map **500**, a more extensive test is completed by plotting the position fix **520** inside the bounding box and drawing four lines in four directions (north, south, east and west) from the position fix **520** to the borders of the pixel map **500**. Subsequently, the number of zone boundary crossings **530** is counted for each of the four lines **525**.

Multiple boundary crossing tests are performed for accuracy. If a given line **525** crosses an odd number of zone boundaries **510**, the position fix **520** is considered inside the zone **515**. If a given line **525** crosses an even number of zone boundaries, the position fix **520** is considered outside the zone **515**. If at least three out of the four boundary crossing tests agree, the zone boundary crossings **530** are used to determine if the position fix **520** is inside or outside the zone. If three out of the four boundary tests do not agree, the position fix **520** is considered outside the zone **515**.

Position fixes **520** that are on the special locations in the pixel map **500** can yield specific location results. In one embodiment, position fixes **520** that land on a zone boundary **510** are determined to be outside the zone boundary **510**. In another embodiment, position fixes **520** that land on a zone boundary **510** are determined to be inside the zone boundary **510**. In one embodiment, position fixes **520** that land on a "long and narrow protrusion" which is only one pixel wide can be considered to always be inside the zone **515**. In another embodiment, position fixes **520** that land on a "long and narrow protrusion" which is only one pixel wide can be considered to always be outside the zone **515**.

After all the deflection points for a given zone are uploaded, the zone is saved in the memory module **280** of the transponder **105** in the form of a pixel map **500**. The pixel map **500** is created by first drawing a square around the entire area of the zone. The square is then divided into an 80/80-pixel map. Each pixel **505** is a square. These squares are then used to draw the outline shape **510** of the zone **515**. A geographical area is then mapped to each pixel **505** of the pixel map **500**. A position fix **520** in the pixel map **500** is mapped from the current geographical location of the vehicle.

FIG. **5**B illustrates a pixel map **550** of a geographical zone. The pixel map **550** is first presented to the user as a geographical map on a screen connected to a computing device. In one embodiment, the user then selects a rectangular shape **555** around the geographical area **560** that the user desires to define. In another embodiment, the user may define a customized shape. The rectangular shape is then divided into smaller rectangles such that the area of the rectangle is divided into a grid. Each pixel in the grid can be activated to be part of the geographical zone. In one embodiment, the user may activate each pixel by double-clicking on each pixel. In another embodiment, the user may select a smaller rectangular region and mark the smaller rectangular region as being part of the geographical zone **560** so that the pixels contained in the smaller geographical zone are activated. In yet another embodiment, the user may select a circular area as being part of the geographical zone **560**, and all pixels in such circular area would be activated. In another

embodiment, the user may define any customized geometrical or non-geometrical shape.

Once all the desired pixels are selected by the user as being part of the geographical zone **560**, the rectangular shape **555** is mapped into a pixilated computer image. In one embodiment, the pixilated computer image contains the same number of pixels as the number of sections in the grid. The pixilated computer image can then be loaded to the transponder **105**. The transponder **105** can be programmed to determine the position of the entity with a simple calculation of whether the pixel in which the transponder's location falls is activated or deactivated. In another embodiment, the geographical zone is defined by selecting a rectangular region and a circular region. The circular region can be defined by a waypoint.

An irregular zone or geographical zone may be defined by a collection of waypoints and pixilated images. Furthermore, each irregular zone may have additional parameters such as speed threshold of the entity, flagged as a "no-fly zone," color coded in order of danger or security threat, communication enabled or disabled, etc.

When the transponder **105** enters or exits waypoints and zones, an event message is transmitted indicating what reference point or zone has been entered or exited. The event message can include latitude, longitude, speed, direction, time, state of the inputs, odometer, event reason or source, and any other relevant information. Thus, the zone boundaries and waypoints allow the user to track a vehicle or an article through configurable boundaries or geographical zones such as state borders or a specified route.

In one embodiment, the waypoint and zone events are configurable to one or more assigned outputs. Meaning, when the transponder **105** enters or exits waypoints and zones it can initiate an output. An output can consist of a LED light unit within the vehicle or article, a door locking mechanism, a fuel valve mechanism and so forth. This means that the user can configure the vehicle to lock its doors or close a fuel valve if the vehicle enters or exits a specific waypoint or zone.

COMMANDS

The transponder **105** is also configurable to respond to various query and set commands sent over the air. The position query commands the transponder **105** to return the last valid GPS position, speed, direction, time, input state, and other relevant information. The transponder can also be configured to respond to an odometer query. Upon receiving this query command, the transponder **105** returns the last valid GPS position, speed, direction, time, input state, running odometer value, and other relevant information.

The transponder **105** is also configurable to respond to various query commands sent over the optional satellite modem. The satellite position query commands the transponder **105** to return the last valid GPS position, speed, and time. The transponder **105** can also be configured to respond to a satellite odometer query. Upon receiving this query command, the transponder **105** returns the state of its inputs and running odometer value. Examples of other forms of query commands that are sent to the transponder **105** are Input and Output Signal Query, Analog to Digital Levels Query, Passenger Count Query, Firmware Version Query, Satellite Status Query, Satellite Position and Velocity Query, Satellite Odometer and IO Query, etc.

Another optional command is the alarm acknowledgement. This command is sent to the transponder **105** to terminate the sending of a priority event (panic, medical or roadside assistance are examples of priority events). When the alarm acknowledgement is received, no further priority messages for the current event are transmitted.

In one embodiment, the command is setting a single output. This is used to change the state of an output to either active or inactive over-the-air. An example would be to unlock the back door of an armored truck when it arrives at the bank or turn on the fuel pumps for a tanker truck when it arrives at a gas station.

In another embodiment, the command may be to send a text message, from the transponder **105** through the communication network to a device configured to receive and interpret text messages.

In another embodiment, the command is a configuration command to configure functionalities of the transponder **105** as previously discussed. Examples of configuration commands include Configure Timed Reporting, Set Odometer, Upload New Firmware, Configure Excess Speed Event, Configure Excessive Idle Event, Configure Satellite Timed Reporting, Configure Power Level Critical, Configure Satellite Communication Port, Enable Event, Configure Priority Events, Enable Cellular Message, Enable Short-Range Radio Message, Assert Output Event, Configure GPS Filter, Enable Input, Set Passenger Count, Configure Smart Timed Reporting, Configure Scheduled Reporting, Configure Satellite Scheduled Reporting.

The transponder **105** also may include a history reporting component. Whenever the transponder **105** cannot transmit data packets due to a lack of coverage via the principle communication mediums, the packers are stored in one of at least two history logs on on-board flash memory storage device. When the transponder determines that the communication link has been re-established, any packets stored in memory are sequentially transmitted, beginning with those messages identified as a priority. For example, emergency or roadside assistance would be a priority message which would be the first message transmitted when the connection is re-established.

In an effort to combat GPS drift, two parameters are included to filter GPS positions received from the GPS receiver. The two filters are based upon maximum allowed speed and maximum allowed acceleration. The parameters can be customized to the type of installation. If a packet is received from the GPS receiver and either of these two parameters is exceeded, the position packet is thrown out.

BACKENED CONTROL SYSTEM

FIG. **6** illustrates a backend control system **150**. The backend control system **150** includes a plurality of gateway systems **151-153**, a codec **155**, and an asynchronous routing system **159**. In turn, the asynchronous routing system **159**, includes a web server **156**, a plurality of router systems **620**, **622**, a real time database **630**, a history database **642**, and a fleet database **670**.

The real time database **630** maintains records of the most recent information form a transponder such as location, speed, direction, odometer reading, etc. The history database **642** maintains records of all events and transactions that were received and sent from the asynchronous routing system **159**. Finally, the fleet database **670** keeps records of all the administrative entities such as the controlled mobile and static objects to which a transponder is attached to (e.g. a vehicle), users, transponder configuration, fleets, etc.

The backend control system **150** can be configured to run on any combination of computer servers. In one embodiment, the plurality of communication gateway systems

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APPENDIX A

151-153 runs on independent computer systems. In another embodiment, the communication gateways 151-153 run on a common computer system.

The communications gateway systems 151-153 direct data flow from each of the transponders 105 into the backend control system 150. The gateway systems 151-153 also direct commands and queries to the appropriate transponder 105. Each gateway establishes and maintains a communication link with a communications network 651-653. In one embodiment, the gateway is a Universal Datagram Protocol/Internet Protocol (UDP/IP) packet receiver and sender 151 which connects to an internet/cellular network 651. There may be more than one UDP/IP gateway 151 transmitting and receiving data. The UDP/IP gateway 151 allows the backend control system 150 to communicate with transponders 105 over GSM/GPRS, CDMA/1×RTT and CDPD networks using UDP packets.

In another embodiment, the gateway system is a Short Message Peer to Peer (SMPP) gateway 152 that connects with a Short Message Service (SMS) network 652. A plurality of SMPP gateway systems 152 transmit and receive data for transponders that communicate over SMS networks using an SMPP protocol. Each SMPP gateway system 152 opens and maintains a continuous connection to the service provider's Short Message Service Center (SMSC) for incoming data so that reception of transponder 105 data from the SMSC can be guaranteed.

In another embodiment, the gateway system is a satellite gateway 153 that connects to a satellite network 653. As illustrated in FIG. 1A, the satellite network 653 may include one or more satellites 130 and, at least on ground station 145. The satellite gateway 153 transmits and receives data for transponders 105 that communicate through satellite communication. In one embodiment, the satellite communication protocol may be that of Inmarsat satellites using eight-byte packets of data. The satellite gateway 153 gateway opens and maintains a continuous connection to the satellite network 653.

The communication between the asynchronous routing system and transponders are channeled through an appropriate gateway system 151-154. An appropriate gateway system 151-154 is selected based on a unique combination of transponder manufacturer, communications protocol and service provider. For example, a transponder 105 that uses CDPD communication woud be routed through a different gateway system 151-154 than a transponder 105 that uses SMS communications protocol. Likewise, transponders 105 that use the same communication protocol such as CDPD, but have a different service provider would have separate gateways.

As the gateway system 151-153 receives each inbound packet of data, the gateway system 151-153 tags each packet with the date and time of arrival, the transponder 105 manufacturer information, the transponder's 105 address information, and repackages the packet for transmission to the codec 155. The gateway 151-153 then writes the repackaged data into a queue 665 that is read by a codec 155.

When the gateway system 151-153 receives an outbound packet from an outbound queue 661-664, the gateway system 151-153 uses the address information to send the packet to the target transponder 105. If required, the gateway system 151-153 verifies before transmission that the gateway system 151-153 has an open and valid connection to the corresponding network 651-653. Each gateway system 151-153 has at least one corresponding outbound queue 661-663. For example, each UDP/IP gateway 151 has at least one outbound UDP/IP queue 661. Each SMPP gateway 152 has at least on outbound SMS queue 662. Each satellite gateway 153 has at least one outbound satellite 663. Each SMTP mail gateway 154 has at least one outbound SMTP queue 664.

After a packet is placed in the inbound queue 665 the data coming from various networks is decoded into a standard data format. Likewise, before a packet is placed in an outbound queue 661-664, the data going to different communications networks is coded from the standard data format, into a network specific format. The coding and decoding of data is carried out by the codec (coder-decoder) 155. The codec 155 permits the greater flexibility because the introduction of new communication network protocols is transparent to the asynchronous routing system 159. Thus, if a new transponder model uses a new communication network protocol, the backend control system does not need to be upgraded. The system upgrades needed would be a codec 155 update and a new gateway if necessary.

When a packet comes into the asynchronous routing system 159, each inbound packet that the codec 155 receives is first examined to determine the transponder model. If the codec 155 supports the specified transponder model, the data is translated from the transponder 105 proprietary format into the standard system format. Once the codec 155 has interpreted the data, the codec 155 then writes the data into a response queue 610. If the codec 155 does not recognize the transponder model, the codec 155 then logs the unsupported data and emails the data to a designated system or network technician.

When a packet is sent from the asynchronous routing system 159 the codec 155 determines the transponder model to which the packet is sent. If the codec 155 supports the specified transponder model, the data is translated from the standard system format into the transponder 105 proprietary format. Likewise, if the packet is sent to another device that is not a transponder 105, the codec determines if it supports that device, and if so, translates to the appropriate format. Once the codec 155 has interpreted and encoded the data, the codec 155 then places the packet into the queue that corresponds to the appropriate type of network communication protocol. An SMS packet data would be placed into the outbound SMS queue 662. If the codec 155 does not support the transponder model, the codec 155 then logs the unsupported data and emails the data to a designated system or network technician.

Once a packet is processed by the codec 155, it then gets processed depending if it is an outbound or inbound packet. Outbound packets are placed in the appropriate outbound queue 661-664. Inbound packets are received by the asynchronous routing system 159 in a response queue 610. The response queue 610 feeds the packets to the response router 620. The response router 620 determines if a client console 176 is tracking the transponder 105 associated with the incoming message. If so, the response router 620 routes the incoming message to the appropriate client console 176. Thus, the client console receives the message before any other process in the asynchronous routing system 159. If no client console 176 is tracking the transponder 105 associated with the incoming message, the response router 620 places the incoming message into a new event queue 621. The new event queue 620 feeds a new event router 622. The new event router 622 analyzes each incoming message and determines if the incoming message is associated to a new priority event for the transponder 105. The new event router 622 determines if the incoming message is associated to a new event by searching a real time database 630 for a similar event associated to the transponder 105. If no event is recorded for the transponder 105, or the event is of high

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priority, the new event router **622** sends a routing request to all client consoles **176** that have permission to view the incoming message. The request is intermittently sent until at least one client console **176** accepts the routing request. Once the routing request is accepted, the client console **176** adds the transponder **105** to an inventory in the client console **176** so that the incoming message can be handled.

Asynchronously, a history queue **640** receives the inbound and outbound messages for all transponders **105**. The inbound messages are fed from the history queue **640** to the history recorder **641**. The history recorder **641** geocodes all packets that have a valid latitude and longitude. The geocoded information is saved in a history database **641** to be used later for reporting and statistical analysis.

Incoming messages from transponders **105** may also be forwarded to an email address, or cellular telephone, or any other communications device. To achieve this functionality, the history recorder **641** also transmits the geocoded locations to remote notify routers **681** by placing the geocoded locations in a remote notify queue **680**. The remote notify router **681** that receives the geocoded location and event information queries the fleet database **670** to find out if the configuration information associated with the transponder **105** requires a notification to a communications device **177**. If a notification is required, the remote notify router **681** retrieves the contact information for the appropriate communications device **177**. The remote notify router **681** then formats and encodes the message sent to the communications device **177**. The message is placed in the outbound SMTP queue **664** to be sent through the SMTP gateway **154**. The message can be placed in the outbound SMS queue **662** to be sent through the SMPP gateway **152**.

The real time database **630** is also updated with the new event information associated with the incoming message. Thus, the real time database **630** contains the latest information reported on a given transponder **105**. The real time database **630** is connected to a web server **158**. The web server **158** is directly connected to the internet **160** and allows users of a web tracking application **171** to make location requests, command requests **632** and report requests **633**. When a web server **158** receives a location request **631** from the web tracking application **171**, the web server **158** queries the history database **642**. The history database **642** contains all events in a chronological order. The web server **158** retrieves all transactions related to the web tracking application **171** query and forwards the data to the web tracking application **171** for displaying in a web browser.

When a web server **158** receives a location request **631** from the web tracking application **171**, the web server **158** queries the real time database **630** for the corresponding transponder **105** information. The real time database **630** provides transponder information as related to the very last incoming message from the incumbent transponder **105**. The web tracking application **171** may also send a command request **632** such as querying the position of the transponder. The command request **632** is sent to the command receiver **690** which in turn process the position request command by tagging the appropriate transponder **105** information. The message is encoded by the codec **155**, placed in the appropriate outbound queue **661-663** and sent through the corresponding gateway system **151-154** to the transponder **105**. The transponder **105** will then send back a response, and the backend control system **150** then processes it updating the real time database **630**. After the real time database **630** has been updated, the web server **631** may refresh the contents of the web tracking application **171** showing the new position of the transponder **105**.

The command receiver **690** processes all commands pertaining to all outbound messages to be sent to transponders. The command receiver may receive command messages from the client consoles **176**, the administrator consoles **175**, or from the web server **158**. When the command receiver **690** receives a command message, the command receiver **690** tags each outbound message with the correct transponder **105** address by searching a fleet database **670** and retrieving the address information. Each message is sent by the command receiver **690** to the codec **155** for encoding.

All of the commands that are processed by the command receiver **690** are ultimately sent remotely to the transponder **105**. In one embodiment, the command is a Position Query. Upon receiving this query command, the transponder **105** returns the last valid position, speed, direction, time and input state. In another embodiment, the command is an Odometer Query. Upon receiving this query command, the mobile products return the last valid GPS position, speed, direction, time, input state, and running odometer value. In another embodiment, the command is an Input/Output Query. Upon receiving this query command, the transponder returns the last updated state of all inputs and all outputs (active/inactive). For any given input, the active state is relative to that the configuration of that input. For instance, if an input is configured to be active-low (H-L), then 0 volts at the input translates into that input being "active." If the input is configured to be active high (L-H), then 12/24 volts at the input translates into that input being "active." In another embodiment, the command is a Time Report Set and/or Home IP. This command is sent to the transponders to configure the reporting interval for the Timed Reporting feature of the firmware. This command can also be used for setting the transponder's destination IP/MIN address. This command allows the transponders can be reconfigured over-the-air to transmit to a new control center or home address if the IP/MIN address of the control center or home address changed. In another embodiment, the command is Set All Outputs. This command is sent to the transponder to set all outputs simultaneously. Any individual output can be either high or low. In another embodiment, the command is Set Single Output. This command is sent to the mobile products to set one individual output either high or low. In another embodiment, the command is Enable/Disable Inputs and Events. This command is sent to the transponders to enable/disable all known transponder features. Both physical and logical events can be individually enabled and/or disabled. While the physical and logical events can be disabled, the ability to query the transponder for its location and status can remain enabled. In another embodiment, the command is an Alarm Acknowledgment. This command can be sent to the transponder to terminate the sending of an emergency event such as panic, roadside assistance, or medical assistance. When the alarm acknowledgement is received, no further emergency messages for the current event are transmitted from the transponder **105**.

The asynchronous routing system **159** interacts with various control consoles. Reporting consoles **174** connect to the fleet database **670** to display fleet information. Administrator consoles **175** also connect to the fleet database to retrieve transponder, vehicle, and user information. Administrator consoles **175** also connect to the command receiver **691** to send commands to the transponder **105**. Operations data processors **173** connect to the fleet database **670** in order to retrieve configuration information for a specific user or transponder **105**. Finally, the client console **176** receives information for a tracked transponder **105** from the response router **620**, receives information for a non-tracked transpon-

der from a new even router **621**, and retrieves information from the fleet database **670**. The client console also transmits command to a transponder **105** by sending the command to the command receiver **691**.

MANAGEMENT SOFTWARE

FIG. **7**A illustrates a screenshot of an instance of the client console **176**. The client console **176** provides real-time transponder **105** location mapping, location tracking, transponder control and transponder message/event handling.

In one embodiment, the client console **176** connects to map databases and transponder databases by configuring multiple parameters. Such parameter can include path definition for the console map sets **710**, any custom data sets **711**, map information display symbols **712** and console operating procedures **713**. The Settings are maintained in the system registry and recalled at program load. In another embodiment, the client console **176** provides the ability to configure mapping parameters used by the client console **176**. The client console **176** also provides with the ability to define the console location, default zoom levels when displaying the various program-generated maps, the map set to be used and whether or not street locations are displayed when mapping a location. FIG. **7**B illustrates a screenshot of an instance of the client console **176**. A graphical user interface allows maps to be displayed on the client console **176**. In one embodiment, the client console **176** displays all available transponders on one master map. In another embodiment, the client console **176** allows a user to view transponders by groups **721** or individually **720**. In another embodiment, the client console allows a user to view all transponders that come within an area **722** displayed by the map. In another embodiment, the client console **176** allows a user to view all transponders that are within a waypoint. In another embodiment, the client console **176** allows a user to view all transponders that are within a zone.

The client console **176** allows a user to employ a variety of mapping tools to help manage transponder **105** location processing. Provided tools include map zoom in/out, map pan, map feature label, map ruler, map location at selected point, map legend, center map on selected point, find a map feature and center map on it, display information for a selected custom dataset element, display information for a selected transponder, display information for a standard map feature and print the displayed map.

Further, the displayed map uses color-coding for both location symbol and location identification to indicate special conditions relating to the transponder **105**. Special situations that are color-coded include transponder moving, transponder stopped, transponder not reporting, transponder location is old and transponder has a priority message active.

As illustrated by FIG. **7**C, the client console **176** can generate a user-operating log that includes all messages received by the console **740**, commands sent by the console **741** and key events **742** that occur during console operation. In another embodiment, the generated log is interactive such that a user can append a free form remark to the event log and to recall and view the event log for any selectable time period. In another embodiment, the client console **176** provides the ability to generate a summary list of the assigned transponder inventory and the current real-time status of a selected transponder.

FIG. **7**D illustrates a screenshot of the client console **176** with a generated list displaying a transponder summary table **750** and a master map **751**. The client console also allows the user to view a chronological listing of all messages **752** received at the client console **176** and all commands **753** transmitted from the client console **176** to the transponder **105**.

The transponder summary table **750** displays all transponder information and is updated in real time as the transponder reports to the client console **176**. The transponder data shown are the data corresponding to the transponders belonging to the inventory of a user. The transponder summary table **750** uses icons and color-coding to alert the user to special conditions. Special situations that are color-coded include transponder moving, transponder stopped, transponder not reporting, transponder location is old and transponder has a priority message active. In another embodiment, the user has the ability to find any item in the transponder summary table **750**, select which columns are visible and to sort the table according to selectable sort types and sort orders for up to three columns.

In another embodiment, the client console **176** provides a user the ability to select an item in the transponder summary table **750** and perform an operation that is related to the selected item or its group. For example if a transponder is selected, various operations related to the transponder may include adding the transponder to the master map, removing the transponder from the master map, creating a group map, creating an individual map, centering the map on the selected transponder location, viewing the input/output/and event states for the transponder, setting the message notification mode for the transponder, viewing an information screen that contains detailed information from the master database pertaining to the transponder and viewing any supplementary information contained in the location data packet that is not otherwise displayed.

In another embodiment, the client console **176** provides a user the ability to select a transponder in the transponder summary table **750** and send a command/query to the selected transponder. The command/query list available to the user is dependent on the user's profile in the master system database. In another embodiment, the command is sent from a web based client console such as the web tracking application **171**.

In another embodiment, the client console **176** provides a user the ability to receive popup alert notification, including a sound cue, whenever a message event, a standard event or priority event is received at the client console **176**. Notification modes may be enabled or disabled for each transponder. In one embodiment, the notification modes are configured in the fleet database **670**. In another embodiment, the notification modes are configured locally in the client console **176**. When a priority message is received, the user has the ability to cancel the message, switch reporting to the emergency mode, or continue to use the standard reporting mode. The transponder summary table **750** displays priority messages with a special icon under the transponder identification column.

FIG. **8** illustrates a screenshot of an instance of the administrator console **175**. The administrator console **175** allows the creation and maintenance of client configurations. The administrator console **175** updates the fleet database **670**. As FIG. **7**B illustrates, the administrator console **175** allows access to each fleet by displaying displays a list of fleets **820**. Each fleet may be accessed to view and manage all the vehicles associated to the selected fleet. A list of vehicles **821** are associated with each fleet in the list of fleets **820**. Each vehicle in the list of vehicles **821** has a corresponding list of transponders **822**, passengers **823** and operators **824**. Each transponder in the list of transponders **822** may be selected for configuration. Likewise, the list of

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operators **824** may be selected to add, edit or delete an operator. The list of passengers **823** may be selected to add, edit or delete a passenger for the corresponding vehicle.

FIG. **9**A illustrates a screenshot of an instance of the operations data processor **173**. The operations data processor **173** allows to create maintain zones, waypoints and transponder loads for the transponder **105**. Zones, waypoints and sites are created and maintained with a point-and-click mapping interface as illustrated by FIG. **9**A. The graphical interface provided by the operations data processor **173** displays a map **910** of the area where a waypoint **920** is to be installed. In one embodiment, the graphical interface allows to expand or reduce the radius **930** around the waypoint. In another embodiment, the radius information is entered by typing the number on a given field of the graphical user interface. The operations data processor **173** allows to maintain a list of waypoints **940** and view each waypoint **920** in a the corresponding map **910**.

FIG. **9**B illustrates a screenshot of an instance of the operations data processor **173**. The graphical interface provided by the operations data processor **173** displays a map **910** of the area where a zone **950**. is to be delineated. The zone **950** is defined by deflection points **951** and the lines that connect the deflection points **951**. The deflection points **951** may be indicated by clicking on the map **910**. A list of zones **960** are also displayed by the operations data processor **173**, along with a collection of deflection points **970**. Each zone **950** can be edited by changing the deflection points **951**.

FIG. **9**C illustrates a screenshot of an instance of the operations data processor **173**. The graphical interface provided by the operations data processor **173** displays a window to configure transponder loads. A transponder load is a collection of zones and waypoints to be loaded to a transponder. Each client edits a collection of transponder loads. The transponder loads are later downloaded to each transponder **105** according to the configuration in the fleet database **670**. A load is configured by selecting a client **980**, and selecting the desired waypoints **981** and zones **982** that were defined by the client **980**. The waypoints **981** and zones **982** selected are those that will later be downloaded to the transponder **105**.

FIG. **10**A illustrates a screenshot of an instance of the history data processor **173**. The history data processor **173** permits the retrieving and mapping historical data and events associated with selected vehicles and transponders. The graphical user interface displays an interactive map **1010** and the geographical points **1020** where an event occurred. In one embodiment, the history data processor **173** allows the user to click on each geographical point **1020** and see the event information **1030** reported at that geographical point **1020**. In another embodiment, the history data processor **173** allows the user to select a group of geographical points **1020** and replay the history of a transponder or of a vehicle along the selected geographical points **1020**. In another embodiment, the history data processor **173** allows the user to select all geographical points **1020** and replay the history of a transponder or of a vehicle along the selected geographical points. In one embodiment, the history replay will replay the movement of the vehicle according to the streets traveled, the direction, and the speed. In another embodiment, as the history of the vehicle is replayed, the event information **1030** is displayed for every geographical point **1020** reached.

In another embodiment, the history replay can replay the history according to selected period. In another embodiment, the history replay can replay the history as related to a selected waypoint **920**. In another embodiment, the history replay can replay the history as related to a selected zone **950**.

FIG. **10**B illustrates a screenshot of an instance of the history data processor **173**. The history data processor **173** also permits the retrieving and reporting mapping historical data and events associated with selected vehicles and transponders. In one embodiment, a graphical user interface form a computer application displays a list of available reports **1040**. In another embodiment, a graphical user interface in a web browser displays a list of available reports **1040**. Once an item in the list of available reports **1040** is selected, the report **1050** is displayed to the user. Each report **1050** is configurable to be generated based on multiple parameter options such as a time period, types of events, types of transponders, a specific transponder, a specific zone, a waypoint, types of vehicles, a vehicle, etc.

FIG. **11** illustrates a screenshot of an instance of a disable transponder processor **1100**. The disable transponder processor **1100** allows an accounting department to disable transponders **105** for nonpayment and enable them at the time of subscription or when payment is made. In one embodiment, a disable transponder processor **1100** can be connected to the accounting processing data exchange **177**. In another embodiment the disable transponder processor **1100** can be a stand-alone application installed on computer systems used by an accounting department. In another embodiment the disable transponder processor **1100** can be a web application accessible only by members of an accounting department.

The disable transponder processor **1100** provides a list of transponders **1110** that are disabled, and a list of transponders that are enabled. If a user disbles or enables a transponder **105**, the transponder configuration **105** is updated in the fleet database **670** and is also sent to the command receiver **690** for processing. The command receiver **690** sends a message to the transponder **105** to turn off its functions.

While the above description contains many specifics, these should not be construed as limitations on the scope of the disclosure, but rather as an exemplification of one embodiments thereof.

The method and system described above contemplate many applications of the present disclosure. The present disclosure includes a system which has the capability to control and monitor a moving object or a static object prone to be moved. The object can be many things such as vehicle, aircraft, airborne items, animals, persons, cargo, specialized and/or volatile cargo such as chemicals, weapons, or hazardous materials. In addition, fragile cargo can include, but is not limited to items such as, medicine, patients, organs for donation, where monitoring parameters such as temperature, pressure, humidity, blood pressure, ekg, and other conditions are critical to the integrity of the item. Another climate-sensitive object for which tracking, monitoring and local control is beneficial includes produce and perishable goods. For example, the transponder could monitor humidity and have the ability to control the amount of moisture in cargo containing perishable items that are susceptible to humidity. Moreover, these objects can include any other item where tracking its movement and/or location is beneficial. A transponder can be mounted, attached, manufactured, or otherwise included upon or within these various articles. The transponder is contemplated to be of many different sizes including nano- and/or micro scale-transponder. Within the context of the tracking system, the transponder works to collect, process, and communicate various information

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about the article or vehicle the transponder is attached to. Furthermore, when requested, the transponder can issue various commands and instructions to the local article or vehicle. These commands or instructions to the local article or vehicle are contemplated to include any command that can change, alter, or enhance, the mechanism, the function, the structure or the composition of the article or vehicle. For example, a medical application of the present disclosure contemplates a transponder with the ability to monitor a patient's vital signs. The transponder can be hardwired or hooked up to intravenous tubes, medical machines, and other medical equipment. Thus, for example, the user is capable of remotely administering medicine by commanding the transponder to perform the function. Furthermore, a change in vital signs could send an event message to the transponder where the transponder could send a message to a response center or directly to a cellular phone of the patient's physician or to a plurality of cellular phones, such as to family members, for example.

Additional applications and situations include military applications where it is necessary to not only track and monitor a vehicle or person, but where it is also beneficial to be able to control functions on the vehicle or person. For example, it may be desired to control the firing ability of a military vehicle, or control similar functions once the vehicle enters a certain territory or turn off certain capabilities once the vehicle enters a peaceful zone. Similarly, an additional application to aircrafts and airborne items considered. The transponder would have the same capabilities; however, the transponder could position based upon on a 3-D point in space, not merely longitude and latitude. Naturally, each one of these applications remains configurable and controllable over-the-air.

Furthermore, the disclosure includes any combination or subcombination of the elements from the different species and/or embodiments disclosed herein. One skilled in the art will recognize that these features, and thus the scope of this disclosure, should be interpreted in light of the following claims and any equivalents thereto.

We claim:

1. A method to define a geographical zone utilized to regulate a movable entity having an attached transponder, comprising:

allowing a user to enter a plurality of waypoints, each waypoint in the plurality of waypoints being defined by a geographical coordinate and a radius; wherein the geographical coordinate is represented by a latitude and longitude, and the radius is represented by a distance magnitude, wherein all waypoints in the plurality of waypoints have the same coordinate but different radii, such that all the waypoints in the plurality of waypoints are concentric; and

loading plurality of waypoints on a transponder.

2. The method of claim **1**, further comprising regulating the entity by performing an action that comprises at least one of monitoring, controlling and visualizing the movement the entity.

3. The method of claim **1**, further comprising regulating the entity by performing an action that comprises at least one of monitoring, controlling and visualizing the non-movement the entity.

4. The method of claim **1**, further comprising regulating the entity by performing an action that comprises at least one of monitoring, controlling and visualizing the position the entity.

5. The method of claim **1**, wherein the transponder can determine whether the transponder is inside or outside the geographical zone by obtaining global positioning coordinates, and calculating whether or not the global positioning coordinates are inside at least one waypoint of the plurality of waypoints.

6. The method of claim **1**, wherein the shape of the geographical zone is a street route.

7. The method of claim **1**, wherein shape of the geographical zone is the shape of a non-geometrical shape.

8. The method of claim **1**, wherein said movable entity is controlled and monitored depending on the location of the movable entity relative to said geographical zone.

9. A method to identify a geographical area for regulating an entity, comprising:

allowing a user to identify a geometrical area in a computer map, the geometrical area using two coordinate attributes;

dividing the identified geometrical area into a grid;

allowing a user to select at least one section from within the grid in order to define a geographical area;

associating the at least one section to a pixel in a pixilated computer image such that the pixels selected by the user in the identified geometrical area are identified as being in the geographical area; and

loading the pixilated computer image to a memory in a transponder.

10. The method of claim **9**, further comprising regulating the entity by performing an action that comprises at least one of monitoring, controlling and visualizing the movement the entity.

11. The method of claim **9**, further comprising regulating the entity by performing an action that comprises at least one of monitoring, controlling and visualizing the non-movement the entity.

12. The method of claim **9**, further comprising regulating the entity by performing an action that comprises at least one of monitoring, controlling and visualizing the position the entity.

13. The method of claim **9**, wherein the pixilated computer image has a directly proportional number of columns and rows as the identified geometrical area.

14. The method of claim **9**, wherein the pixilated computer image has the same number of columns and rows as the identified geometrical area.

15. The method of claim **14**, wherein the geometrical area is rectangular or circular.

16. The method of claim **9**, wherein a second geographical area is defined by a plurality of geographical areas.

17. The method of claim **9**, wherein an entity having attached the transponder may be located in the geographical area by obtaining a position of the transponder from a ground positioning unit operably connected to the transponder, correlating the position of the transponder in the geographical area to a representative position of the transponder in the pixilated computer image, and determining whether the representative position of the transponder in the pixilated computer image falls on a pixel that is flagged as being in the geographical area.

18. The method of claim **9**, wherein the shape of the geographical area is a square, rectangle, triangle, circle, oval, or trapezoid.

19. The method of claim **9**, wherein shape of the geographical area is the shape of a non-geometrical shape.

20. The method of claim **9**, wherein the shape of the geographical area is the shape of a border delimiting a street route, a state, a city, a county, or a country.

21. The method of claim **9**, wherein the shape of the geographical area is a street route.

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22. The method of claim 9, wherein said movable entity is controlled and monitored depending on the location of the movable entity relative to said geographical area.

23. A method of determining the position of a transponder in relation to a geographical zone, comprising:

locating the transponder within a pixilated computer image by activating a pixel corresponding to the geographical coordinates where the transponder is located;

extending two vertical lines in opposite direction and originating from the pixel;

extending two horizontal lines in opposite direction and originating from the pixel;

determining the number of times each line crosses the boundary of the geographical zone;

assigning an outside status to each line that crosses the boundary a even number of times;

assigning an inside status to each line that crosses the boundary a odd number of times; and

identifying the transponder as being inside the boundary if the status of three out of four lines indicate an inside status.

24. The method of claim 23, wherein the transponder has a ground positioning system receiver that calculates position coordinates, further locating the transponder position as one pixel in the pixilated computer image.

25. The method of claim 23, wherein each one of the plurality of geographical coordinates are represented by a latitude and longitude.

26. The method of claim 23, wherein each one of the plurality of geographical coordinates are Mercator coordinates.

27. The method of claim 23, wherein the shape of the geographical zone is a square, rectangle, triangle, circle, oval, or trapezoid.

28. The method of claim 23, wherein shape of the geographical zone is the shape of a non-geometrical shape.

29. The method of claim 23, wherein the shape of the geographical zone is the shape of a border delimiting a street route, a state, a city, a county, or a country.

* * * * *

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
12/350,817	01/08/2009	2161	715	081221-011500	23	4

CONFIRMATION NO. 7586

33717
GREENBERG TRAURIG LLP (LA)
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INTELLECTUAL PROPERTY DEPARTMENT
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UPDATED FILING RECEIPT

OC000000034518279

Date Mailed: 02/17/2009

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

James Ashley JR., Norco, CA;
Patrick Mooney, Brea, CA;

Assignment For Published Patent Application

WIRELESSWERX INTERNATIONAL, INC., Urbanizacion Marbella, PANAMA CANAL ZONE

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CIP of 11/848,178 08/30/2007

Foreign Applications

If Required, Foreign Filing License Granted: 01/21/2009

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/350,817**

Projected Publication Date: 05/28/2009

Non-Publication Request: No

Early Publication Request: No
** **SMALL ENTITY** **

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Title

MAPPING IN A MULTI-DIMENSIONAL SPACE

Preliminary Class

707

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Title 37, Code of Federal Regulations, 5.11 & 5.15

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Electronic Acknowledgement Receipt	
EFS ID:	4902622
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:	Cynthia Anne Dixon/Shaula Stephenson
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Attorney Docket Number:	081221-011500
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Application Type:	Utility under 35 USC 111(a)

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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
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Warnings:					
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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.

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PATENT
Conf. No. 7586

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	James Ashley, Jr., et al.	Examiner:	to be assigned
Serial No.	12/350,817	Group Art Unit:	2161
Filed:	January 8, 2009	Docket No.	081221-011500
Title:	MAPPING IN A MULTI-DIMENSIONAL SPACE		

Commissioner for Patents
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Alexandria, VA 22313-1450

POWER OF ATTORNEY

The undersigned hereby appoints all attorneys associated with Customer Number 33717 as attorneys and/or patent agents with the full power to represent the applicant in connection with this application.

CERTIFICATE UNDER 37 C.F.R. § 3.73(b)

WIRELESSWERX INTERNATIONAL, INC., a corporation organized and existing under the laws of the country of Panama and having its principal place of business at Arias, Fábrega & Fábrega, PH Plaza 2000 Building, Calle 50 & Calle 53, Urbanizacion Marbella, Panama, certifies that it is the assignee of the entire right, title and interest in the patent application identified above by virtue of copies of assignments or other documents in the chain of title, which are attached.

The undersigned (whose title is supplied below) is empowered to act on behalf of the assignee.

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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 are made with the knowledge that willful false statements, and the like so made, are punishable by fine or imprisonment, or both, under Section 1001, Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

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WIRELESSWERX INTERNATIONAL, INC.

Date: 2/23/09

By: _____
Steve Artim
CEO

Customer No.: 33717

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/350,817	01/08/2009	James Ashley JR.	081221-011500

CONFIRMATION NO. 7586

33717
GREENBERG TRAURIG LLP (LA)
2450 COLORADO AVENUE, SUITE 400E
INTELLECTUAL PROPERTY DEPARTMENT
SANTA MONICA, CA 90404

IMPROPER CPOA LETTER

OC000000034906565

Date Mailed: 03/11/2009

NOTICE REGARDING POWER OF ATTORNEY

This is in response to the Power of Attorney filed 03/04/2009. The Power of Attorney in this application is not accepted for the reason(s) listed below:

- The Power of Attorney is from an assignee and the Certificate required by 37 CFR 3.73(b) has not been received.

/hsarwari/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

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Electronic Acknowledgement Receipt

EFS ID:	5039763
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:	Cynthia Anne Dixon/Shaula Stephenson
Filer Authorized By:	Cynthia Anne Dixon
Attorney Docket Number:	081221-011500
Receipt Date:	26-MAR-2009
Filing Date:	08-JAN-2009
Time Stamp:	13:52:42
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		115poa.pdf	162536 7a155b1f18c80fb2caba4415c8cb9ae96d3d3361	yes	4

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Power of Attorney	1	2
	Assignee showing of ownership per 37 CFR 3.73(b).	3	4
Warnings:			
Information:			
	Total Files Size (in bytes):	162536	

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.

ASSIGNMENT

WHEREAS, we, **JAMES ASHLEY, JR.**, with an address at 1830 Trotter Trail, Norco, CA 92860 and **PATRICK MOONEY**, with an address at 1295 Birchcrest Avenue, Brea, CA 92821, (hereinafter "ASSIGNORS"), have made certain new and useful inventions and improvements for which an application for Letters Patent of the United States entitled **MAPPING IN A MULTI-DIMENSIONAL SPACE** was filed on January 8, 2009 and assigned U.S. Patent Application Serial No. 12/350,817; and

WHEREAS, **WIRELESSWERX INTERNATIONAL, INC.**, a corporation organized and existing under the laws of the country of Panama and having its principal place of business at Arias, Fábrega & Fábrega, PH Plaza 2000 Building, Calle 50 & Calle 53, Urbanizacion Marbella, Panama, (hereinafter "ASSIGNEE"), desires to document its ownership of the entire right, title and interest in and to said inventions, applications and Letters Patent to be granted and issued thereon;

NOW, THEREFORE, for and in consideration of the sum of One Dollar ($1.00) by the ASSIGNEE to us paid, and other valuable consideration, the receipt and legal sufficiency of all of which is hereby acknowledged, we, said ASSIGNORS, acknowledge that we have transferred and do hereby sell, assign, transfer and set over unto said ASSIGNEE, its successors and assigns, the entire right, title and interest in and to said inventions and all improvements thereon, in and to said application for Letters Patent thereon, in and to applications pertaining to or based upon said inventions and applications, including divisional and continuing applications and continuations-in-part, and in and to any and all Letters Patent which may be granted and issued on said inventions and applications, or any of them, not only for, to and in the United States of America, its territories and possessions, but for, to and in all countries foreign thereto, together with and including all priority rights based upon any and all applications in the United States of America covered by this Assignment.

We do hereby acknowledge that we have agreed, and do hereby agree, that we will, at the request of said ASSIGNEE, execute any and all applications for Letters Patent for said inventions and any and all other papers and documents and do all other and further lawful acts

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that said ASSIGNEE may deem necessary or desirable to obtain Letters Patent on said inventions, to secure the grant of such Letters Patent and to perfect and vest in the ASSIGNEE the entire right, title and interest in the inventions, applications and Letters Patent.

And for the above-named considerations, we do hereby authorize and empower the ASSIGNEE, its successors and assigns, to apply for and obtain, in its or their own names, Letters Patent for the said inventions before competent International Authorities and in any and all countries foreign to the United States in which applications for Letters Patent can be so made or Letters Patent so obtained.

Dated: 1/29/2009

By _____
JAMES ASHLEY, JR.

Witnessed By: _____
signature
name: Stephen Punak
address: 63 Via Pico Plaza #223
San Clemente, Ca 92672

Witnessed By: _____
signature
name: Oscar Chen
address: 18940 Cedar Ridge Ct
Walnut, Ca 91789

Dated: 1/29/2009

By _____
PATRICK MOONEY

Witnessed By: _____
signature
name: Stephen Punak
address: 63 Via Pico Plaza #223
San Clemente, Ca 92672

Witnessed By: _____
signature
name: Oscar Chen
address: 18940 Cedar Ridge Ct.
Walnut, Ca 91789

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PATENT
Conf. No. 7586

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	James Ashley, Jr., et al.	Examiner:	to be assigned
Serial No.	12/350,817	Group Art Unit:	2161
Filed:	January 8, 2009	Docket No.	081221-011500
Title:	MAPPING IN A MULTI-DIMENSIONAL SPACE		

Commissioner for Patents
Post Office Box 1450
Alexandria, VA 22313-1450

POWER OF ATTORNEY

The undersigned hereby appoints all attorneys associated with Customer Number 33717 as attorneys and/or patent agents with the full power to represent the applicant in connection with this application.

CERTIFICATE UNDER 37 C.F.R. § 3.73(b)

WIRELESSWERX INTERNATIONAL, INC., a corporation organized and existing under the laws of the country of Panama and having its principal place of business at Arias, Fábrega & Fábrega, PH Plaza 2000 Building, Calle 50 & Calle 53, Urbanizacion Marbella, Panama, certifies that it is the assignee of the entire right, title and interest in the patent application identified above by virtue of copies of assignments or other documents in the chain of title, which are attached.

The undersigned (whose title is supplied below) is empowered to act on behalf of the assignee.

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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 are made with the knowledge that willful false statements, and the like so made, are punishable by fine or imprisonment, or both, under Section 1001, Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Please direct all correspondence to:

Attn: Cynthia A. Dixon
GREENBERG TRAURIG, LLP
2450 Colorado Avenue, Suite 400E
Santa Monica, CA 90404
Tel: (310) 586-7700
Fax: (310) 586-7800

WIRELESSWERX INTERNATIONAL, INC.

Date: 2/23/09

By: _____
Steve Artim
CEO

Customer No.: 33717

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UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/350,817	01/08/2009	James Ashley JR.	081221-011500

CONFIRMATION NO. 7586

33717
GREENBERG TRAURIG LLP (LA)
2450 COLORADO AVENUE, SUITE 400E
INTELLECTUAL PROPERTY DEPARTMENT
SANTA MONICA, CA 90404

POA ACCEPTANCE LETTER

OC000000035262753

Date Mailed: 04/02/2009

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 03/26/2009.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/ttran/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

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UNITED STATES PATENT AND TRADEMARK OFFICE

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12/350,817	01/08/2009	James Ashley JR.	081221-011500

CONFIRMATION NO. 7586

33717
GREENBERG TRAURIG LLP (LA)
2450 COLORADO AVENUE, SUITE 400E
INTELLECTUAL PROPERTY DEPARTMENT
SANTA MONICA, CA 90404

PUBLICATION NOTICE



Title:MAPPING IN A MULTI-DIMENSIONAL SPACE

Publication No.US-2009-0137255-A1
Publication Date:05/28/2009

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

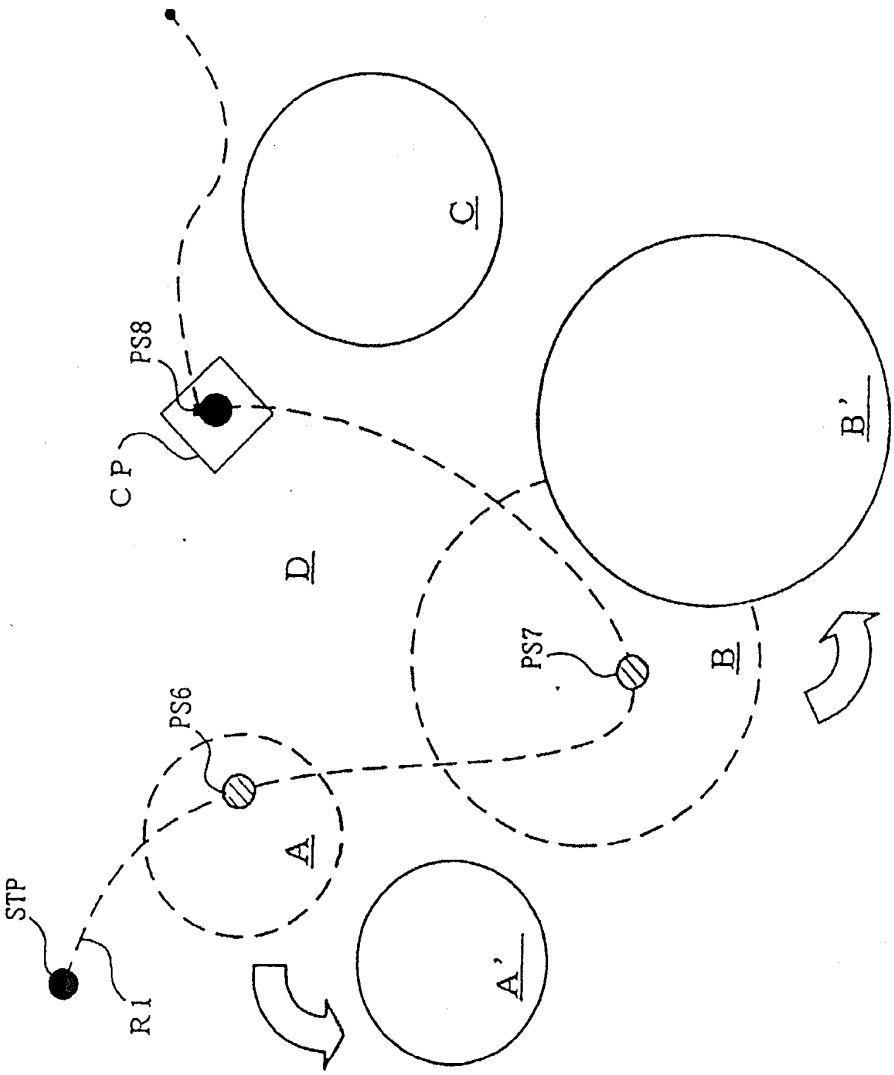
In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently http://pair.uspto.gov/. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

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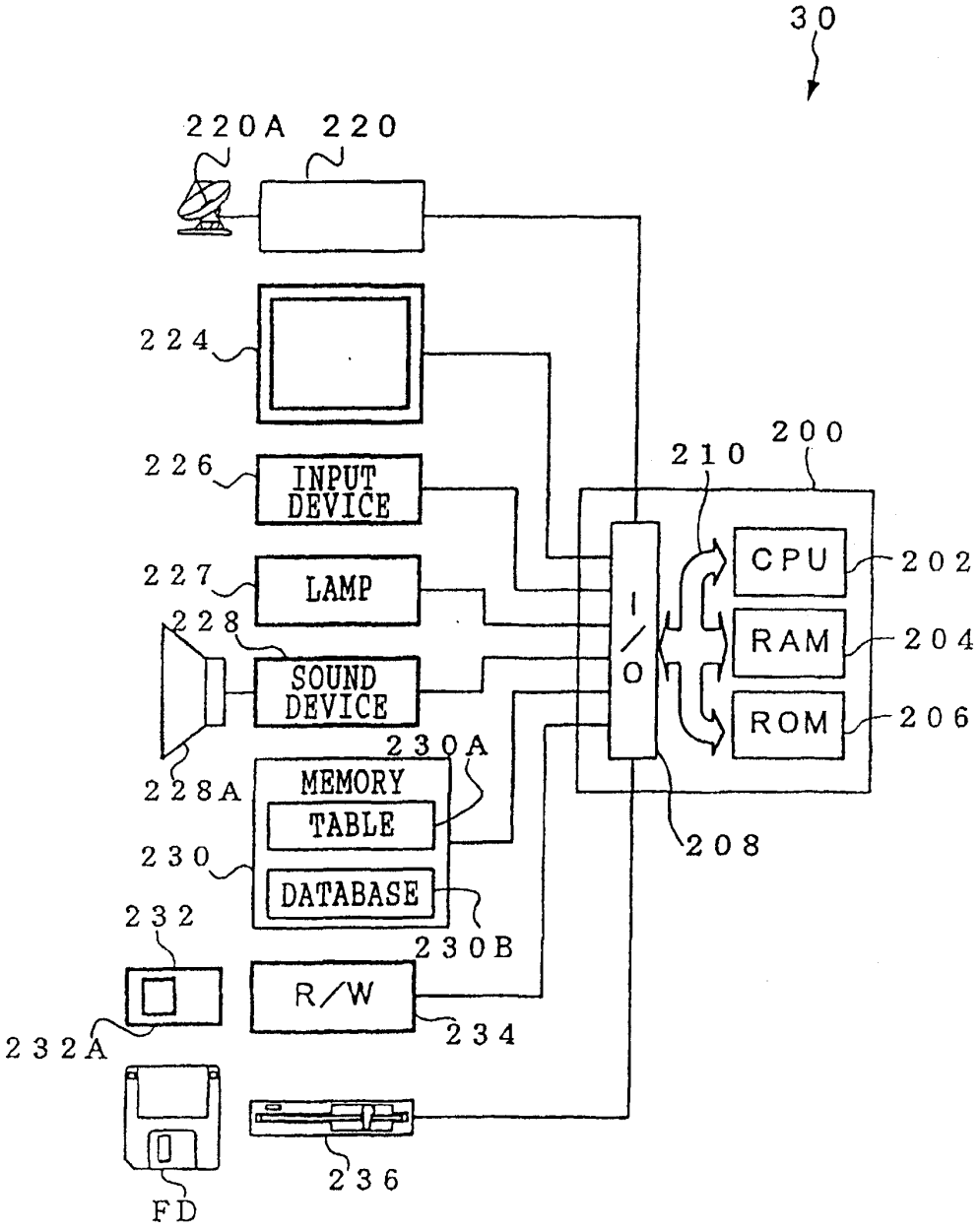
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FIG. 46



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FIG. 47



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FIG. 48A

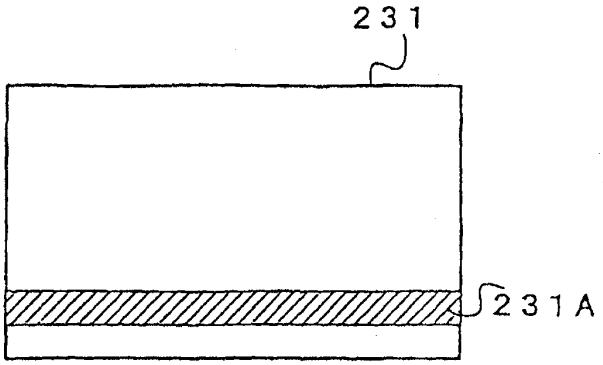
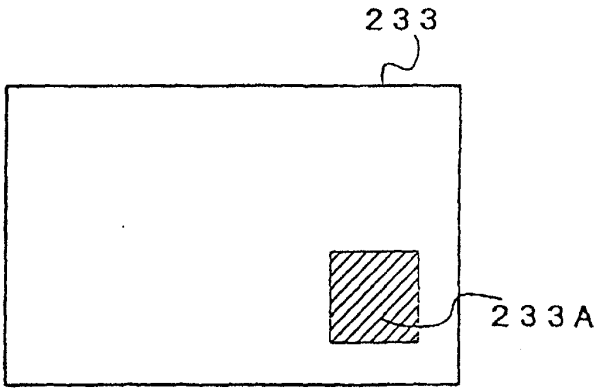


FIG. 48B



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FIG. 49A

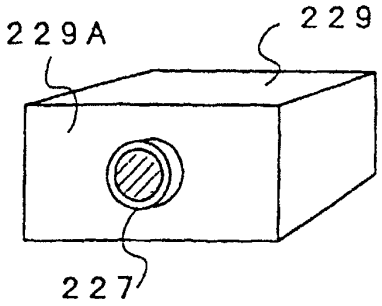


FIG. 49B

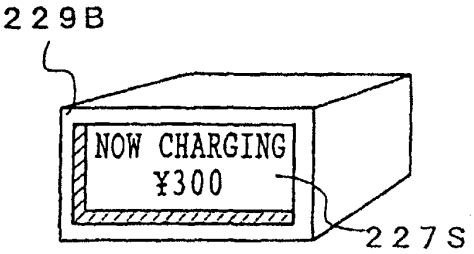
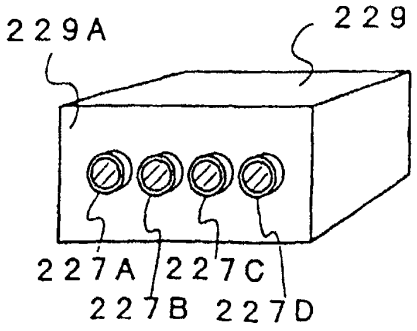
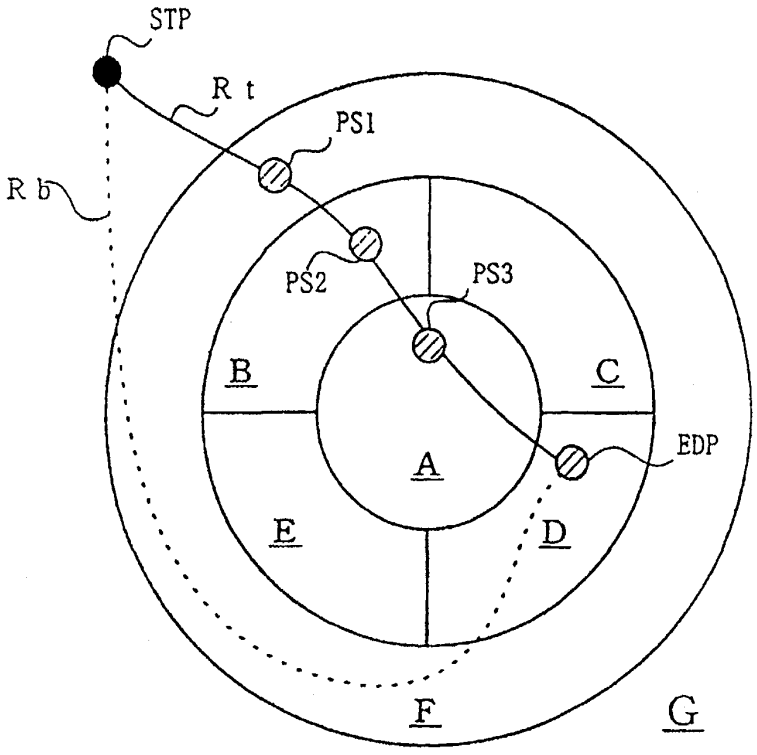


FIG. 49C



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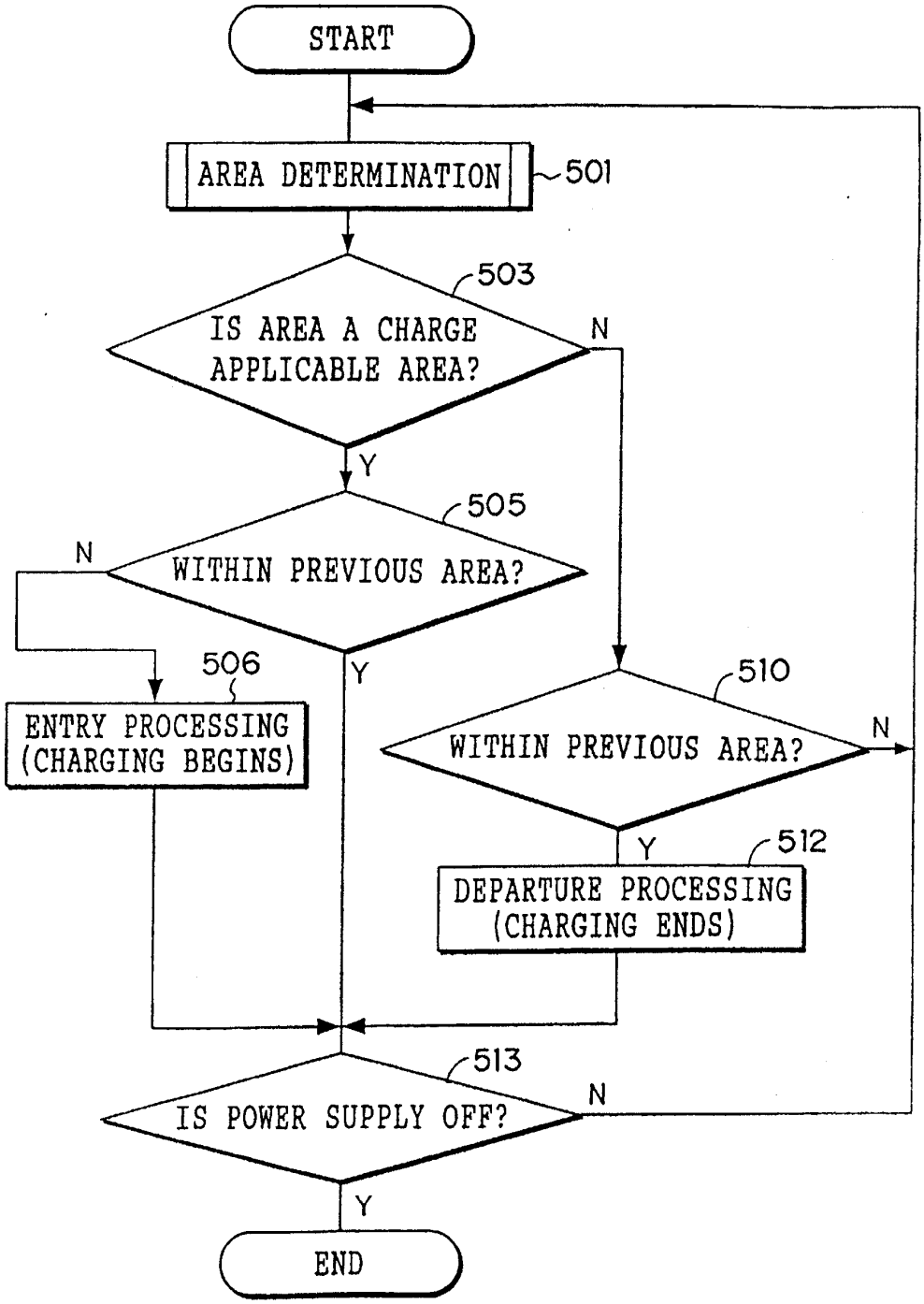
FIG. 50



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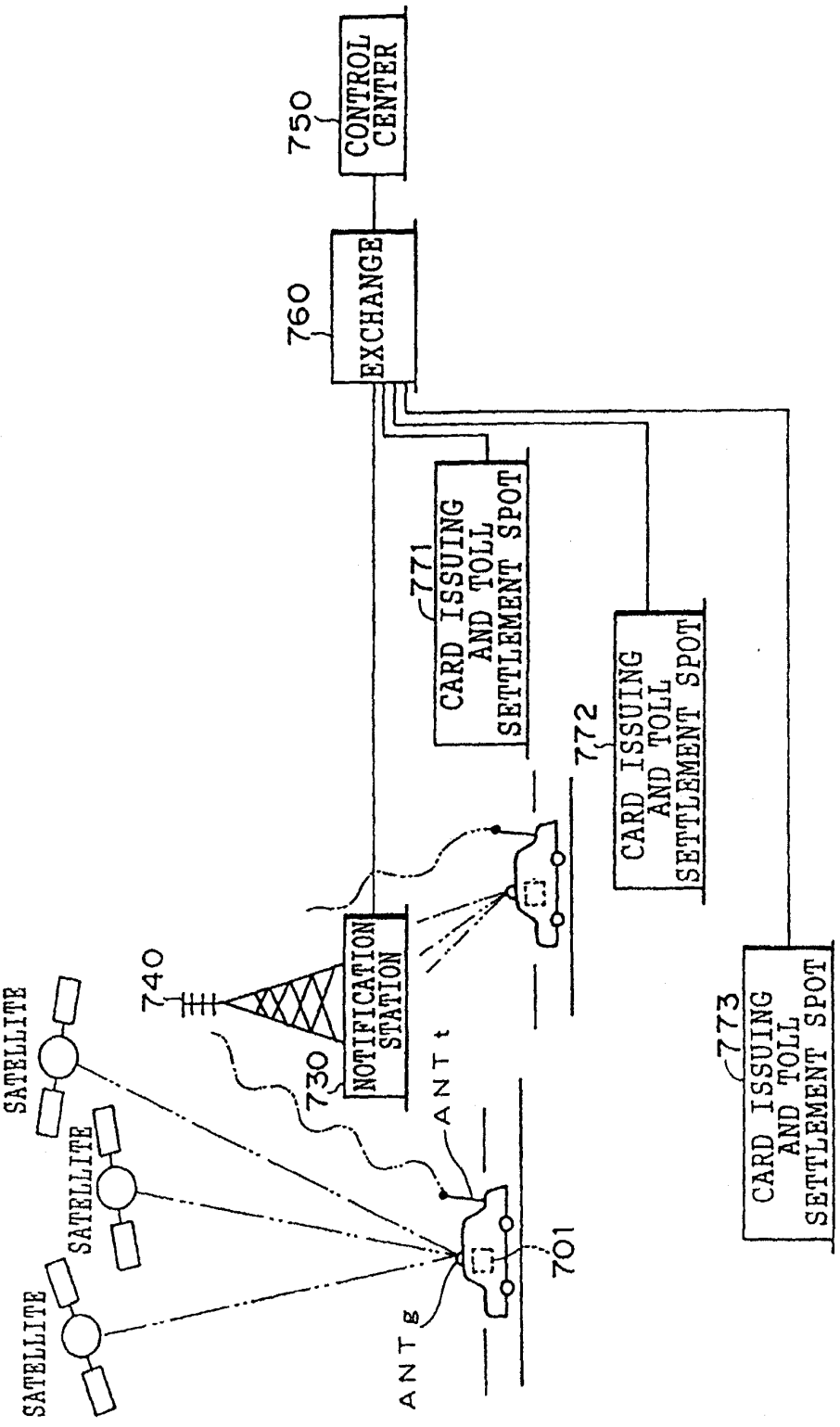
FIG. 51

DEVICE MOUNTED IN VEHICLE PROCESSING FLOW



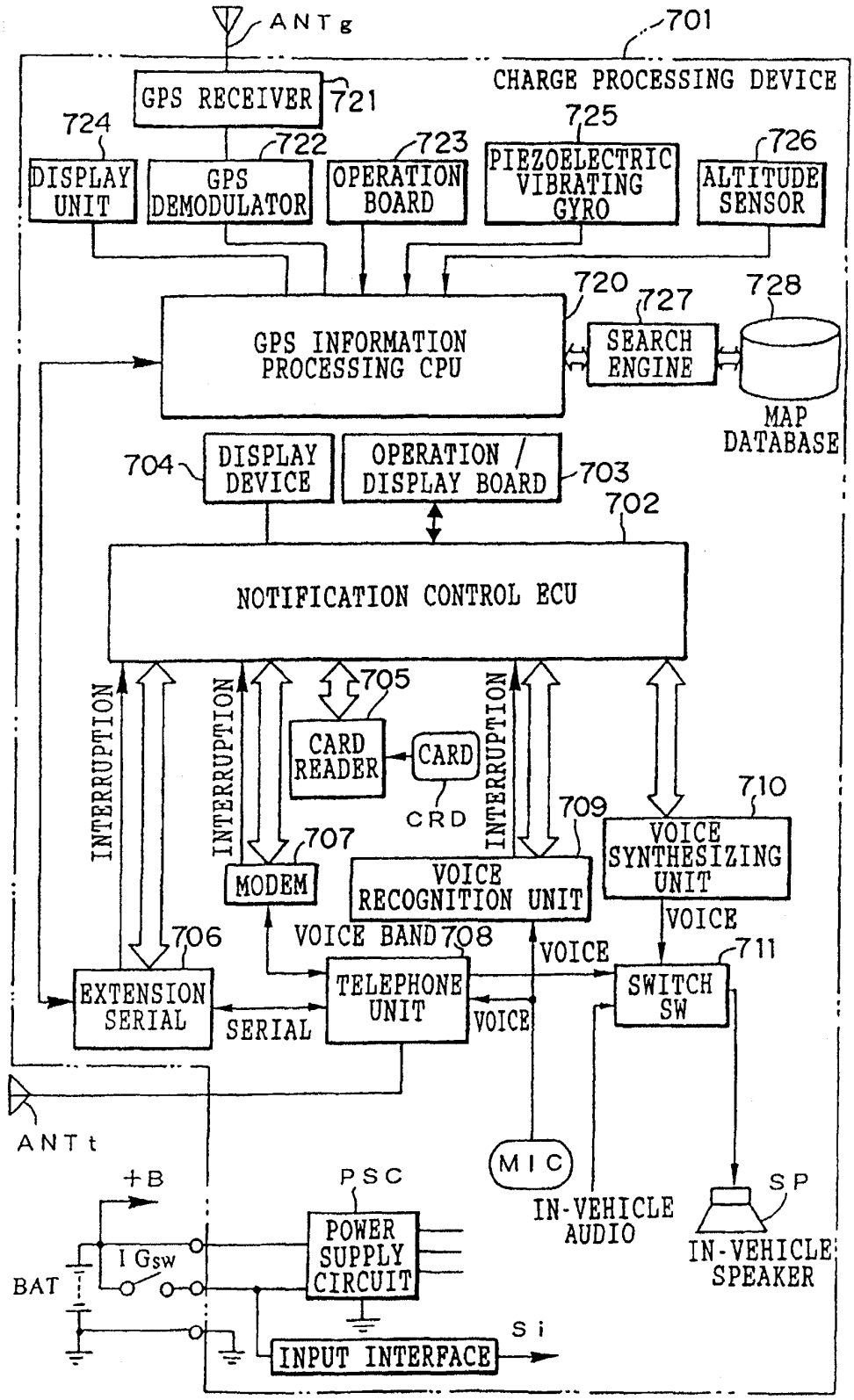
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FIG. 52



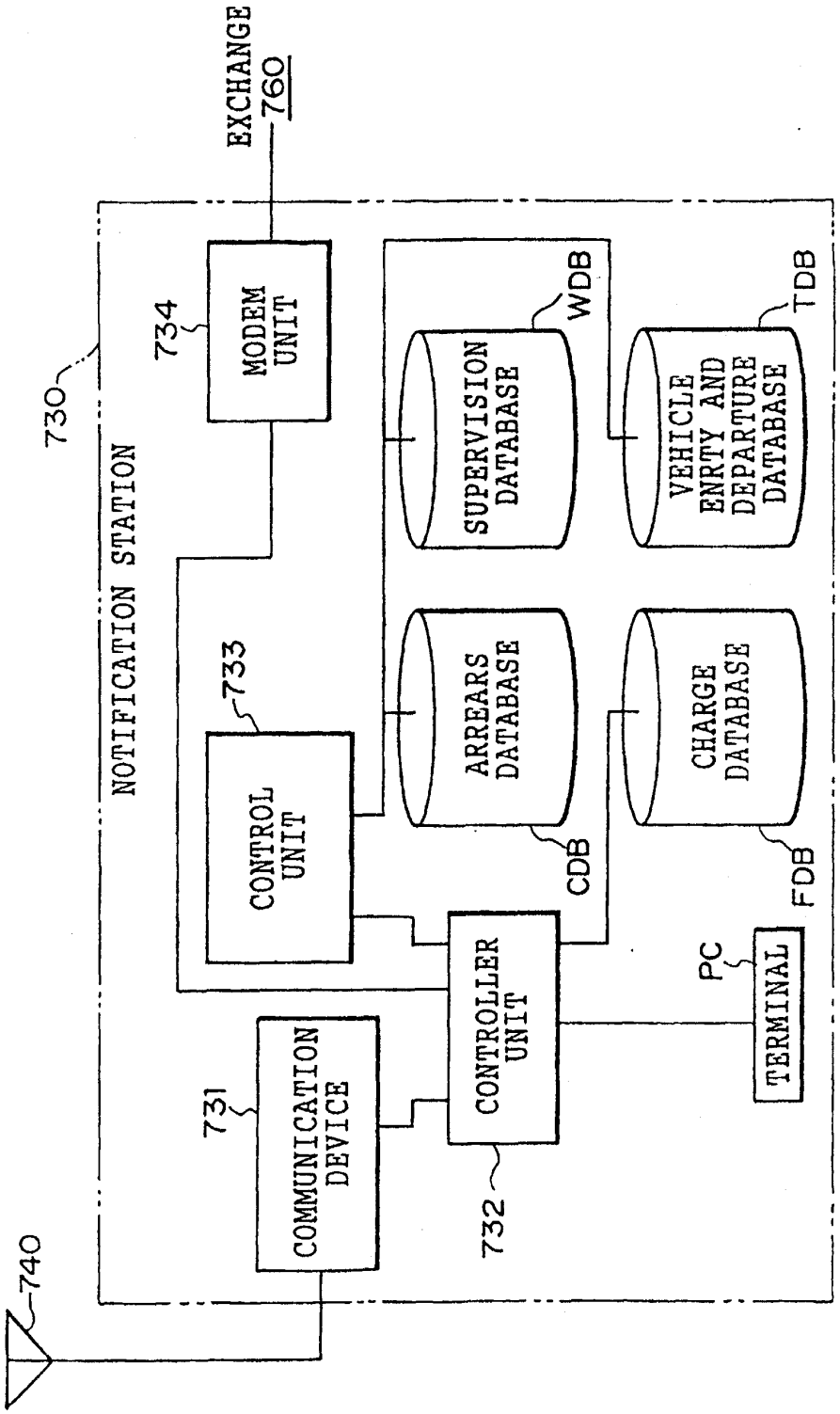
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FIG. 53



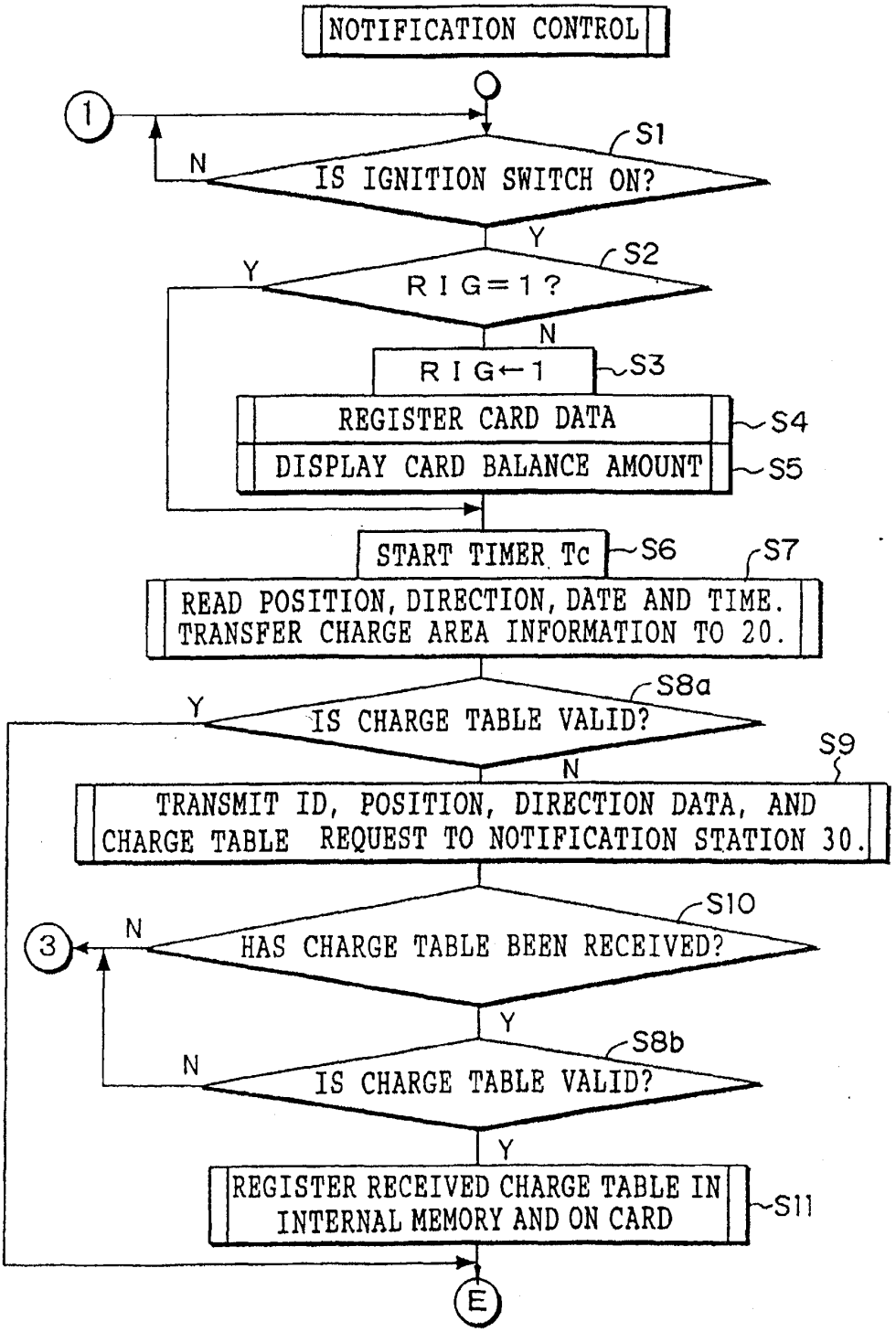
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FIG. 54



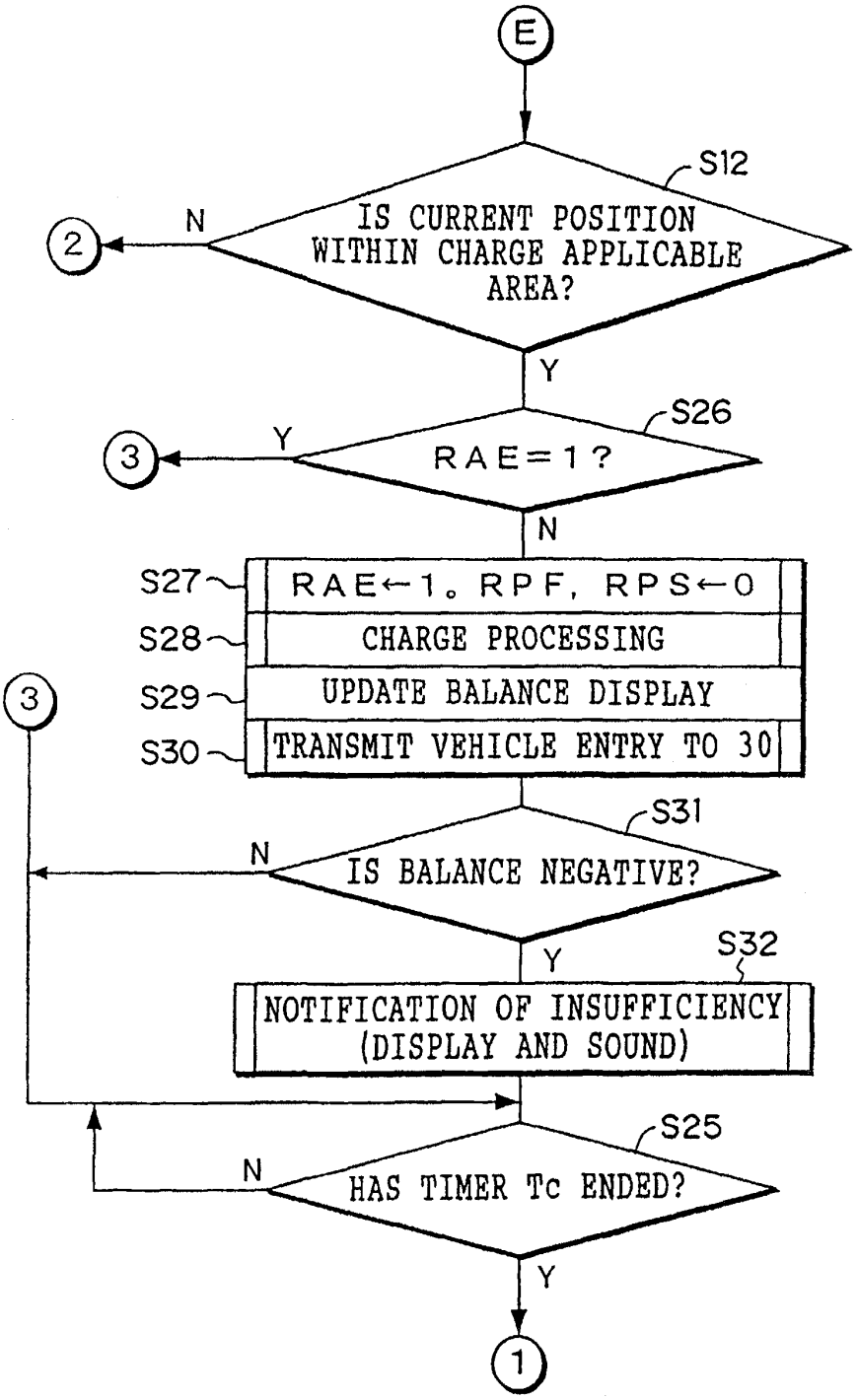
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FIG. 55



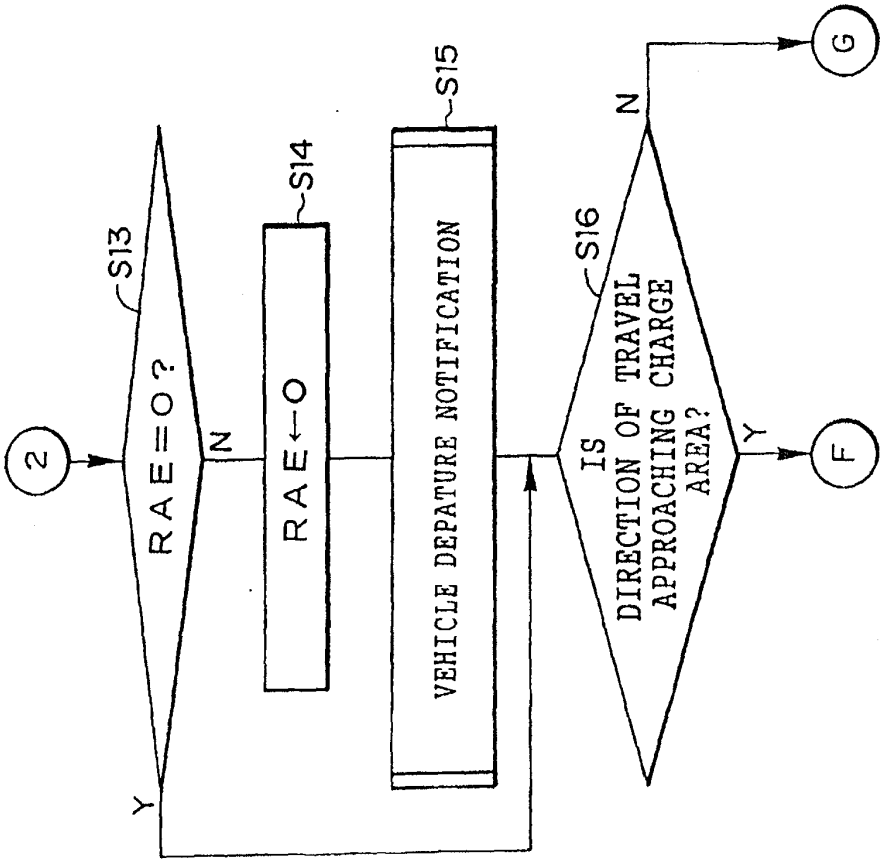
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FIG. 55 (CONTINUED)



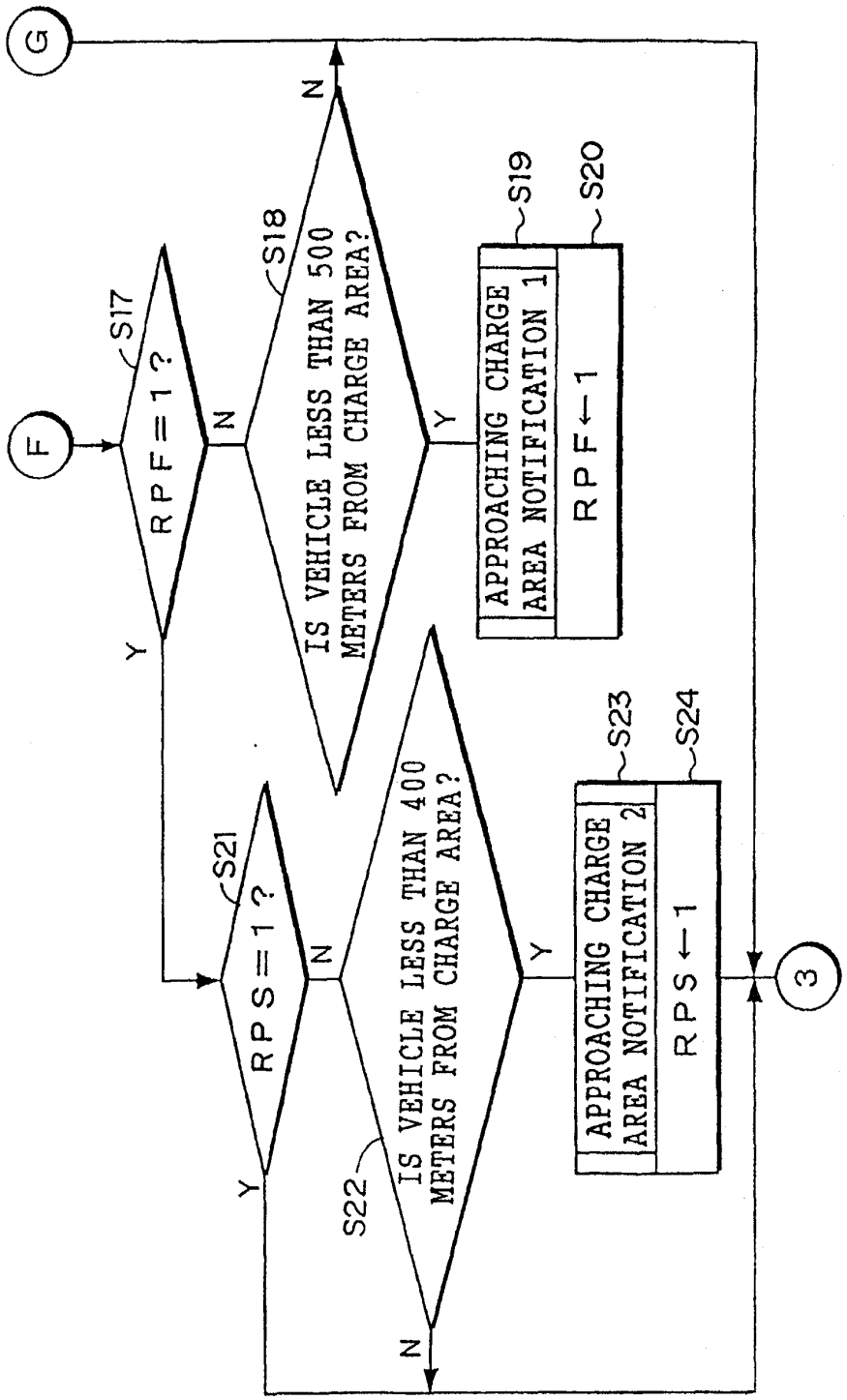
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FIG. 56



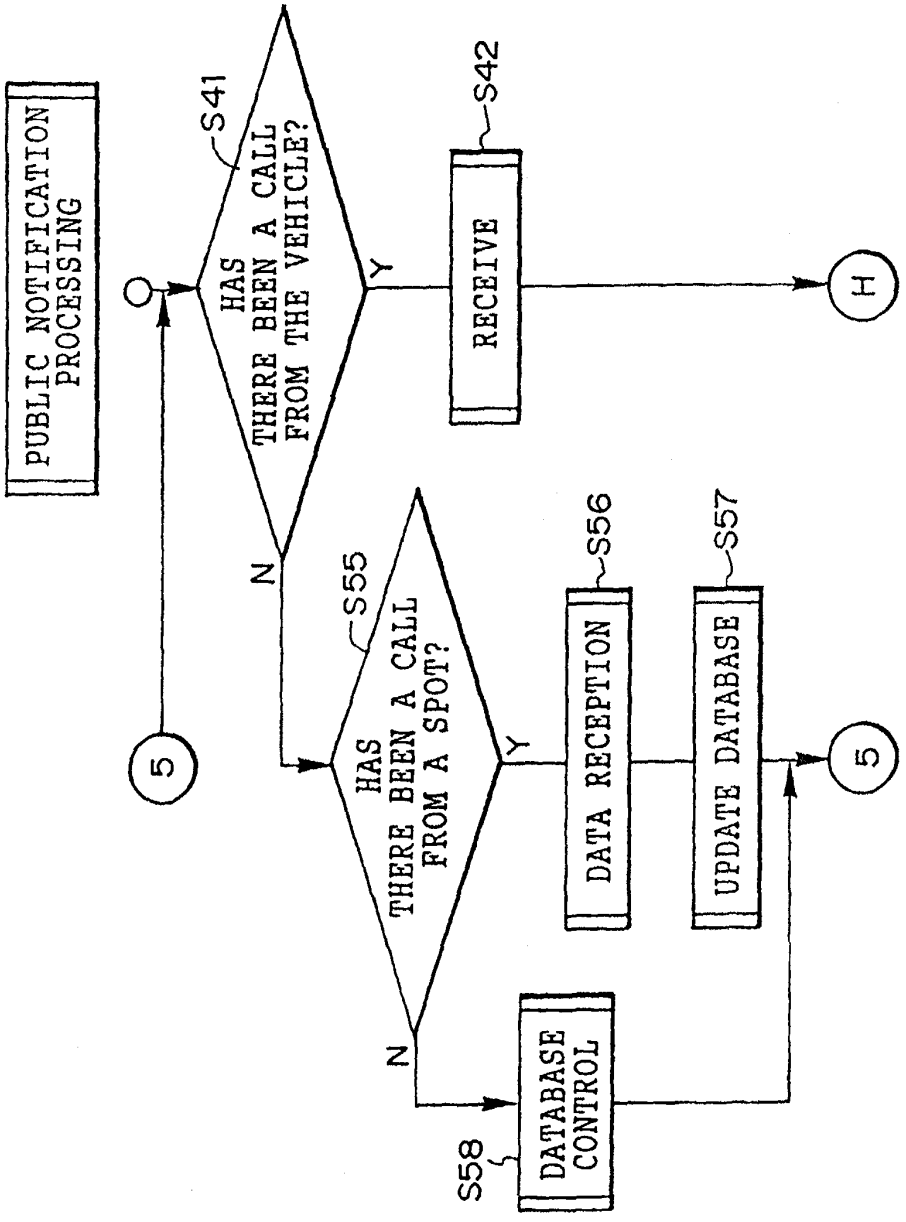
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FIG. 56 (CONTINUED)



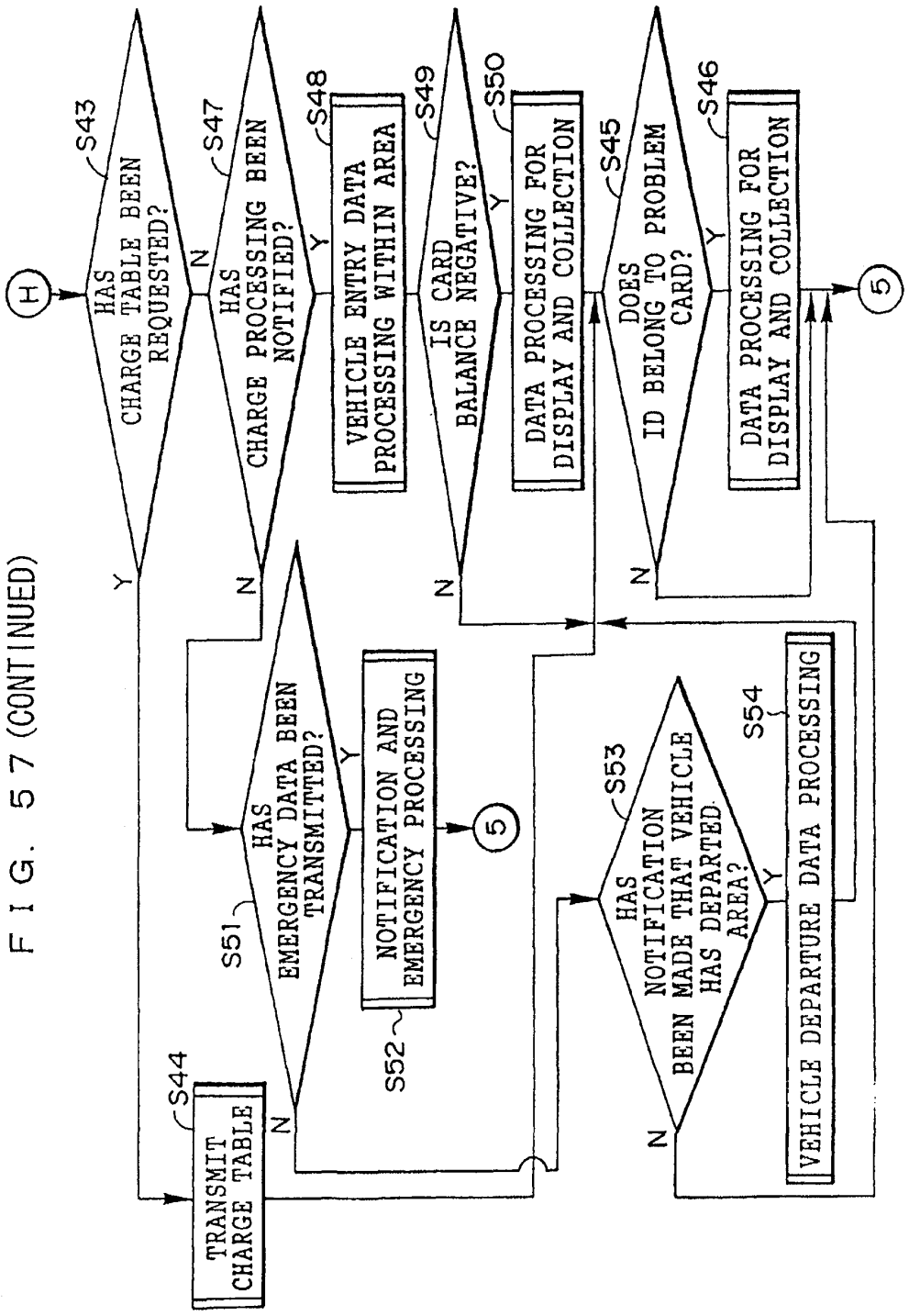
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FIG. 57



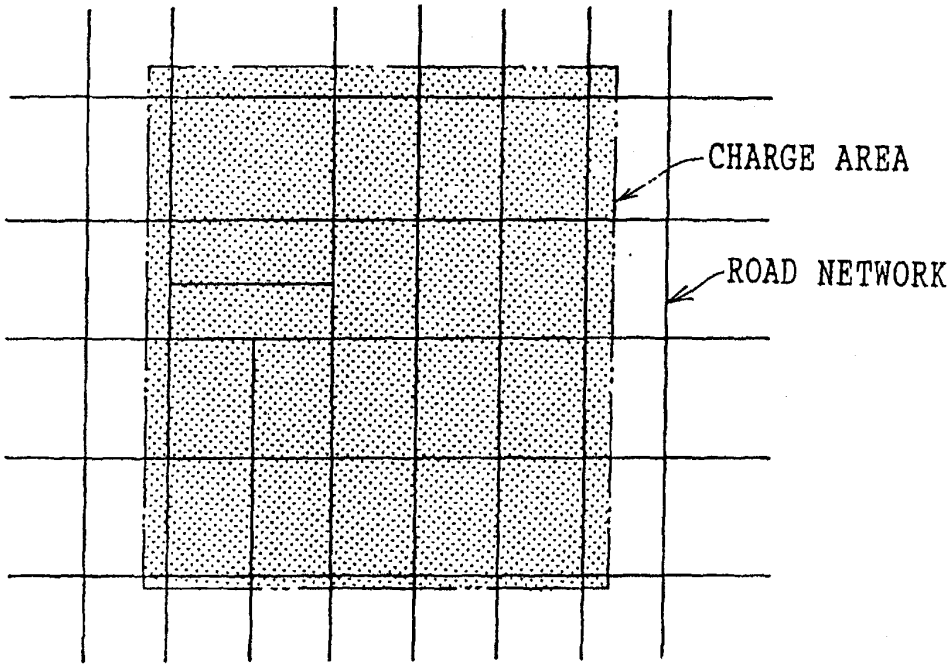
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FIG. 57 (CONTINUED)



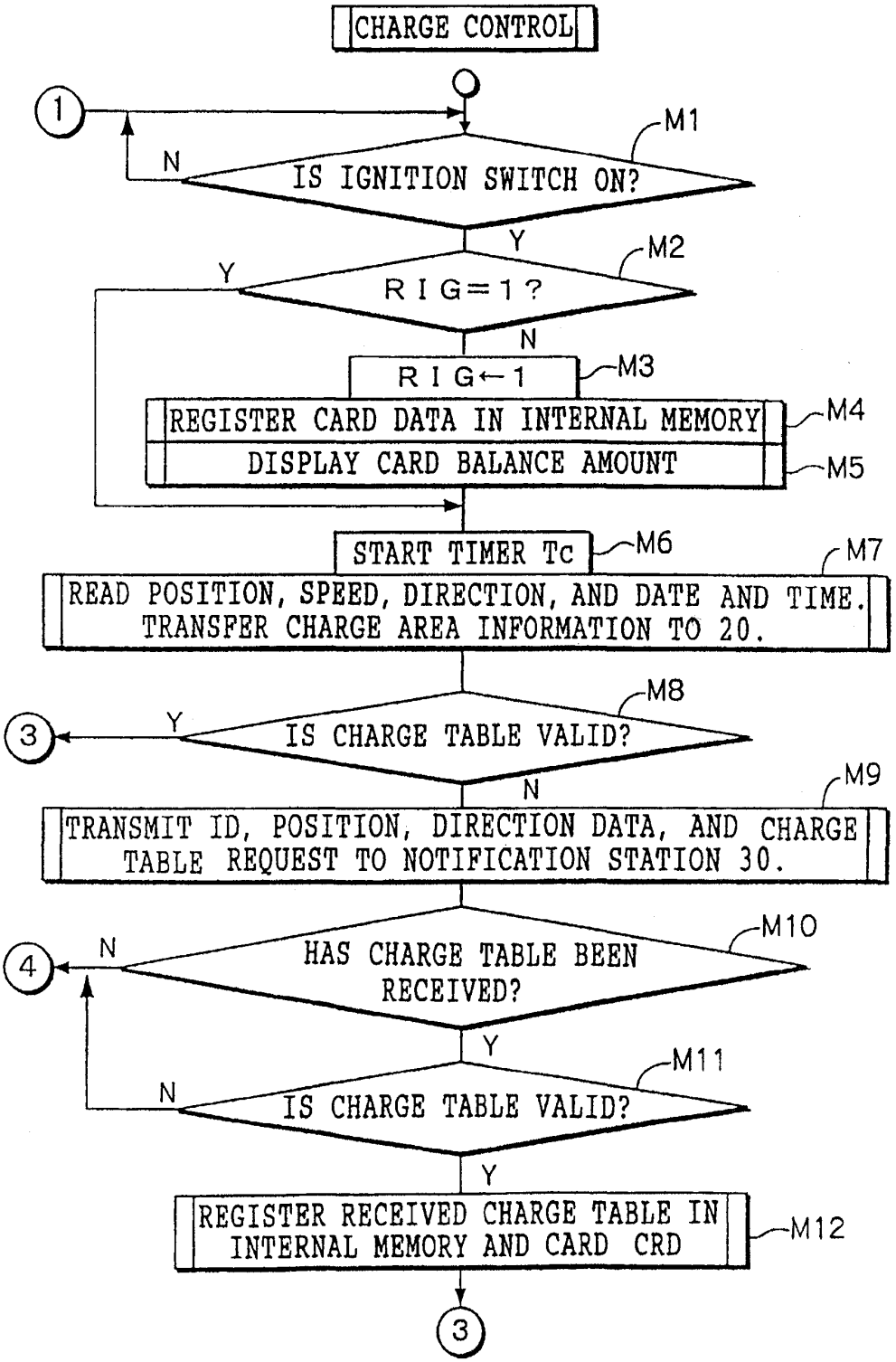
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FIG. 58



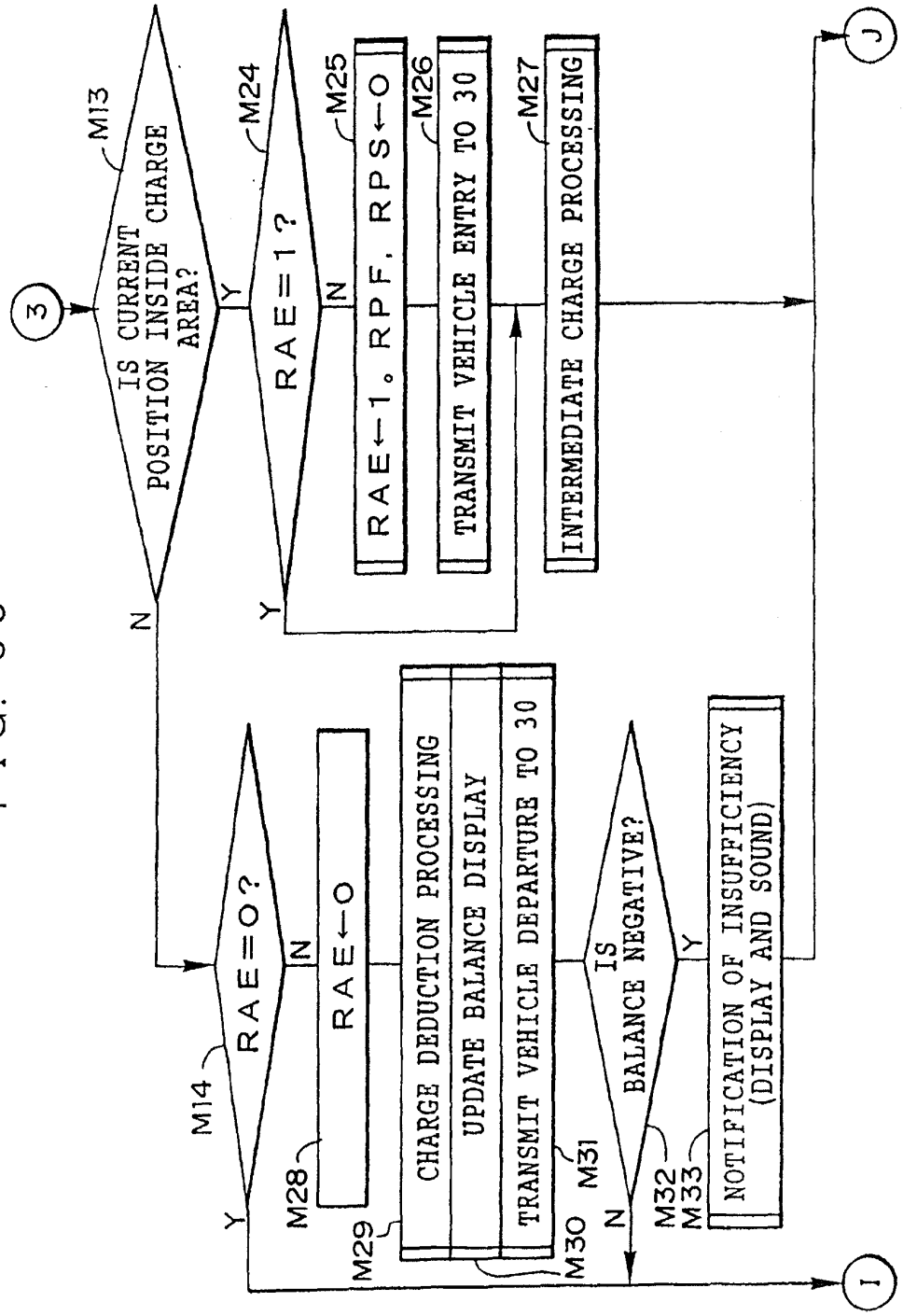
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FIG. 59



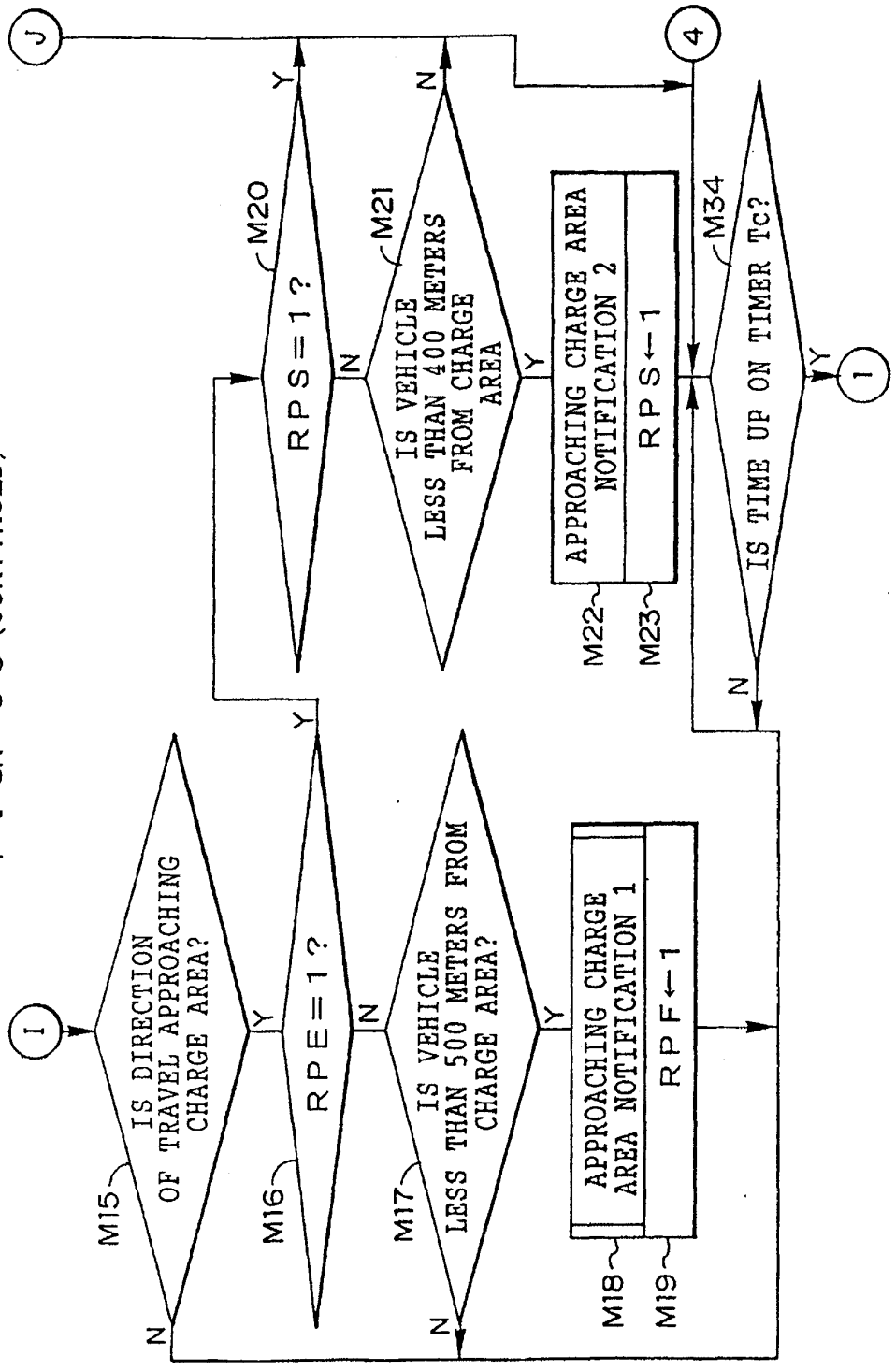
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FIG. 60



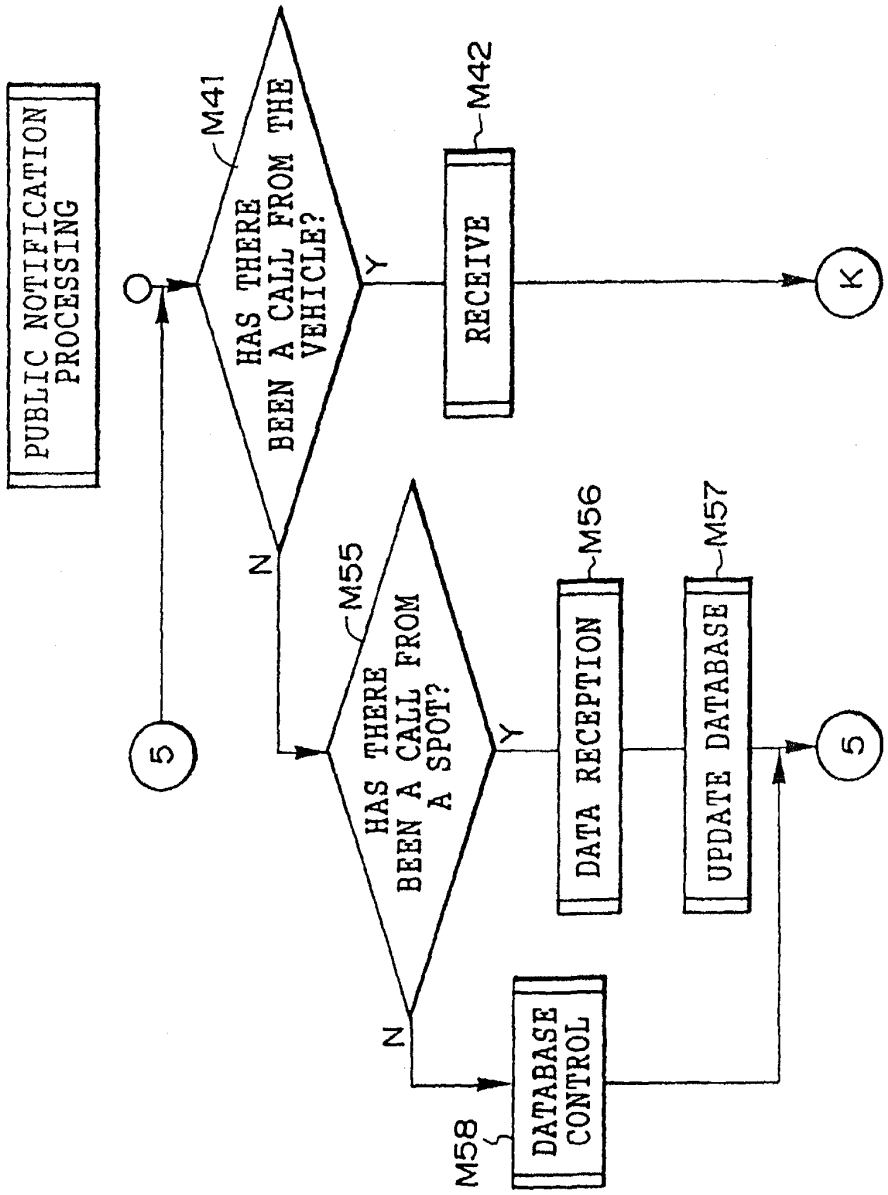
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FIG. 60 (CONTINUED)



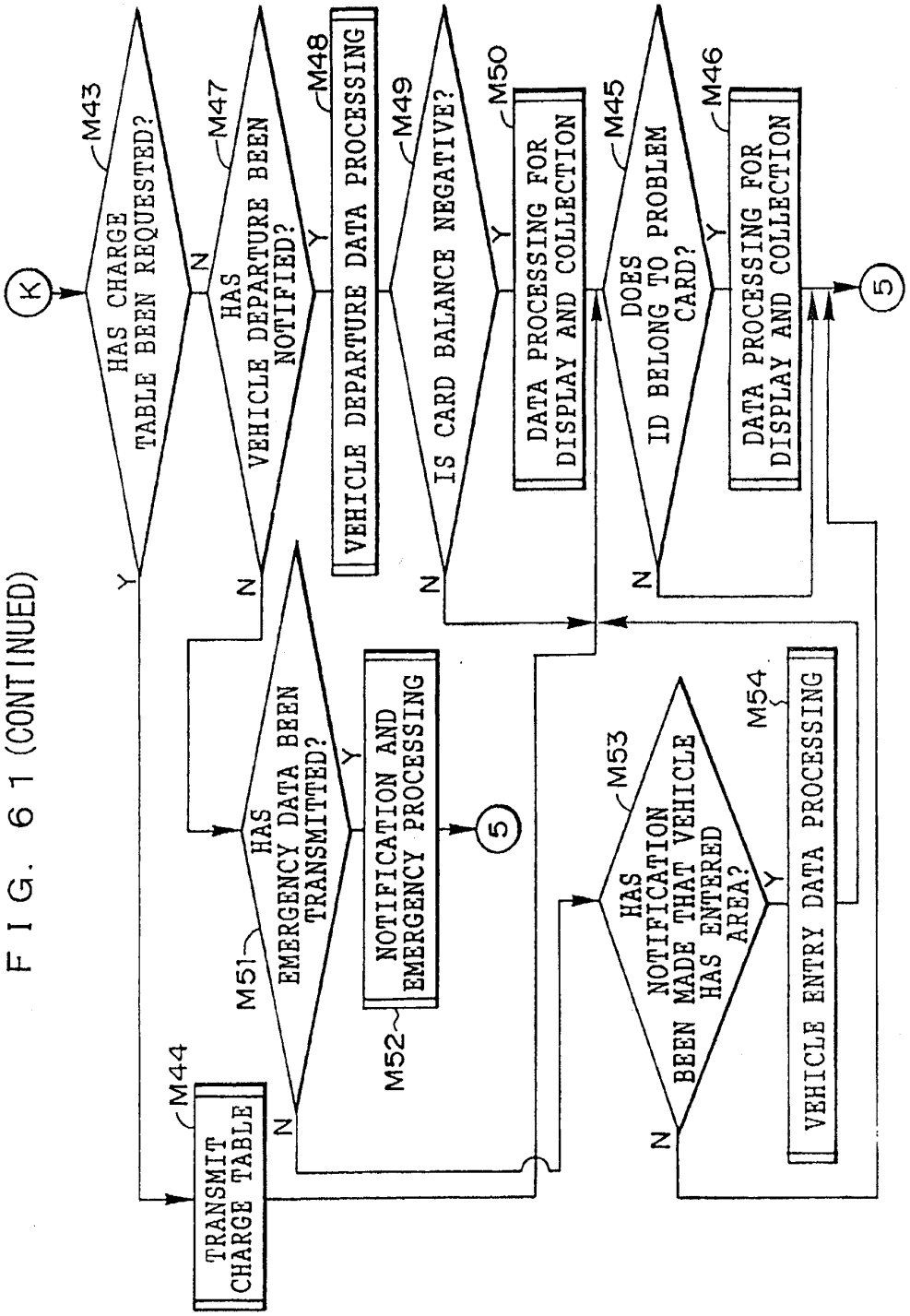
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FIG. 61



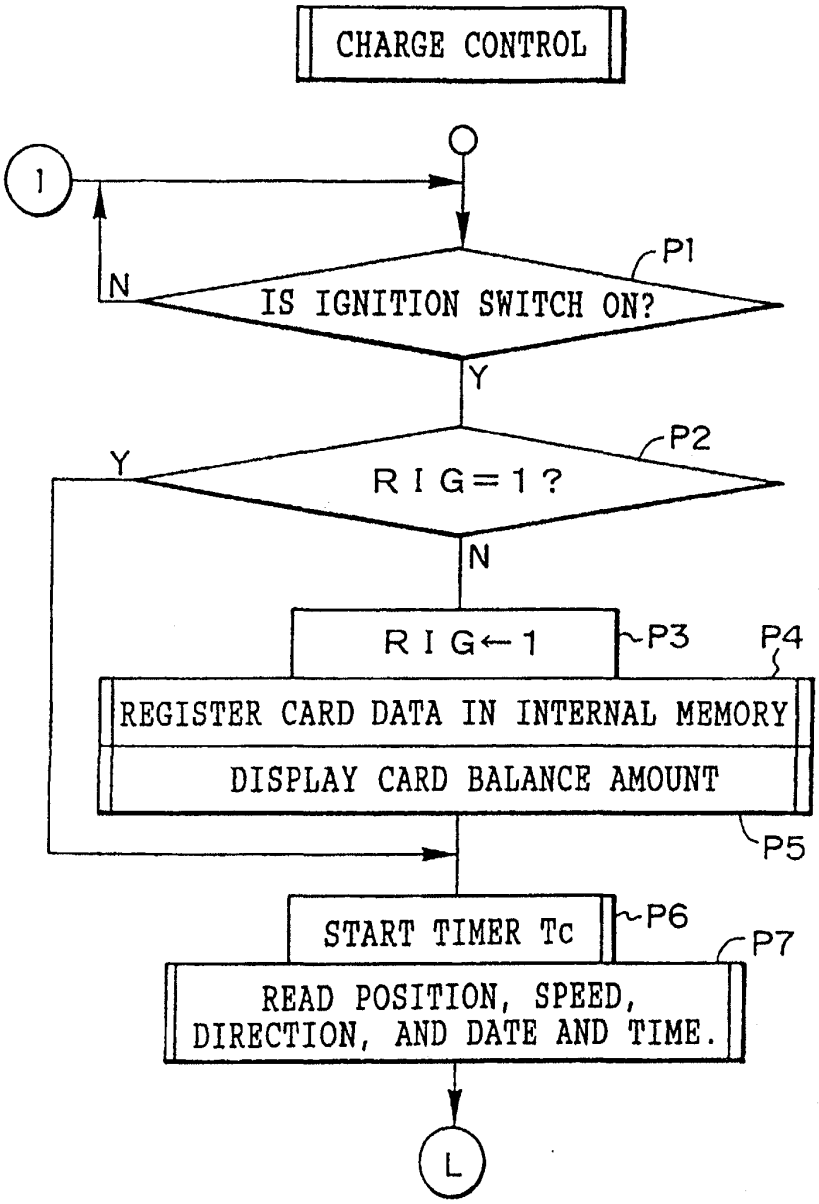
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FIG. 61 (CONTINUED)



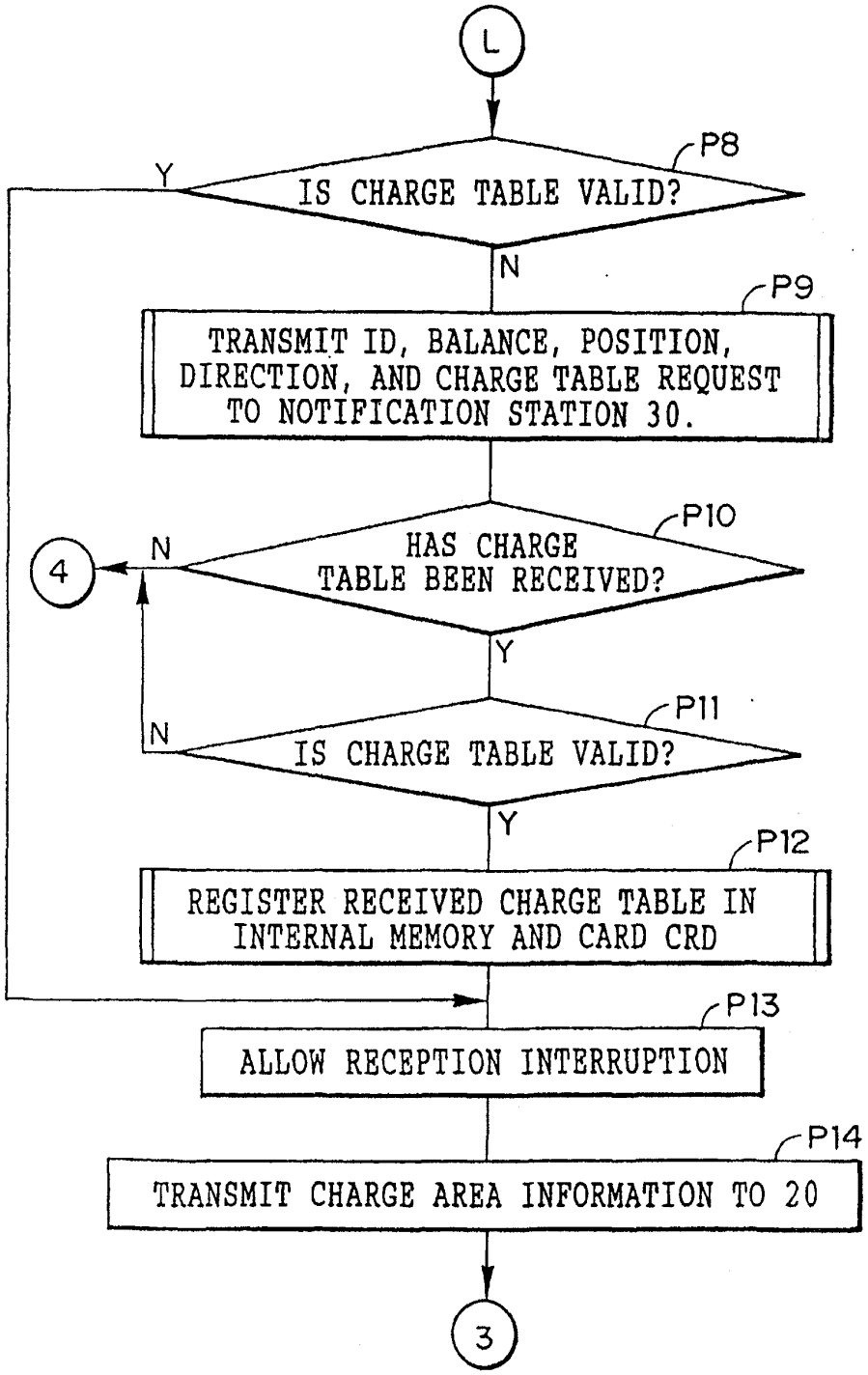
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FIG. 62



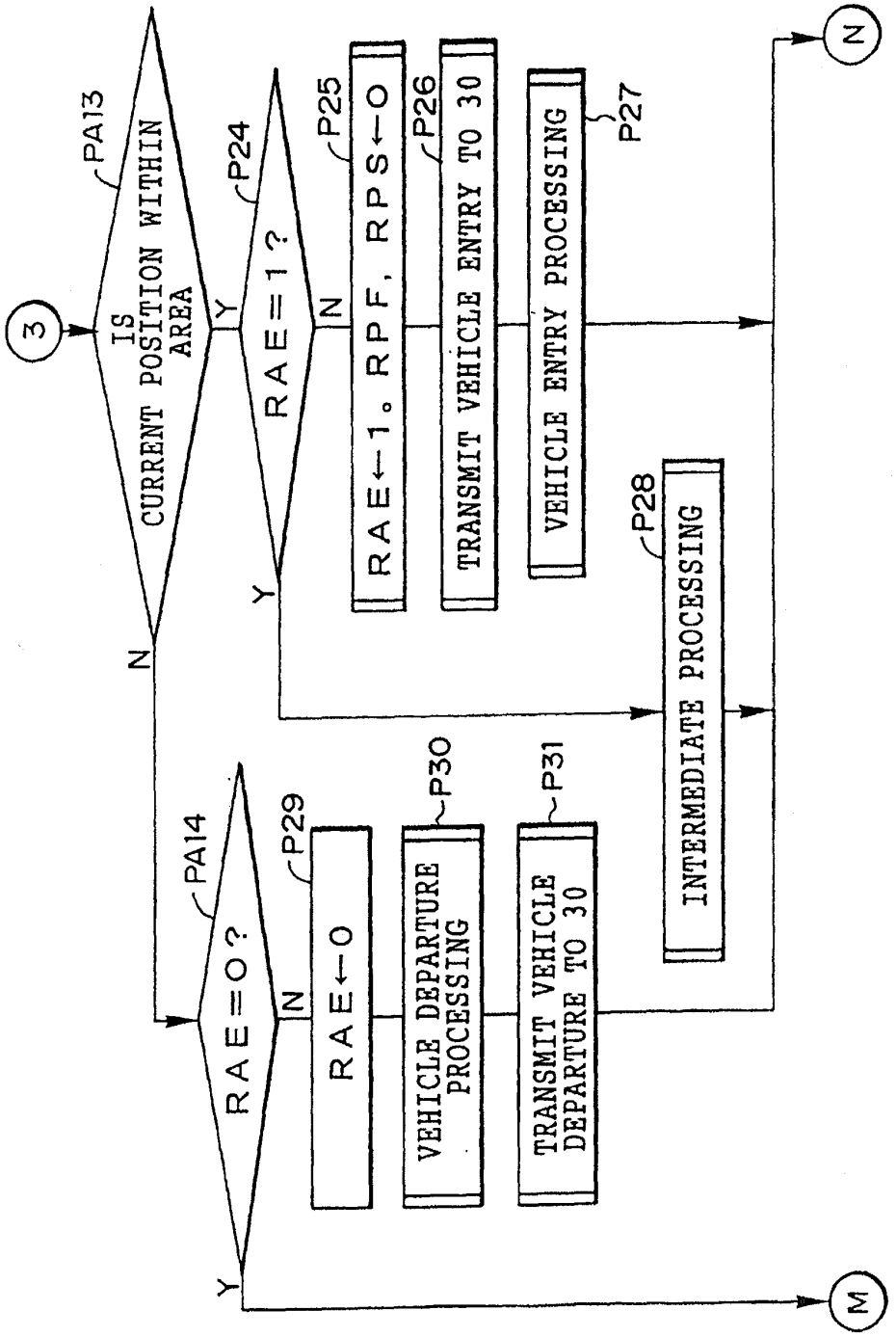
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FIG. 62 (CONTINUED)



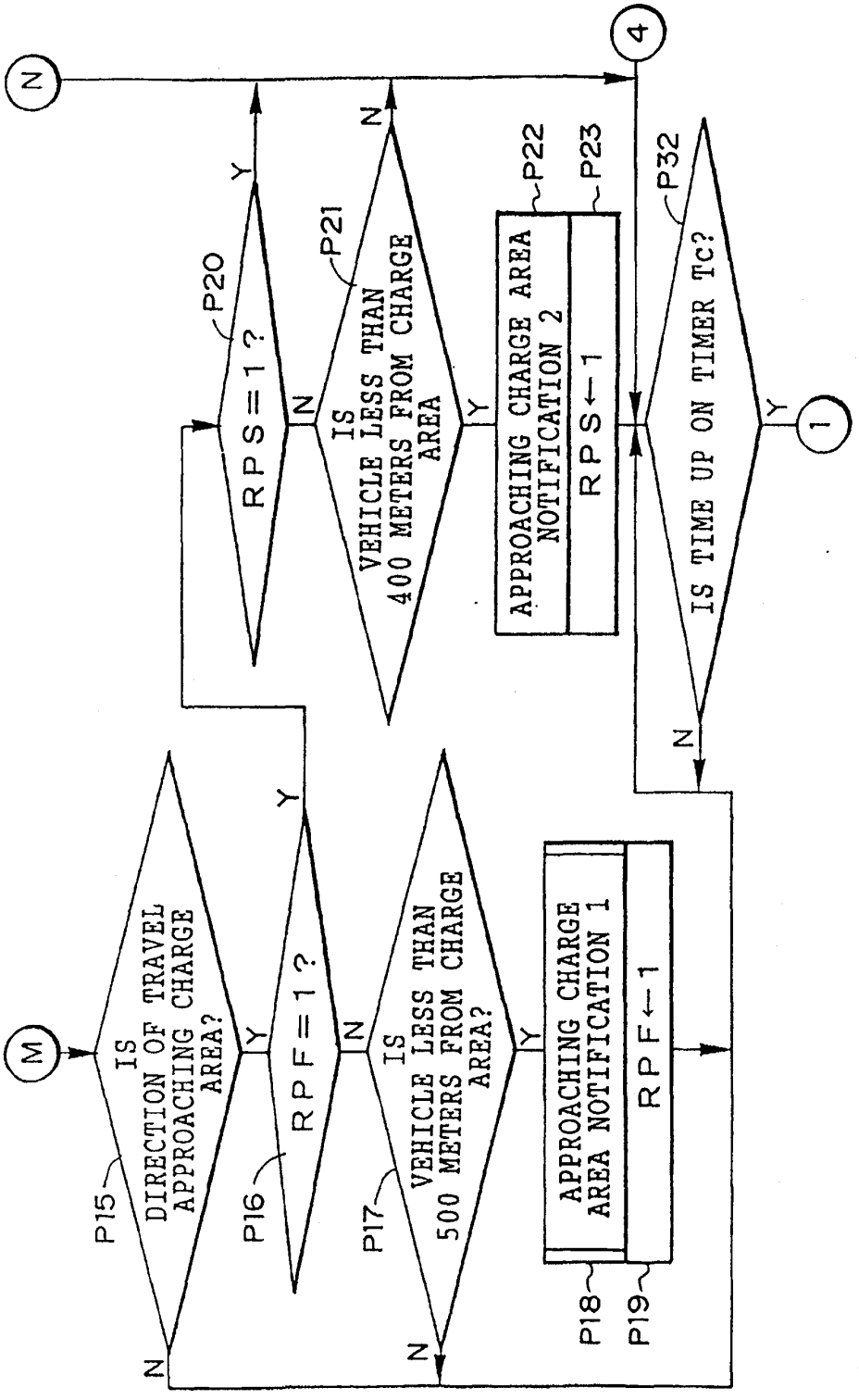
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FIG. 63



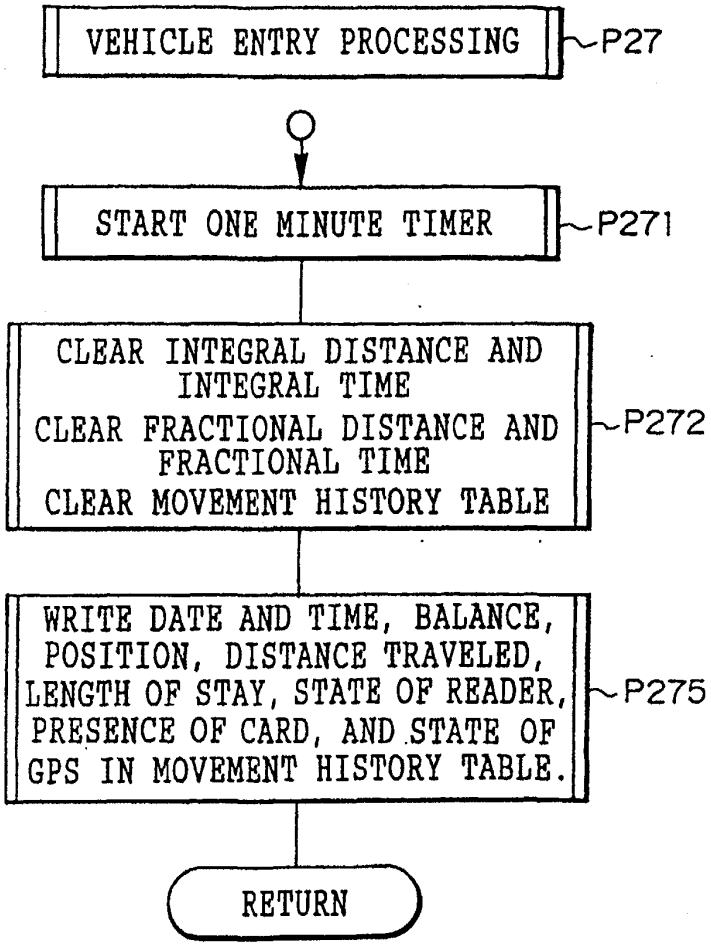
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FIG. 63 (CONTINUED)



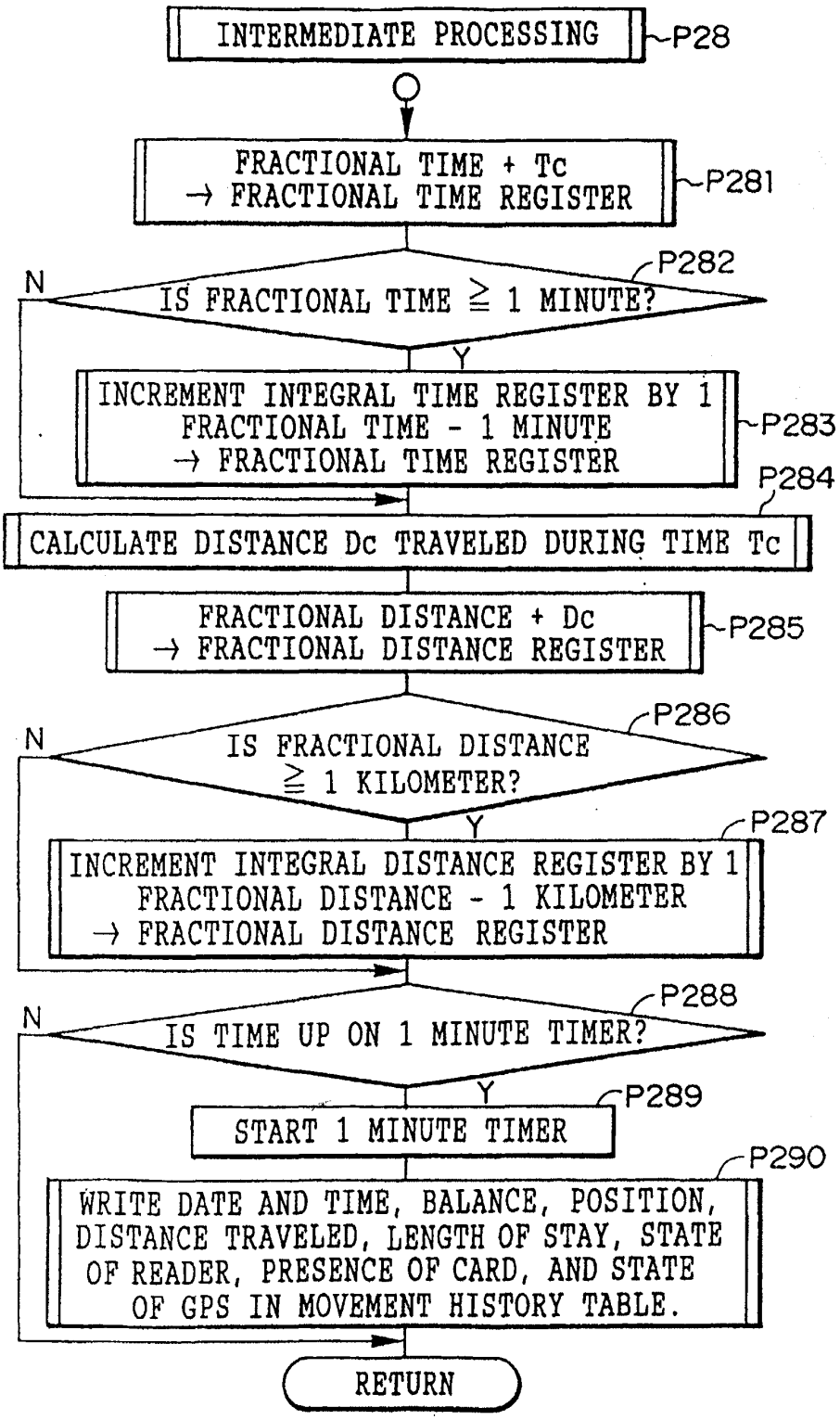
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FIG. 64



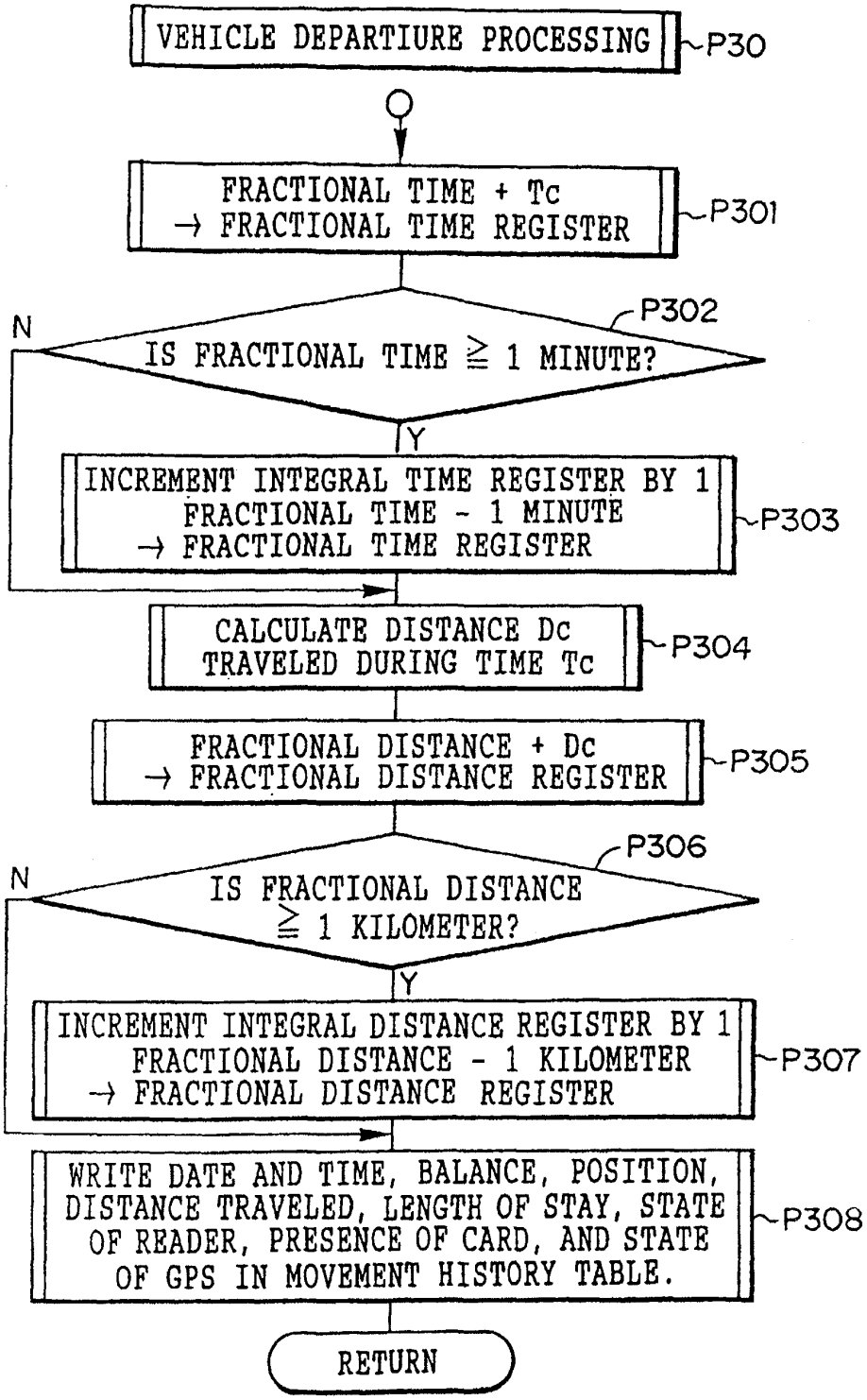
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FIG. 65



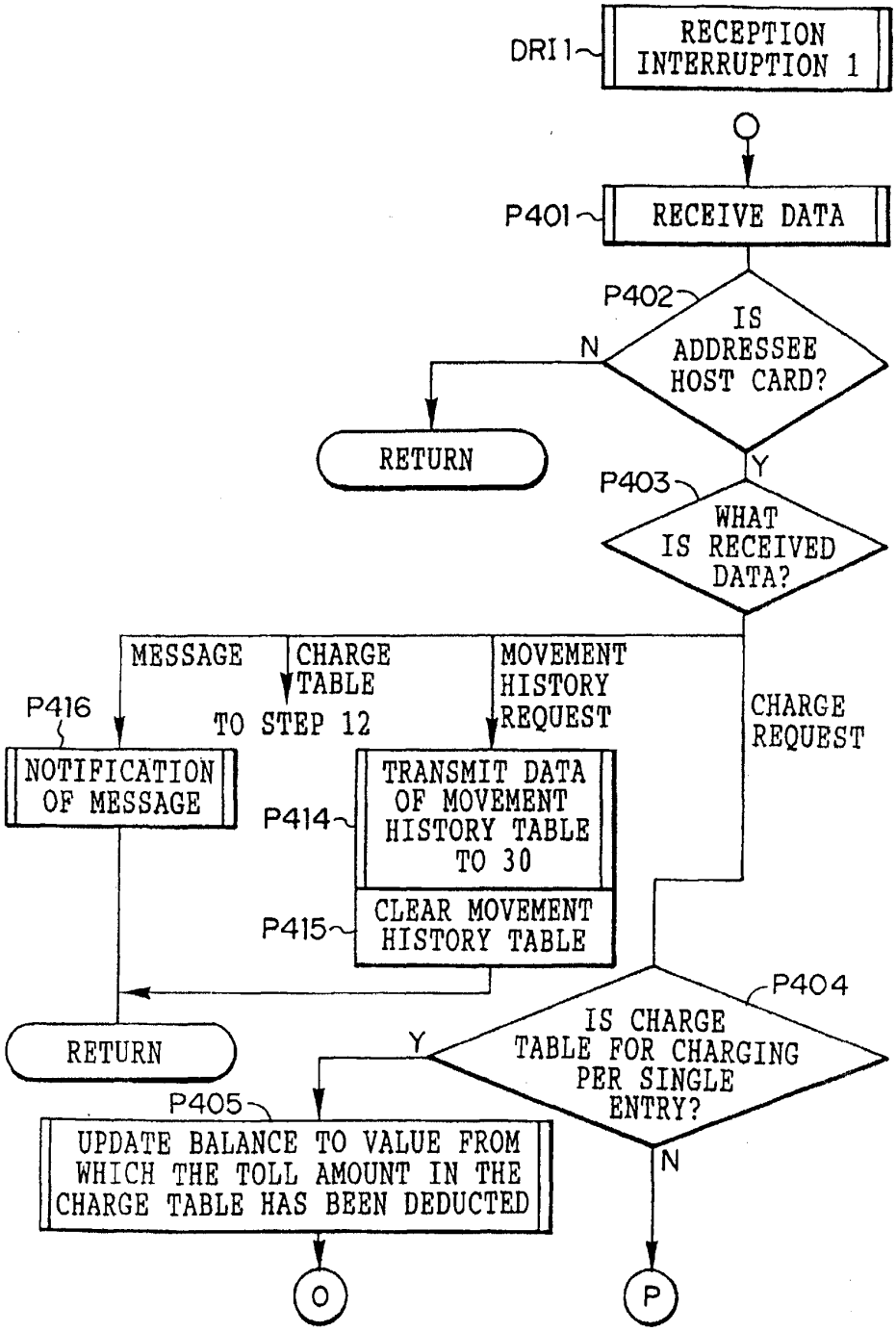
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FIG. 66



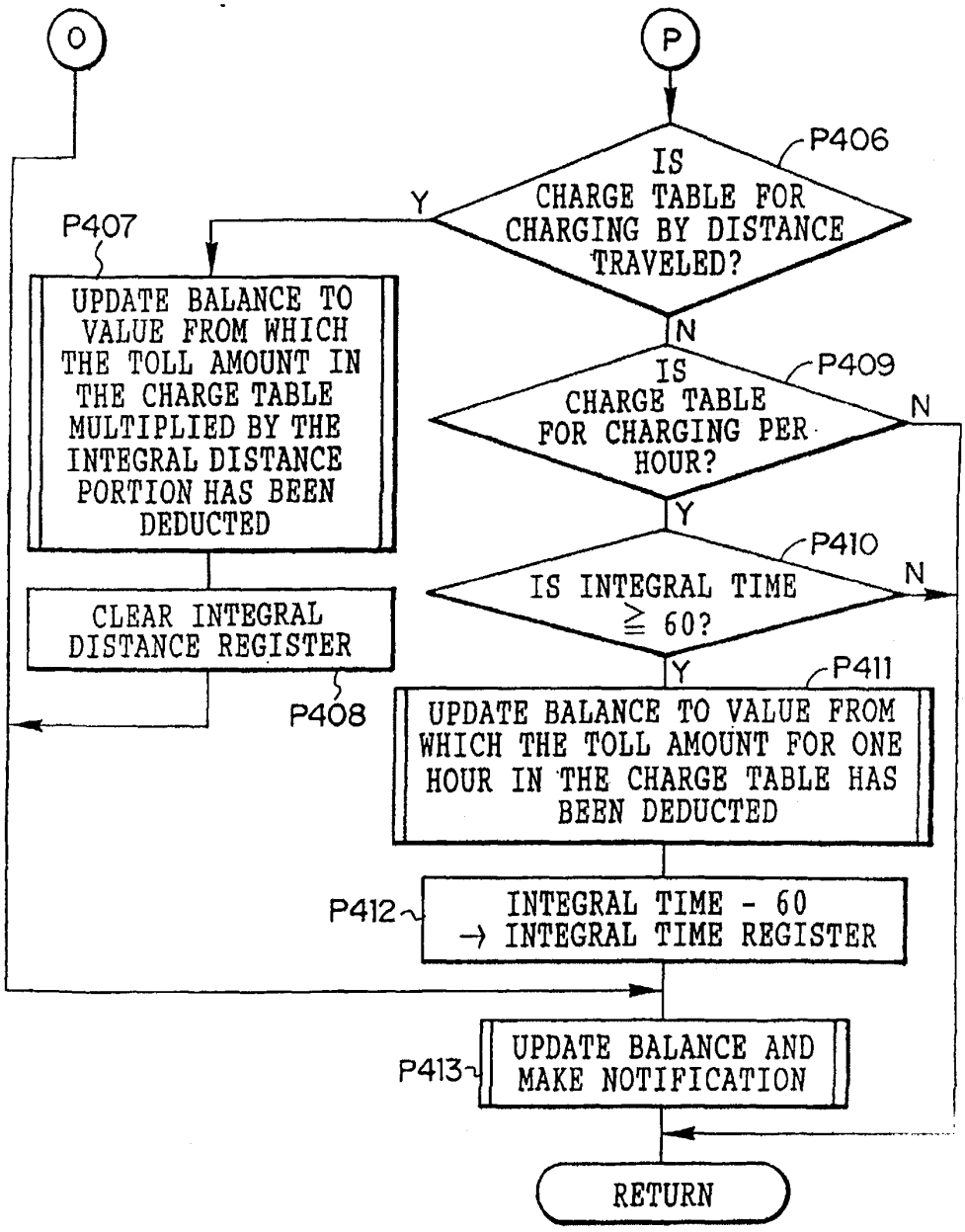
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FIG. 67



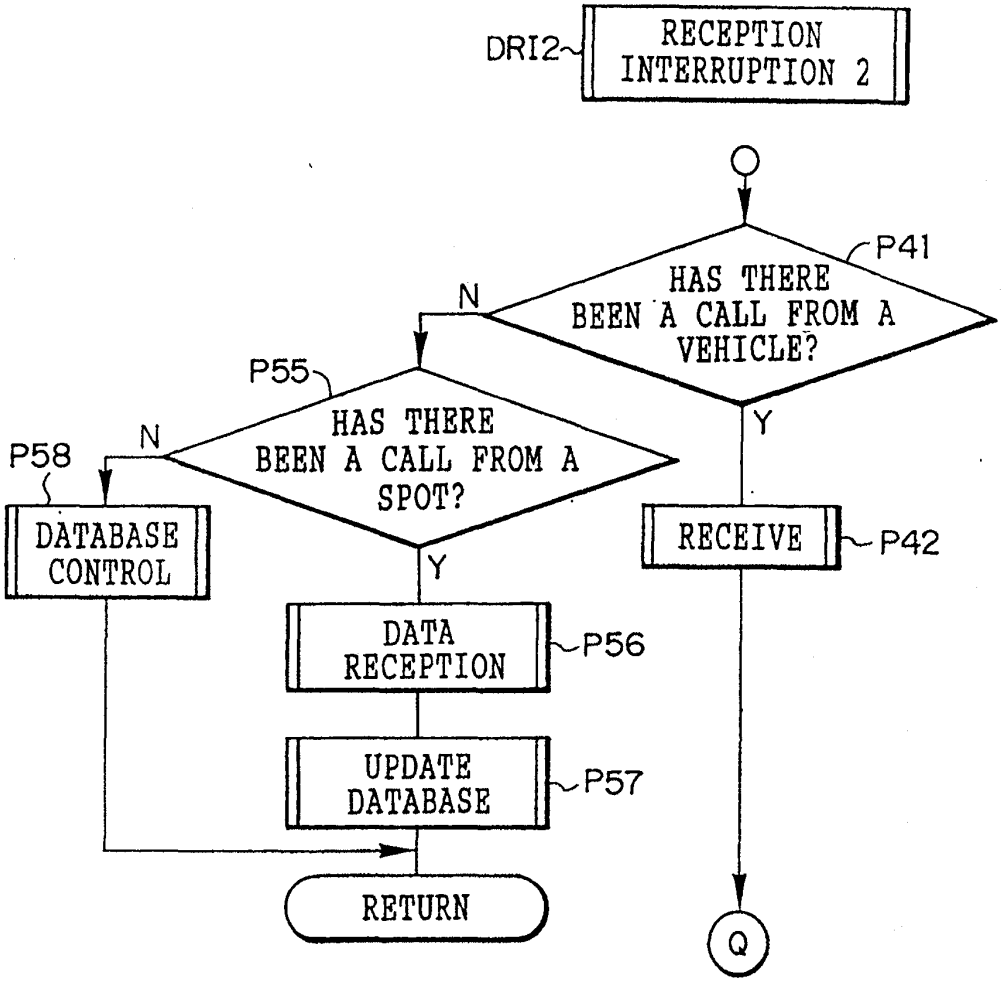
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FIG. 67 (CONTINUED)



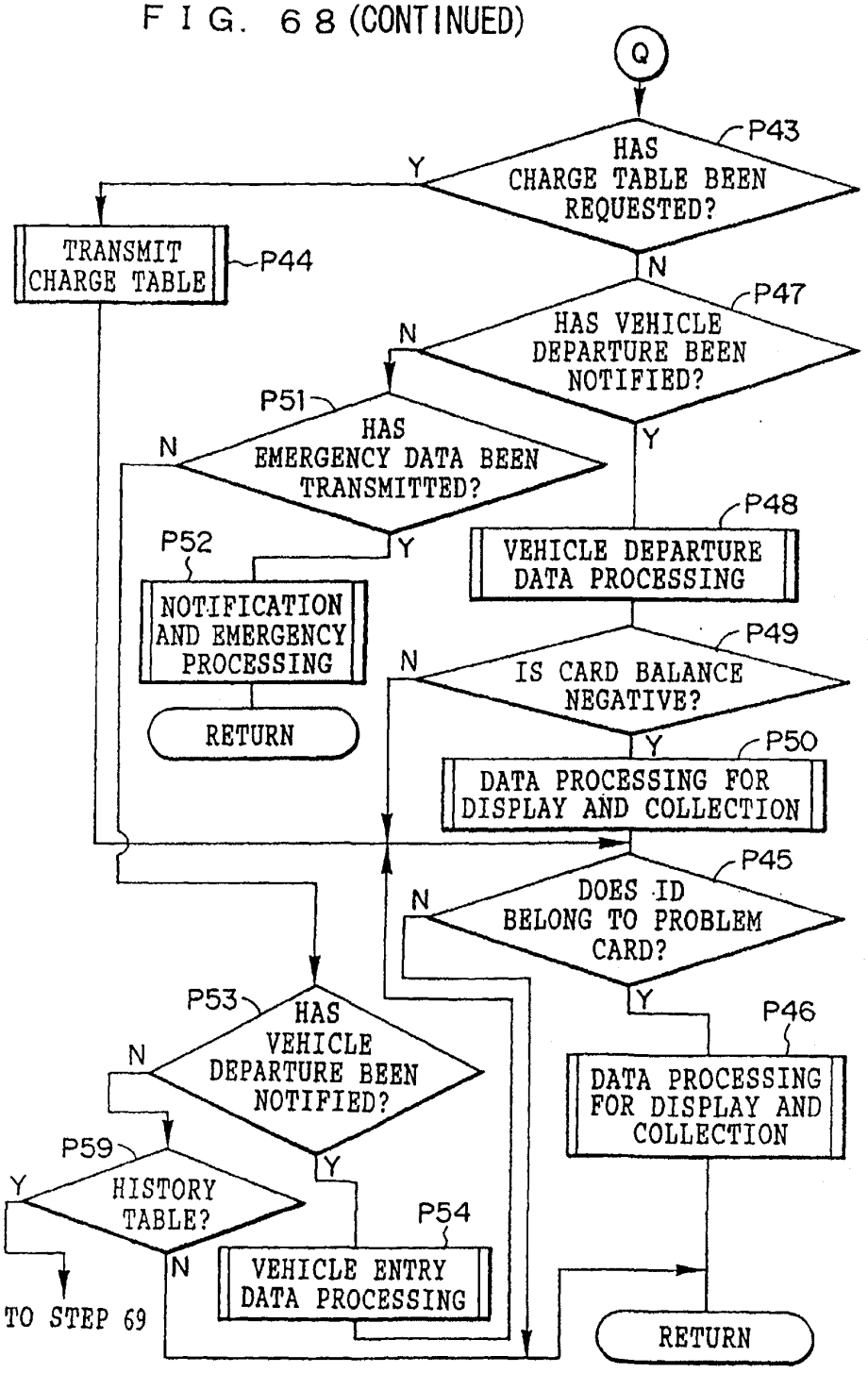
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FIG. 68



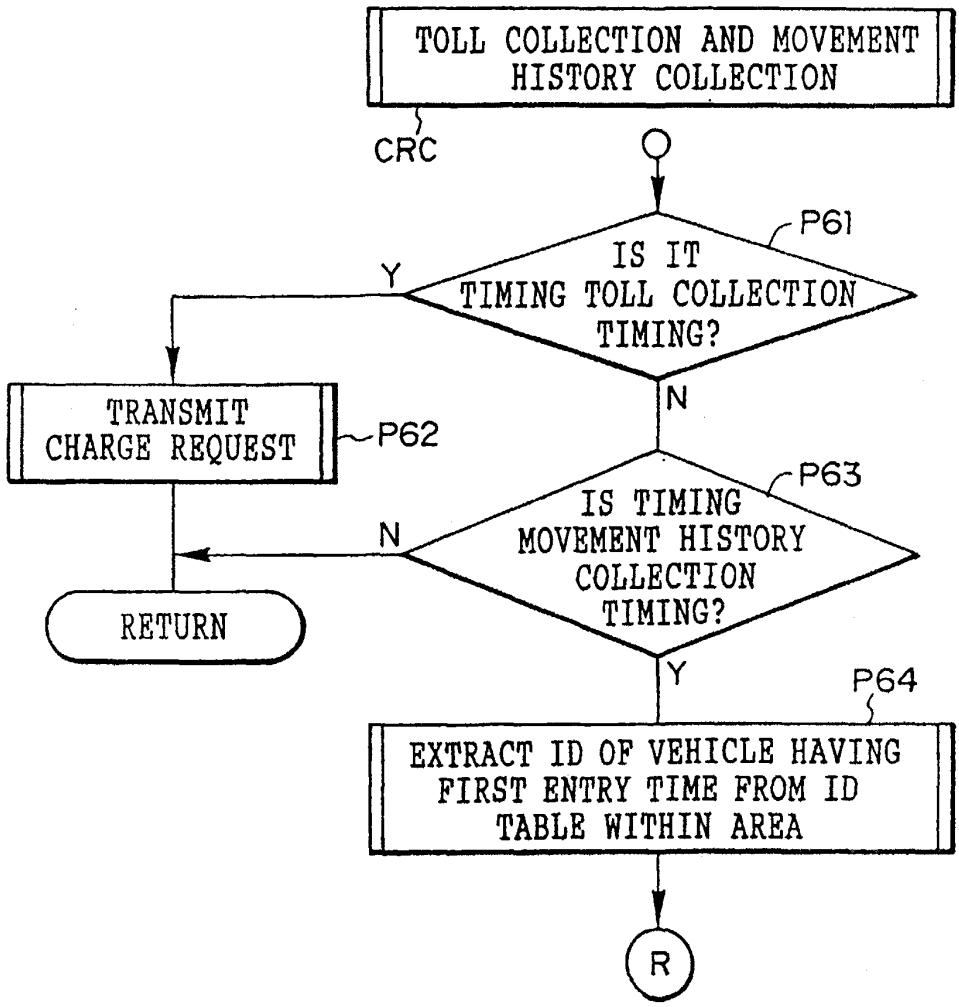
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FIG. 68 (CONTINUED)



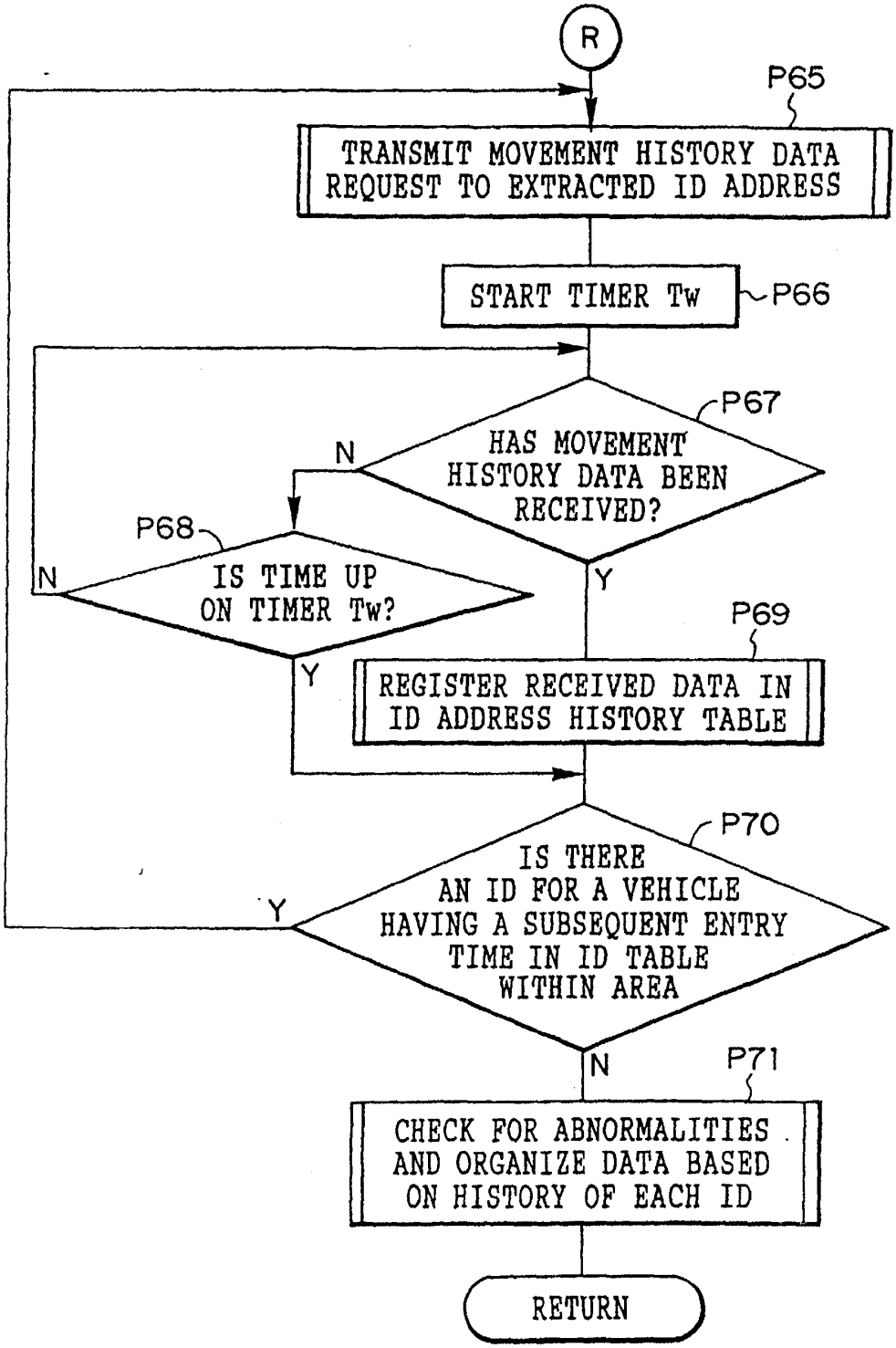
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FIG. 69



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FIG. 69 (CONTINUED)



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INTERNATIONAL SEARCH REPORT

International application No.
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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1926-1999 Toroku Jitsuyo Shinan Koho 1994-1999
Kokai Jitsuyo Shinan Koho 1971-1999 Jitsuyo Shinan Toroku Koho 1996-1999

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.
X	JP, 08-96181, A (Mitsubishi Heavy Industries,Ltd.), 12 April, 1996 (12. 04. 96) (Family: none)	1, 3-6 28, 29
Y		2, 7-27 30-45
X	JP, 09-319904, A (Mitsubishi Heavy Industries,Ltd.), 12 December, 1997 (12. 12. 97) (Family: none)	1, 4, 6 22-25 28, 29, 37
Y		2, 3, 5 7-21, 26, 27 30-36 38-45
X	JP, 09-269236, A (Fujitsu Ten Ltd.), 14 October, 1997 (14. 10. 97) (Family: none)	1, 4, 6 28, 29 37, 38
Y		30, 31 39, 43-45

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

* Special categories of cited documents:
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"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
16 April, 1999 (16. 04. 99)	18 May, 1999 (18. 05. 99)
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
Facsimile No.	Telephone No.

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PCT/JP99/00246

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP, 07-253330, A (Toshiba Corp.), 3 October, 1995 (03. 10. 95) (Family: none)	1, 28, 29
Y		30, 31
Y	JP, 08-007131, A (Toyota Motor Corp.), 12 January, 1996 (12. 01. 96) (Family: none)	7-21
Y	JP, 09-153156, A (Hitachi,Ltd., et al.), 10 June, 1997 (10. 06. 97) (Family: none)	43-45
Y	JP, 09-326058, A (Matsushita Electric Industrial Co., Ltd.), 16 December, 1997 (16. 12. 97) (Family: none)	1, 4, 6, 22
Y	JP, 09-128572, A (Matsushita Electric Industrial Co., Ltd.), 16 May, 1997 (16. 05. 97) (Family: none)	1, 2

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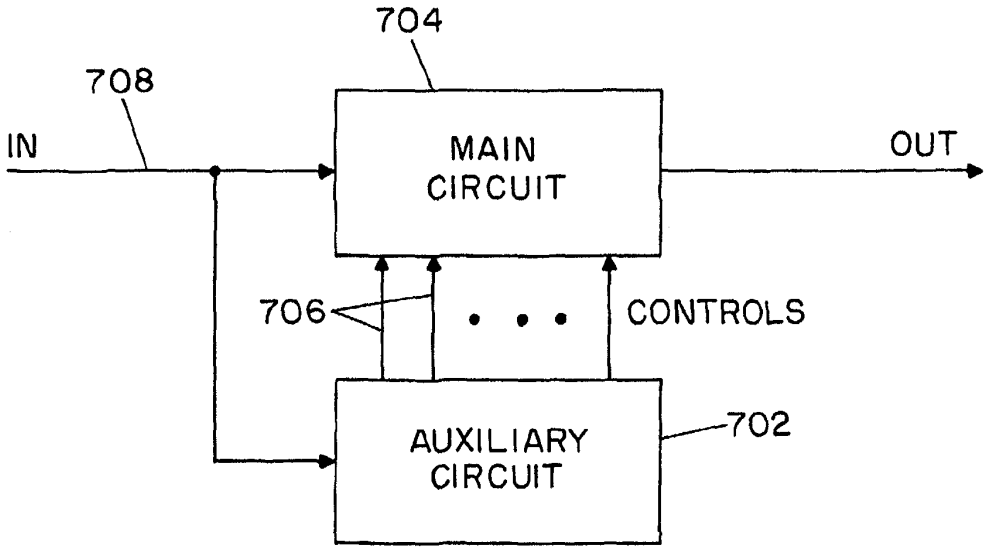
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: CIRCUITS WITH DYNAMIC BIASING



(57) Abstract: Techniques are provided for the implementation of dynamically biased circuits. In these circuits, bias currents are varied according to signal amplitude. Benefits include reduced power dissipation, reduced noise, and increased dynamic range. The techniques can be employed in various types of circuits such as, for example, amplifiers, log-domain circuits, and filters.

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CIRCUITS WITH DYNAMIC BIASING

TO ALL WHOM IT MAY CONCERN:

Be it known that WE, NAGENDRA KRISHNAPURA and YANNIS P. TSIVIDIS, citizens of INDIA and GREECE, respectively, whose post office addresses are 722 Willow Avenue, Apt. 1, Hoboken, NJ 07030; and 410 Riverside Drive, Apt. 52A, New York, NY 10025, respectively, have made an invention entitled

CIRCUITS WITH DYNAMIC BIASING

of which the following is a

SPECIFICATION

BACKGROUND OF THE INVENTION

[0002] In order to conserve energy in electronic circuits, particularly in battery-operated electronics, it is preferable to use bias currents which are no larger than necessary. Therefore, because the minimum required bias current tends to depend on signal amplitude, it is often desirable to use actual bias currents which are dependent on the amplitude of the signal. An additional advantage of amplitude-dependent biasing is that,

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if the bias current is only as large as needed, it will produce the least possible amount of noise (*e.g.*, shot noise). These advantages have been discussed in the electronics literature with respect to at least one specific log-domain circuit. D.R. Frey and Y.P. Tsividis, "Syllabically Companding Log Domain Filter Using Dynamic Biasing," Electronics Letters, vol. 33, no. 5, Aug. 28, 1997. Amplitude-dependent biasing can used in other circuits, *e.g.*, amplifiers. However, one potential problem is that the bias can, in some cases, interact with the signal. Accordingly, there is a need for circuits in which the bias control and the signal properties are "orthogonal" — *i.e.*, do not interact with each other.

SUMMARY OF THE INVENTION

[0003] It is therefore an object of the invention to provide a circuit which can accommodate signals of various amplitudes in an energy-efficient manner.

[0004] It is a further object of the invention to provide a circuit which can accommodate signals of various amplitudes while maintaining a high signal-to-noise ratio.

[0005] It is yet another object of the invention to provide a circuit which can accommodate signals of various amplitudes while avoiding excessive interaction between the bias control and the signal.

[0006] These and other objects are accomplished by a circuit having a bias which can be adjusted according to a signal which is received, generated, or transmitted by the circuit.

[0007] In accordance with one aspect of the invention, a signal is processed using an apparatus comprising: (1) 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

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adapted to receive at least one input signal, and the selected one being configured 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 exhibits distortion; and (2) an amplitude detector configured to perform the operations of: (a) receiving the at least one input signal; (b) detecting at least one amplitude of the at least one input signal, and (c) 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.

[0008] In accordance with another aspect of the invention, a signal is processed using a filter having at least one input and at least one bias, wherein the at least one input comprises: (1) a first input for receiving a first input signal; and (2) a second input for receiving a second input signal, wherein the filter is configured to perform the steps of: (a) 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 (b) applying a second filtering operation to the second input signal, the second input signal controlling the at least one bias, the second filtering operation 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.

[0009] In accordance with an additional aspect of the invention, a signal is processed using a filter having at least one input and first and second biases, wherein the at least one input comprises first and second inputs, the first input being adapted to receive a first input

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signal and a first bias signal related to an amplitude of at least one of the first and second input signals, the first bias signal being for controlling the first bias, the second input being adapted to receive a second input signal and a second bias signal, the second bias signal being for controlling the second bias, the second bias signal being approximately equal to the first bias signal, and the filter being configured to filter a difference of first and second input signals, thereby generating a filter output signal.

[0010] In accordance with another aspect of the invention, a signal is processed using a combined filter comprising: (1) a first filter having a first filter configuration, a first bias input for receiving a first bias, a first input for receiving a first input signal, and a first output for providing a first output signal; (2) a second filter having a second filter configuration, a second bias input for receiving a second bias, a second input for receiving a second input signal, and a second output for providing a second output signal, the second filter configuration matching the first filter configuration, the first bias and the second bias being adjusted in accordance with at least one amplitude of at least one of the first input signal and the second input signal, and the first bias and the second bias being adjusted to be approximately equal; and (3) a combined filter output configured to provide a combined output signal comprising a difference of the first output signal and the second output signal.

[0011] In accordance with yet another aspect of the invention, a signal is processed using an apparatus comprising: (1) a first transistor, comprising a first signal-receiving terminal, a first current-carrying terminal adapted to be connected to a voltage source, and a second current-carrying terminal connected to the first signal-receving terminal; (2) a second transistor, comprising: a second signal-receiving terminal connected to the first

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signal-receiving terminal, a third current-carrying terminal adapted to be connected to the voltage source, and a fourth current-carrying terminal; (3) a first adjustable current source in communication with the second current-carrying terminal and allowing a first bias current to flow through the second current-carrying terminal; (4) a second adjustable current source in communication with the fourth current-carrying terminal and allowing a second bias current to flow through the fourth current-carrying terminal, the second bias current being approximately equal to the first bias current, and the first and second adjustable current sources being adjusted in accordance with an amplitude of a first input signal coupled into at least one of the second current-carrying terminal and the fourth current-carrying terminal; and (5) an output connected to the fourth current-carrying terminal.

[0012] In accordance with an additional aspect of the invention, a signal is processed using an apparatus comprising: (1) a dynamically biased signal-processing circuit having an input and an output; and (2) a feedback path providing a feedback signal from the output to the input.

[0013] In accordance with a further aspect of the invention, a signal size is detected by a detector comprising: (1) a differencing block configured to perform the operations of: (a) receiving a first input signal, (b) receiving a second input signal, and (c) generating a difference signal comprising a difference of the first and second input signals; (2) an exponentiator configured to exponentiate a signal comprising the difference signal, thereby generating an exponentiated signal, wherein an output signal of the detector comprises the exponentiated signal; and (3) a filter configured to perform low-pass filtering of a signal comprising the difference signal, thereby generating a filtered signal,

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wherein the output signal further comprises the filtered signal, and wherein the second input signal comprises the output signal.

[0014] In accordance with yet another aspect of the invention, a signal size is detected by a detector comprising: (1) first, second, third, fourth, and fifth nodes, wherein an input signal is received by the first node; (2) a first transistor, comprising: (a) a first signal-receiving terminal connected to the second node, (b) a first current-carrying terminal connected to the third node, and (c) a second current-carrying terminal adapted to receive a first bias current; (3) a second transistor, comprising: (a) a second signal-receiving terminal connected to the fourth node, (b) a third current-carrying terminal connected to the third node, and (c) a fourth current-carrying terminal adapted to receive a second bias current, the fourth current-carrying terminal being connected to the fourth node; (4) a high-frequency shunt connected between the fourth node and a first voltage node, the first voltage node being adapted to be connected to a first voltage source; (5) a third transistor, comprising: (a) a third signal-receiving terminal connected to the fourth node, (b) a fifth current-carrying terminal connected to the fifth node, and (c) a sixth current-carrying terminal adapted to receive a third bias current; and (6) a fourth transistor, comprising: (a) a fourth signal-receiving terminal adapted to be connected to a second voltage source, (b) a seventh current-carrying terminal connected to the fifth node, and (c) an eighth current-carrying terminal connected to the first node.

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BRIEF DESCRIPTION OF THE DRAWINGS

[0015] Further objects, features, and advantages of the invention will become apparent from the following detailed description taken in conjunction with the accompanying figures showing illustrative embodiments of the invention, in which:

Fig. 1 is a schematic diagram illustrating a transconductor having dynamic biasing in accordance with the invention;

Fig. 2 is a schematic diagram illustrating an amplifier output stage having dynamic biasing in accordance with the invention;

Fig. 3 is a block diagram illustrating a feedback amplifier having a dynamically biased output stage in accordance with the invention;

Fig. 4 is a voltage graph illustrating the use of dynamic biasing to avoid crossover distortion in a circuit in accordance with the invention;

Fig. 5 is a block diagram illustrating the use of dynamic biasing applied to a low-pass input of a circuit in accordance with the invention;

Fig. 6 is a block diagram illustrating the use of dynamic biasing applied to the input of a circuit having an internal low-pass node in accordance with the invention;

Fig. 7 is a block diagram illustrating the use of an auxiliary circuit for dynamic bias in accordance with the invention;

Fig. 8a is a schematic diagram illustrating a first-order log-domain filter in accordance with the invention;

Fig. 8b is a schematic diagram illustrating a replica of the circuit of Fig. 8a, in accordance with the invention;

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Fig. 9a is a block diagram illustrating a circuit having a differential output in accordance with the invention;

Fig. 9b is a block diagram illustrating a circuit having a single-ended output in accordance with the invention;

Fig. 10a is a graph of input current, and the envelope thereof, being received by a circuit in accordance with the invention;

Fig. 10b is a graph of differential output of a circuit in accordance with the invention;

Fig. 10c is a graph of voltage at a node within a circuit in accordance with the invention, wherein the circuit is dynamically biased;

Fig. 10d is a graph of voltage at a node within a circuit in accordance with the invention, wherein the circuit has a constant bias;

Fig. 10e is a graph of noise current of a circuit in accordance with the invention, wherein the circuit is dynamically biased;

Fig. 10f is a graph of noise current in a circuit in accordance with the invention, wherein the circuit has a constant bias;

Fig. 11 is a block diagram illustrating an envelope detector in accordance with the invention;

Fig. 12 is a schematic diagram illustrating a current-mode envelope detector in accordance with the invention;

Fig. 13 is a schematic diagram illustrating a current mirror circuit in accordance with the invention;

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Fig. 14 is a schematic diagram illustrating a class-AB log-domain filter in accordance with the invention;

Fig. 15a is a block diagram illustrating a linear, lossy-low-pass filter;

Fig. 15b is a block diagram illustrating a companding low-pass filter having input-output characteristics similar to those of the filter of Fig. 15a;

Fig. 16 is a schematic diagram illustrating a circuit including the envelope detector of Fig. 12 coupled to a current mirror circuit in accordance with the invention;

Fig. 17a is a schematic diagram illustrating a band-pass filter;

Fig. 17b is a schematic diagram illustrating a band-pass filter having an auxiliary input for the introduction of dynamic bias in accordance with the invention;

Fig. 18 is a graph of simulated frequency response of the band-pass filter of Fig. 17b;

Fig. 19 is a schematic diagram illustrating an exemplary Tow-Thomas biquad circuit having band-pass and low-pass outputs;

Fig. 20a is a block diagram illustrating a log-domain filter;

Fig. 20b is a block diagram illustrating a log-domain filter with an input stage omitted;

Fig. 21 is a block diagram illustrating the use of a multiple-stage auxiliary circuit in accordance with the invention;

Fig. 22 is a schematic diagram illustrating a compensation circuit in accordance with the invention;

Fig. 23 is a schematic diagram illustrating a feedback arrangement in accordance with the invention;

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Fig. 24 is a schematic diagram illustrating an amplifier in accordance with the invention; and

Fig. 25 is a schematic diagram illustrating a log-domain filter in accordance with the invention.

[0016] Throughout the figures, unless otherwise stated, the same reference numerals and characters are used to denote like features, elements, components, or portions of the illustrated embodiments. Moreover, while the subject invention will now be described in detail with reference to the figures, and in connection with the illustrative embodiments, changes and modifications can be made to the described embodiments without departing from the true scope and spirit of the subject invention as defined by the appended claims.

DETAILED DESCRIPTION OF THE INVENTION

[0017] Fig. 1 illustrates an example of a transconductor circuit which is dynamically biased in accordance with the invention. The circuit of Fig. 1 is powered by voltage sources V_{CC} and V_{L100}. It is to be noted that voltage (*i.e.*, electrical potential) is inherently relative, and accordingly, the term "voltage source," as used herein, is defined to include ground (*i.e.*, a voltage source producing a voltage of zero). In particular, in the circuit of Fig. 1, either of V_{CC} and V_{L100} can be a connection to ground. The same is true for at least one voltage source in each of the circuits disclosed herein.

[0018] In the circuit of Fig. 1, transistors Q_{102} and Q_{104} form a current mirror which sends current through transistors Q_1 and Q_2, respectively. The emitters of transistors Q_1 and Q_2 are connected by a resistor R_{106}. Each of transistors Q_1 and Q_2 is biased with a bias current I_E which flows through its current-carrying terminals —specifically its emitter

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and collector. The transconductor of Fig. 1 is operated in a differential mode in which the input voltage V_i is applied across the respective signal-receiving terminals (*i.e.*, the base terminals) of the transistors Q_1 and Q_2. The transconductor produces an output current I_O.

[0019] If the transconductance of the bipolar transistors is much larger than $1/R_{106}$, the transconductance of the stage, I_o/V_i, becomes approximately equal to $1/R_{106}$, independently of I_E. Accordingly, I_E can be set at the minimum value required for a given signal. Specifically, a high value of I_E can be used for large signals, and a low value of I_E can be used for small signals.

[0020] In order to establish the most suitable bias of a signal processing circuit —such as, for example, a transconductor, an amplifier, or a filter — it can be desirable to base the bias upon a signal representing the amplitude or envelope of the signal being processed. The amplitude or envelope signal can be received from an external source, or can be generated using an envelope detector. A low-pass-filtered rectifier, well-known for use in many other applications, is one example of a circuit which can be used as an envelope detector.

[0021] It is to be noted that the circuit of Fig. 1 can also be reconfigured to have a topology in which the current sources I_E are connected to V_{CC}, the current mirror is connected to V_{L100}, the NPN transistors are replaced with PNP transistors, and the PNP transistors are replaced with NPN transistors.

[0022] The technique of the invention can also be employed in the output stage of an amplifier, an example of which is illustrated in Fig. 2. The output stage of Fig. 2 is powered by two voltage sources V_{DD} and V_{L200}. The circuit includes p-channel field

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effect transistors ("FETs") F_{202} and F_{204} which serve as current sources and are controlled by a bias voltage V_C. The bias voltage V_C is applied to the signal-receiving terminal — in this case, the gate — of each of p-channel transistors F_{202} and F_{204}. The bias currents flowing through the current-carrying terminals — in this case, the sources and drains — of p-channel FETs F_{202} and F_{204} are fed into respective drain terminals of n-channel FETs F_{206} and F_{208}. The gates of n-channel transistors F_{206} and F_{208} are connected by a resistor R_{210}. The gate and drain of FET F_{206} are connected together. An input voltage V_i is coupled to the gate of n-channel FET F_{208} through a capacitor C_{212}. An output voltage V_O and an output current I_O are generated at the connected drains of n-channel transistor F_{208} and p-channel transistor F_{204}. In accordance with the invention, the bias voltage V_c can be adjusted according to the input signal, such that F_{202} and F_{204} produce higher bias currents for larger signals and lower bias currents for smaller signals.

[0023] One method of feeding a signal into a circuit is through alternating current ("AC") coupling — for example, through a capacitor, as illustrated in Fig. 2. However, other techniques can also be used. In the circuit of Fig. 2, the transconductance of the stage will depend on the bias current. If there is high gain in front of this stage, and the entire circuit is operated in a closed-loop (*i.e.*, feedback) mode, such bias-dependent transconductance need not have a large effect on the transfer function of the entire circuit. In addition, the stage can be reconfigured by using p-channel FETs in the circuit mirror and n-channel FETs to control the bias current; in such a reconfigured circuit, the sources of the p-channel FETs of the current mirror would be connected to V_{dd}, and the sources of the n-channel biasing FETs would be connected to V_{L200}.

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[0024] In accordance with the invention, dynamically biased circuits can be designed as shown in Fig. 3. In the circuit of Fig. 3, an input signal u_3 passes through the positive input of a differencing block 302, from which the difference signal d_3 passes to a gain stage 304 where it is amplified to produce an amplified signal w_3. In this example, the gain stage 304 is assumed to have a very large gain — ideally ∞. The amplified signal w_3 enters a dynamically biased circuit 306 which generates an output signal y_3. The bias of the dynamically biased circuit 306 is controlled by a bias control 310. A feedback path 308 connects the output of the dynamically biased circuit 306 to the negative input of the differencing block 302. The difference signal d_3 seen by the gain stage is $u_3 - \beta y_3$, where β is the feedback factor ($\beta < 1$ for an amplifier). In the steady state of the feedback loop, the difference signal $d_3 = u_3 - \beta y_3$ is 0. This implies that the output attains a value $y_3 = u_3/\beta$. It is to be noted that the value of y_3 is independent of any quantity other than the input u_3. Therefore, it can be seen that the bias of the dynamically biased circuit has no effect on the output. As a result, disturbances due to bias changes are reduced due to the application of feedback.

[0025] In particular, when the bias of the dynamically biased circuit 306 is changed, the output tends to change. However, the changed output y_3, through the negative feedback loop 308 and the gain stage 304, causes a change in the input w_3 of the dynamically biased circuit 306 in such a manner as to counteract the influence of the bias 310 and restore the output y_3 to its original value. An advantage of the circuit of Fig. 3, as compared to a class-B circuit, is that the circuit of Fig. 3 produces no crossover distortion.

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[0026] There are several ways in which one may configure dynamically biased circuit topologies. For example, a low-pass class B or class AB circuit can be dynamically biased to avoid the crossover region, where large distortion usually occurs. An exemplary voltage characteristic of such a circuit is illustrated in Fig. 4. In this example, the average value of the input signal V_{in} is varied, so that $V_{in}(t)$ always stays clear of the high-distortion region of the voltage characteristic. By this technique, the bias is controlled to be sufficient to preserve the linearity of the circuit, but otherwise to be as small as possible so that low power dissipation — and in some circuits, low noise — is achieved.

[0027] Additional examples of circuits in accordance with the invention are illustrated in Figs. 5 and 6. The circuit 502 of Fig. 5, which can be, for example, a filter or an amplifier, is not a low-pass circuit. Therefore, because the bias tends to be slowly varying, it can be beneficial to apply the bias to a separate, low-pass input 504, and to apply the signal being processed to the main input 506, as shown in Fig. 5. The circuit generates an output signal 508.

[0028] Figs. 17a and 17b illustrate an example of a type of filter, in this case a band-pass filter, which can be dynamically biased using a low-pass input in accordance with the invention. Fig. 17a illustrates an exemplary band-pass filter having an input u_{bp} and an output y_{17}. The filter includes two resistors R_{173} and R_{174} and a capacitor C_{172} which serve as an input network. The filter also includes an amplifier 175 with a gain of $-k$, where k is a positive number — *e.g.*, a positive integer. Feedback is provided by a feedback capacitor C_{171}.

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[0029] Fig. 24 illustrates an example of an amplifier which can be used as the amplifier 175 in the circuit of Fig. 17. The exemplary amplifier 175 includes transistors Q_{2401} and Q_{2402} and resistors R_{L1}, R_{E1}, and R_{E2}. The signal-receiving terminal (*i.e.*, the base) of Q_{2401} receives an input voltage V_{i24}. The transistor Q_{2401} has current-carrying terminals — a collector and an emitter. The collector of Q_{2401} is connected to the signal-receiving terminal (*i.e.*, the base) of transistor Q_{2402}, and is also connected to a voltage source V_{H24} through a resistor R_{L1}. The emitter of Q_{2401} is connected to another voltage source V_{L24} through an additional resistor R_{E1}. In the specific example illustrated in Fig. 24, V_{H24} has a higher voltage than V_{L24}. Q_{2401}, R_{L1}, and R_{E1} form an emitter degenerated amplifier stage having a gain of $-k$, where $k = R_{L1}/R_{E1}$. The output voltage of this stage is the collector voltage V_{C2401} of Q_{2401}.

[0030] In the illustrated amplifier 175, transistor Q_{2402} and resistor R_{E2} form an emitter follower stage having a gain of 1. The base of Q_{2402} receives the amplified voltage V_{C2401} from the collector of Q_{2401}. The collector of Q_{2402} is connected to voltage source V_{L24}. The emitter of Q_{2402} is connected to voltage source V_{H24} through resistor R_{E2}. The output voltage V_{024} of the emitter follower — which is also the output voltage of the entire amplifier 175 — is the voltage at the collector of Q_{2402}.

[0031] The gain $-k$ of the amplifier 175 does not strongly depend on the bias currents I_{E2401} and I_{E2402} flowing through Q_{2401} and Q_{2402}, respectively. However, the bias currents I_{E2401} and I_{E2402} affect the size of the input voltage V_{i24} that can be accommodated by the amplifier 175. Furthermore, a direct current ("DC") voltage component V_{inDC} of the input voltage V_{i24} can affect the bias currents I_{E2401} and I_{E2402}, as is demonstrated below.

[0032] The bias current I_{E2401} flowing the Q_{2401} is:

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$$I_{E2401} = (V_{inDC} - V_{be24})/R_{E1},$$

where V_{be24} is the base-emitter voltage of the transistors Q_{2401} and Q_{2402}. The bias current I_{E2402} flowing through Q_{2402} is:

$$I_{E2402} = [(V_{inDC} - V_{be24})R_{L1}/R_{E1} - V_{be24}]/R_{E2}.$$

[0033] It can thus be seen that the bias currents I_{E2401} and I_{E2402} of the amplifier 175 can be controlled by adjusting the DC component V_{inDC} of the input voltage V_{i24} received by the amplifier 175. For example, V_{inDC} can be reduced if the AC amplitude of V_{i24} is small, thereby reducing the bias currents I_{E2401} and I_{E2402}. Because of the reduced bias currents I_{E2401} and I_{E2402}, the amplifier 175 has reduced power consumption.

[0034] For the application of dynamic biasing to the circuit of Fig. 17a, it might not be effective simply to add a bias to the input u_{bp}, because any DC components of u_{bp} are blocked, by C_{172}, from reaching the input of the amplifier 175. In fact, in the circuit of Fig. 17a, the DC gain from the input u_{bp} to the output y_{17} is essentially zero. However, in accordance with the invention, this circuit can be reconfigured to provide another input through which DC signals can reach the amplifier 175. For example, as illustrated in Fig. 17b, the originally grounded end of R_{174} can be disconnected from ground and used as an auxiliary input u_{1p}. From this auxiliary input u_{1p} to the output y_{17}, the filter has a low-pass characteristic. Accordingly, a dynamic bias — which tends to be slowly varying — can be applied to this input u_{1p}. Fig. 18 illustrates exemplary simulated transfer functions of the filter of Fig. 17b, from the main and auxiliary inputs u_{bp} and u_{1p} to the output y_{17}. The component values used for the circuit simulation of Fig. 18 are: R_{173}=R_{174}=1kΩ, C_{171}=C_{172}=0.1μF, and k=8. As can be seen from Fig. 18, the transfer function from the

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input u_{bp} of the filter to the output y_{17} vanishes at both low and high frequencies. However, the transfer function from the auxiliary input u_{1p} to the output y_{17} vanishes only for high frequencies. Specifically, in this example, it can be seen that the DC (*i.e.*, very low frequency) gain is essentially zero for the main input u_{bp} and 1 for the auxiliary input u_{1p}.

[0035] If a circuit comprises a low-pass circuit 602, as illustrated in Fig. 6, it is possible to have the same input 604 for both the bias 610 and the signal 612, yet separate outputs 606 and 608. The bias 610 and the signal 612 can, optionally, be combined using a voltage adder 614, to thereby generate the input signal 604. Furthermore, although the intended output of the circuit 602 may not be low-pass, some internal portions of the circuit can, in some cases, be adjusted even if the bias control is itself low-frequency. Such a technique can be used, for example, in topologies derived from the Tow-Thomas biquad.

[0036] An example of such a biquad circuit is illustrated in Fig. 19. The circuit receives an input voltage u_{19} and generates a band-pass output voltage y_{bp} and a low-pass output voltage y_{lp}. The input signal u_{19} is fed through an input resistor R_{1904} to the negative input terminal of a first amplifier 1918, which produces the band-pass output voltage y_{bp}. A feedback circuit including a resistor R_{1902} and a capacitor C_{1914}, connected in parallel, provide coupling between the output and negative input of the first amplifier 1918. The band-pass output signal y_{bp} is fed through a resistor R_{1912} into the negative input of a second amplifier 1920, which generates the low-pass output voltage y_{lp}. A feedback capacitor C_{1916} connects the output and negative input of the second amplifier 1920.

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[0037] Finally, a feedback circuit connects the low-pass output y_{lp} with the negative input terminal of the first amplifier 1918. The feedback circuit includes a third amplifier 1922 and three resistors R_{1910}, R_{1908}, and R_{1906}. Resistor R_{1910} connects the low-pass output y_{lp} with the negative input of the third amplifier 1922. The output of the third amplifier 1922 is connected, through R_{1906}, to the negative input of the first amplifier 1918. Resistor R_{1908} connects the output and negative input of the third amplifier 1922. It is to be noted that any or all of the amplifiers 1918, 1920, and 1922 shown in Fig. 19 can comprise the amplifier 175 illustrated in Fig. 24. The amplifier 175 of Fig. 24 has been discussed extensively above for use in the circuits of Figs. 17a and 17b.

[0038] In accordance with the invention, a dynamic bias can be applied to the band-pass output — which can also serve as a low-pass input — of the circuit of Fig. 19. Such a technique allows adjustment of the low-pass portion of the circuit (which includes the second amplifier 1920), thereby providing benefits such as increased energy efficiency, reduced noise, and increased dynamic range, as discussed above.

[0039] In some filters it may not be possible to adequately control multiple points within a filter from a single bias input, because the individual transfer functions of various portions of the circuit may be different. In such a case, it can be beneficial to use an auxiliary circuit such as shown in Fig. 7, and feed individual bias control signals 706 to multiple points in the main circuit. The auxiliary circuit 702 can be approximately similar to the main circuit 704. Individual envelope or mean value extraction circuits can, optionally, be used to generate the various outputs 706. The auxiliary circuit 702 can, optionally, be a low-pass equivalent of the main circuit 704, and can be fed by the envelope (or mean value, etc.) of the input 708, such that the individual bias control

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signals 706 are delayed by suitable amounts before being fed to the main circuit 704. In particular, if the main circuit 704 is a filter, there are typically phase shifts at the various internal nodes. The auxiliary circuit 702 preferably mimics these phase shifts such that the bias control signals 706 adjust the respective internal nodes of the main circuit 704 using the correct phases.

[0040] Fig. 21 further illustrates the use of such an auxiliary circuit. The auxiliary circuit 702 of Fig. 21 includes multiple stages 2102 which can, optionally, be essentially identical to the multiple stages 2106 of the main circuit 704. Each of the stages 2102 of the auxiliary circuit produces an output signal 2108 which can be essentially identical, in both amplitude and phase, to the intermediate signals 2110 present between the respective stages 2106 of the main circuit 704. Each of the output signals 2108 is sent into its own envelope detector 2104 which generates a bias control signal 706 for the appropriate portion of the main filter 704. Because the auxiliary circuit 702 matches the main circuit 704, any phase or time shifts present in the main circuit 704 are also present in the respective outputs 2108 of the auxiliary circuit 702. As a result, each of the bias control signals 706 is phase or time shifted by the proper amount.

[0041] It may be desirable to use two matching versions of a signal-processing circuit, each fed by different polarity signals, with the outputs of the two versions being subtracted so that the bias component cancels out, as described in further detail below with respect to a particular log-domain circuit. In another embodiment, the signal and bias can be fed to one circuit, while the second circuit receives only the bias.

[0042] In accordance with an additional embodiment of the invention, an externally linear time-invariant filter — which can be internally non-linear — can be biased dynamically

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(*i.e.*, variably) in accordance with the signal so that large signals do not overload the filter, and small signals are not buried under noise. For example, a log-domain filter can be biased in such a manner, and dynamic biasing can be used for other types of filters as well.

[0043] Fig. 8a illustrates an example of a first-order, log-domain, low-pass filter. Such a filter generally operates by performing a logarithm operation upon an input signal, filtering the resulting logarithmic signal, and performing an exponential (*i.e.*, anti-logarithm) operation upon the filtered signal to restore the filtered, logarithmic signal to an output signal which is linearly related to the input signal. A log-domain filter is considered a "companding" filter because it first compresses the signal and then expands it. Generally, companding filters are internally non-linear, yet they can be designed to be externally linear — *i.e.*, the output being linear with respect to the input.

[0044] The concept of companding is further illustrated by Figs. 15a and 15b. Fig. 15a illustrates an exemplary linear first order filter. In the filter of Fig. 15a, an integrator 1502 having a gain constant k is connected in a negative feedback loop with an amplifier 1504 having a gain of a/k. Negative feedback is provided using a differencing block 1506. The resulting circuit is a low-pass filter having the following transfer function:

$$H(s)=\frac{Y(s)}{U(s)}=\frac{k}{s+a}$$

which generally describes a low-pass filter having a bandwidth of a rad/s. Fig. 15b illustrates a general companding equivalent of the low-pass filter in Fig. 15a. A nonlinearity block 1512 having a non-linear function $f(v)$ is used to provide the output y, and an amplifier 1508 having a gain of $1/f'(v)$, where $f'(v)$ is the derivative of $f(v)$, is used

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at the input. $f(v)$ serves as an expander, and the amplifier with gain $1/f'(v)$ serves as a compressor. For example, in a log-domain filter, $f(v)$ would be an exponential function. The compressor and expander, together with a modified feedback path 1510, form a low-pass filter that is equivalent to the linear filter of Fig. 15a and realizes the transfer function $H(s)$ given above. The relation between the input u and the intermediate variable v is non-linear in Fig. 15b.

[0045] In the case of the circuit of Fig. 8a, assuming that all of the transistors are ideal (*i.e.*, that their base currents are zero or negligible), the input portion of the circuit, formed by transistors Q_{1p} and Q_{2p}, has a logarithmic voltage/current characteristic. Specifically, the base-emitter voltage of Q_{2p}, V_{be2p}, is approximately constant, and the base-emitter voltage of Q_{1p}, V_{be1p}, is proportional to the logarithm of the normalized input currents: $V_{be1p}=V_t\ln[(i_{in}+I_{bias})/I_s]$. Therefore, the base voltage of Q_{2p}, V_{b2p}, is:

$$V_{b2p}=V_{be2p}+V_t\ln[(i_{in}+I_{bias})/I_s],$$

where V_t is the thermal voltage of Q_{2p} and I_s is the saturation current of Q_{2p}.

[0046] The filter uses transistor Q_{3p} to send the logarithmic component of V_{b2p} into the base of transistor Q_{4p}. At low frequencies, the output portion of the circuit, formed by transistor Q_{4p}, produces a current i_{4p}, into the collector of Q_{4p}, which is exponentially related to the base voltage of Q_{4p} :

$$i_{4p}=K\exp\{\ln[(i_{in}+I_{bias})/I_s]\}=K[(i_{in}+I_{bias})/I_s],$$

where K is a constant.

[0047] Accordingly, the relationship between the input signal i_{in} and the output signal i_{outp} is ultimately linear. Low-pass filtering is provided by a high-frequency shunt — in this

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case, the capacitor C_{1p} — which shorts out high-frequency signals at the base of Q_{4p}. Ideally, in a log-domain filter, the relationship between the large signal currents i_{1p} and i_{4p} in the input and output transistors Q_{1p} and Q_{4p}, respectively, is linear and time invariant — assuming that i_{1p} is always positive. Assuming that the base currents of Q_{2p} and Q_{3p} are negligible, i_{1p} is the sum of an AC input signal i_{in} and a bias current I_{bias}. I_{bias} is typically constant. The output i_{outp} is obtained by subtracting $(I_{2p}/I_{3p})I_{bias}$ from i_{4p}. I_{2p}/I_{3p} is the DC gain of the filter.

[0048] In accordance with the invention, dynamic biasing can be applied to circuits such as the filter of Fig. 8a, by varying I_{bias} in accordance with the envelope of the input i_{in} so that I_{bias} is slightly larger than the minimum value required to keep i_{1p} positive at all times. Such dynamic biasing lowers the power consumption and the output noise of the filter for small inputs, while enabling the circuit to accommodate very large inputs without excessive distortion.

[0049] Dynamic biasing also alters the "gain" from the input current to the internal voltages. Gain alteration has also been used for syllabic companding, which involves slowly varying the gain of an input amplifier in order to accommodate varying signal sizes and to maintain a relatively constant-amplitude output signal. However, dynamic biasing is simpler to implement than syllabic companding. On the other hand, in dynamic biasing systems, the time varying I_{bias} is filtered along with the input signal, and is also included in the output signal. Accordingly, i_{outp} is no longer merely a filtered version of i_{in}, but also includes a filtered version of I_{bias}. Consequently, it can be preferable to use a compensation circuit for some applications, in order to compensate for the presence of the filtered I_{bias} signal in the output signal.

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[0050] An example of such a compensation circuit is illustrated in Fig. 22. The circuit of Fig. 22 is similar to the circuit for which compensation is desired — *i.e.*, the circuit of Fig. 8a. In particular, the compensation circuit of Fig. 22 includes transistors Q_{2201}, Q_{2202}, Q_{2203}, and Q_{2204}, which behave similarly to the transistors Q_{1p}, Q_{2p}, Q_{3p}, and Q_{4p}, respectively, of the filter of Fig. 8a. Capacitor C_{2210} of Fig. 22 provides low-pass filtering similarly to capacitor C_{1p} of Fig. 8a. However, the compensation circuit of Fig. 22 includes an additional transistor Q_{2206} which mirrors the current flowing through Q_{2203}. The emitter current I_x of Q_{2206} is fed into the node 82 (in Fig. 8a) to which the emitter of Q_{3p} is connected. A current source I_{min} provides bias current into the collector of Q_{2201}.

[0051] The compensation circuit receives, into the collector of Q_{2201}, the envelope I_E of i_{in}, rather than i_{in} itself. For larger amplitude input signals, I_E increases, causing an increase in the current flowing through Q_{2203}. The increased current in Q_{2203} causes an increase in the current I_x which flows into node 82 of the filter of Fig. 8a, thereby increasing the base voltage of Q_{4p}. As a result, the quiescent (*i.e.* bias) current flowing through Q_{4p} is increased, thereby enabling the exponentiator stage of the filter of Fig. 8a to accommodate the larger input signal i_{in} which is being received.

[0052] If the amplitude of i_{in} decreases, I_E decreases, which reduces I_x. The voltage at node 82 drops, thereby decreasing the bias current flowing through Q_{4p}. Consequently, power consumption and shot noise are reduced for input signals having smaller amplitudes.

[0053] Moreover, there is an additional method for distortionless dynamic biasing. In accordance with the invention, a single-ended filter such as the circuit illustrated in

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Fig. 8a is duplicated. The duplicate circuit is operated with the same bias I_{bias} but an inverted input $-i_{in}$, as shown in Fig. 8b.

[0054] The duplicate circuit, an example of which is illustrated in Fig. 8b, includes transistors Q_{1n}, Q_{2n}, Q_{3n}, and Q_{4n} which correspond to transistors Q_{1p}, Q_{2p}, Q_{3p}, and Q_{4p} of the original circuit, illustrated in Fig. 8a. The circuit of Fig. 8b also includes current sources I_{2n} and I_{3n} — which are of approximately equal value to I_{2p} and I_{3p}, respectively, of the original circuit. Capacitor C_{1n} of the duplicate circuit is approximately equal in value to C_{1p} of the original circuit. The output transistor currents i_{4p} and i_{4n} in the respective filters of Figs. 8a and 8b can be written as:

$$i_{4p}(t) = (i_{in}(t) + I_{bias}(t)) * h(t); \quad i_{4n}(t) = (-i_{in}(t) + I_{bias}(t)) * h(t), \qquad (1)$$

where $h(t)$ is the impulse response of each filter (*i.e.*, the impulse response between i_{1p} and i_{4p}, and between i_{1n} and i_{4n}, where all base currents are assumed to be zero or negligible) and "*" denotes convolution. In the differential output $i_{out} = i_{4p} - i_{4n}$, the bias dependent term $I_{bias}(t) * h(t)$ cancels out, giving the result: $i_{out}(t) = 2i_{in}(t) * h(t)$. The relation between i_{out} and i_{in} is therefore linear and time invariant, and is the same (except for a factor of 2) as that between i_{outp} and i_{in} in the original log-domain filter (the circuit of Fig. 8a) operating with a constant bias. No extra circuitry is required to compensate for the effect of I_{bias}, because I_{bias} is not present in the output.

[0055] In accordance with the invention, a dynamically biased log-domain filter can be operated pseudo-differentially to cancel the effects of time varying bias, as illustrated in Fig. 9a. For example, two matching circuits 902 and 904 — which can be, for example,

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the circuits of Figs. 8a and 8b — can be used in the differential configuration illustrated in Fig. 9a. The input signal of such a configuration would be $2i_{in}$, and the output signal would be i_{4p}-i_{4n}. Such a configuration can eliminate the need to provide a bias current of $(I_{2p}/I_{3p})I_{bias}$ into transistor Q_{4p}, or a bias current of $(I_{2n}/I_{3n})I_{bias}$ into transistor Q_{4n}. Furthermore, structures that operate using differential input (*e.g.* certain class-AB circuits) can also be used in Fig. 9a. Such a differential circuit 908 is represented by the dotted lines of Fig. 9a.

[0056] In addition to cancellation of the bias dependent terms, pseudo-differential operation has benefits such as cancellation of even-order non-linearities and common mode interferences. For example, if the elements of a circuit are non-ideal — *e.g.*, if the transistors in a log-domain filter have characteristics which deviate from ideal logarithms and exponentials — the input and bias signals can interact with the non-idealities to generate harmonics, especially even-order harmonics. Because even-order harmonics have the same sign and approximately the same values in both halves of a pseudo-differential circuit, these harmonics cancel, thereby providing improved signal quality.

[0057] Furthermore, if I_{bias} contains noise, approximately the same noise signal, with the same sign, is present in each half of the circuit. Consequently, noise signals introduced by I_{bias} are cancelled in the differential output. In contrast, the input signal i_{in} is present with opposite signs in the respective halves of the circuit. Therefore, the input signal is not canceled in the differential output. As a result, the circuit of Fig. 9a provides an improved signal-to-noise ratio.

[0058] In accordance with another aspect of the invention, the scheme shown in Fig. 9b, in which the second filter 904 receives only the bias signal, can be used. The technique of

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supplying the input signal to only one of the filters can be advantageous for applications in which single-ended input is desired. Either of the arrangements of Figs. 9a and 9b can, optionally, include a differencing block 906 at the output, which can be advantageous for applications in which single-ended output is desired. Single-ended input and/or output can be desirable for, *e.g.*, for proper interfacing with other circuits.

[0059] The linear time-invariant relation between the input and output transistor currents in a log-domain filter enables the cancellation of time varying bias components at the output. In contrast, if time varying gains are placed before and after a classical linear filter, pseudo-differential operation does not result in a linear time-invariant system.

[0060] The base emitter voltage of Q_{1p} in Fig. 8a is given by: $V_{be1p} = V_t \ln[(i_{in} + I_{bias})/I_s]$. An increase in the envelope of i_{in} by a factor α causes I_{bias} to increase by the same factor because I_{bias} is derived from the envelope of i_{in}. In other words, i_{in1} becomes $i_{in2}=\alpha i_{in1}$ and I_{bias1} becomes $I_{bias2}=\alpha I_{bias1}$, where i_{in1} and I_{bias1} are the initial values of i_{in} and I_{bias}, and i_{in2} and I_{bias2} are the new values. Therefore, V_{be1p1} (the initial value) becomes V_{be1p2} (the new value):

$$V_{be1p2}=V_t \ln[\alpha(i_{in1}+I_{bias1})/I_s] = V_t \ln[(i_{in1}+I_{bias1})/I_s] + V_t \ln(\alpha)=V_{be1p1}+V_t \ln(\alpha).$$

[0061] It can thus be seen that V_{be1p} undergoes only a DC shift equal to $V_t \ln(\alpha)$. Because of the linearity between i_{1p} and i_{4p}, it can be seen that V_{be4p} also undergoes only a DC shift. Therefore, the AC signal applied to the voltage-mode filter 802 between the input and output transistors (enclosed by dashed lines in Fig. 8a) remains the same regardless

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of the input signal strength if dynamic biasing is used. This confirms the analogy of dynamic biasing to syllabic companding. Like syllabic companding, dynamic biasing also increases the dynamic range of a log-domain filter.

[0062] Fig. 14 illustrates an exemplary class-AB instantaneous companding log-domain filter which can be dynamically biased in accordance with the invention. The filter of Fig. 14 incorporates log-domain filters similar to those of Figs. 8a and 8b, in accordance with the invention. The left half of the filter includes transistors Q_{1p} and Q_{2p} which perform a logarithm operation upon the signal u_p entering the left half. Transistors Q_{3p} and Q_{4p} restore the left half of the signal to linearity by performing an exponential operation upon the logarithmic signal. Capacitor C_{1p}, which serves as a high-frequency shunt, provides low-pass filtering. Q_{2p} is biased with a bias current I_{2p}, and Q_{3p} is biased with a bias current I_{3p}. The right half of the filter includes components Q_{1n}, Q_{2n}, Q_{3n}, Q_{4n}, and C_{1n} which perform the same functions — in the right half — as Q_{1p}, Q_{2p}, Q_{3p}, Q_{4p} and C_{1p} perform in the left half. The two halves of the filter are cross-coupled using transistors Q_{5p} and Q_{5n}.

[0063] The difference current u_p-u_n is the input to the filter, and the difference current y_p-y_n is the output. The filter can operate in a class-AB mode in which the left half of the circuit handles positive portions of the input signal — *i.e.*, when u_p is positive and u_n is negative — and the right half handles negative portions of the input signal — *i.e.*, when u_p is negative and u_n is positive.

[0064] Figs. 10a-10f illustrate the results of a simulation, in accordance with the invention, of an exemplary pseudo-differential configuration of the low-pass filters of Figs. 8a and 8b, where the combined filter was configured to have a -3dB frequency of 100kHz

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($I_{2p} = I_{3p} = 1\mu A$, $C_{1p} = 61.5$ pF). The input was a sinewave with a changing envelope (Fig. 10a). The circuit was simulated in two different modes of operation: (i) with a dynamic bias 10% larger than the changing envelope, and (ii) with a constant bias 10% larger than the largest envelope (the largest envelope being 2μA, as illustrated in Fig. 10a). The constant bias case corresponds to classical class-A operation. The outputs of the filter in the two different modes are plotted in Fig. 10b and are identical in this simulation. Figs. 10c and 10d show the base emitter voltage of Q_{4p} (a voltage internal to the filter) in the two cases. Syllabic companding is clearly seen in Fig. 10c — the internal voltage swing is constant regardless of the input amplitude. With a constant bias, the amplitude of the internal voltage varies with the input current, as can be seen in Fig. 10d. The results of transient noise simulations are shown in Figs. 10e and 10f. It is evident from these figures that dynamic biasing provides noise reduction for small input signals. These results demonstrate the external linearity and syllabic companding nature of the dynamically biased filter.

[0065] The technique of the invention provides several advantages over conventional circuits. First, compensation circuits used in conventional circuits require extra design effort, in some cases as much as for the main filter, and add to the power consumption and noise of the overall filter. In contrast, the method of the invention — illustrated by example in Fig. 9a — has no additional design overhead because the required filter is simply duplicated. Furthermore, the technique of the invention introduces no additional power consumption or noise because there is no "extra" circuitry other than the filter used to differentially process the input signal.

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[0066] Fig. 25 illustrates an additional example of a log-domain filter which can be dynamically biased in accordance with the invention. Similarly to the log-domain filter of Fig. 8a, the log-domain filter of Fig. 25 can be used in one or both of filter blocks 902 and 904 of the circuits of Figs. 9a and 9b. The filter of Fig. 25 receives an input signal u_{2500} which, if the filter is used in block 902 of one of the circuits of Figs. 9a and 9b, equals $i_{in} + I_{bias}$. Transistors Q_{2501}, Q_{2502}, and Q_{2503} are biased with currents I_{bias}, I_{2502}, and I_{2503}, respectively. The output signal y_{2500} is the collector current of transistor Q_{2504}. The emitters of Q_{2501} and Q_{2503} are connected to each other, as are the emitters of Q_{2502} and Q_{2504}. A bias voltage V_{25bias} fixes the base voltages of Q_{2501} and Q_{2504}. The bases of Q_{2502} and Q_{2503} are connected to each other, and are also connected to V_{25bias} through a capacitor C_{2510}.

[0067] A FET F_{2506} is used, in a feedback arrangement, to control the current flowing through Q_{2501}. The FET F_{2506} serves as a regulated current source. The source terminal of F_{2506} is connected to a voltage source V_{L25}. The drain of F_{2506} is connected to the emitter of Q_{2501}. The gate of F_{2506} is connected to the collector of Q_{2501}. If Q_{2501} is in a region of its operating characteristic — *i.e.*, its current-voltage characteristic — in which its collector current would tend to exceed u_{2500}, the collector voltage of Q_{2501} drops, causing the gate voltage of F_{2506} to drop. The drop in gate voltage causes the drain current of F_{2506} to decrease, which increases the emitter voltage of Q_{2501}. The increase in emitter voltage decreases the base-emitter voltage V_{be2501} of Q_{2501}, which tends to cause a decrease in the collector current of Q_{2501}. If, on the other hand, Q_{2501} is in a region of its operating characteristic in which its collector current would tend to be less than u_{2500}, the opposite result occurs: V_{be2501} is increased, which tends to cause an increase in the

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collector current of Q_{2501}. In equilibrium, the collector current and base-emitter voltage V_{be2501} of Q_{2501} are thus regulated to maintain the transistor Q_{2501} in a region of its operating characteristic in which the collector current of Q_{2501} is exponentially dependent upon the base-emitter voltage V_{be2501}, and in which the base-emitter voltage V_{be2501} is logarithmically related to the collector current of Q_{2501}.

[0068] As a result, Q_{2501} performs a logarithm operation on u_{2500}, thereby generating V_{be2501}. Because the base voltage of Q_{2501} is fixed by V_{25bias}, the resulting logarithm signal is present at the emitters of Q_{2501} and Q_{2503}. Because the base and collector of Q_{2503} are connected together, Q_{2503} acts as a diode which communicates the logarithm signal to the base of Q_{2502}. High-frequency signal components are suppressed by a high-frequency shunt — in this case, capacitor C_{2510} — connected between the base of Q_{2502} and voltage source V_{25bias}. Q_{2502} is biased by a current I_{2502}. The collector current and base-emitter voltage of Q_{2502} are regulated by a FET F_{2508} which operates similarly to the FET F_{2506} which regulates the collector current and base-emitter voltage V_{be2501} of Q_{2501}.

[0069] Transmitter Q_{2502} communicates the low-pass-filtered, logarithm signal from the base of Q_{2502} to the emitter of Q_{2502}, this emitter being connected to the emitter of Q_{2504}. Because the base voltage of Q_{2504} is fixed by voltage source V_{25bias}, the filtered, logarithm signal is induced in the base-emitter voltage V_{be2504} of Q_{2504}. Because the output signal y_{2500} is exponentially related to V_{be2504}, transistor Q_{2504} exponentiates the filtered, logarithm signal which is present in V_{be2504}, thereby restoring the signal to linearity. Consequently, y_{2500} is linearly related to u_{2500}. The transfer function between y_{2500} and u_{2500} is:

$$H_{2500}(s) = Y_{2500}(s)/U_{2500}(s) = (I_{2502}/I_{2503})/(1 + sC_{2510}V_t/I_{2503}),$$

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where V_t is the thermal voltage of the various transistors in Fig. 25.

[0070] Even if the current gains of the transistors are finite, the only base current that significantly affects the operation of the circuit is that of Q_{2502}. However, the base current of Q_{2502} is a constant I_{2502}/β which is subtracted from I_{2503}. Consequently, no significant additional nonlinearity is introduced into the circuit, and the only effect of the finite β — assuming that β is constant with respect to the collector currents — is a reduction of the bandwidth of the filter. If this bandwidth reduction is undesirable, it can be counteracted either by injecting a current I_{2502}/β, as illustrated in Fig. 25, or by using automatic tuning techniques known to those skilled in the art.

[0071] Instantaneous companding via class-AB or class-B operation is another technique which has been used to realize high dynamic range log-domain filters. In this technique, a differential filter receives an input signal which equals the difference of half-wave rectified or geometrically split currents.

[0072] However, the technique of the invention provides several advantages over class-AB instantaneous companding. For example, in a preprocessing circuit in accordance with the invention, the accuracy of the envelope detector is less important, provided that its output is larger than the actual envelope. In contrast, a class-AB splitter generally must accurately reproduce the input signal in the splitter's difference output in order to avoid added distortion. For at least this reason, the envelope detector of the invention is simpler to design than a class-AB splitter. Furthermore, in conventional circuits, mismatch of circuit elements can lead to distortion because of internal non-linearity (in class-AB filters) and incomplete cancellation of bias components (in dynamically biased filters).

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For example, various frequency components of the input signal can interact with circuit nonlinearities to cause intermodulation distortion, *i.e.*, spurious signals at various sum and difference frequencies of the various frequency components. In fact, in a conventional companding filter, if internal components deviate from their ideal nonlinear (*e.g.*, ideal logarithm or ideal exponential) characteristics, such deviation can also result in distortion. In contrast, circuits in accordance with the invention tend to produce slowly varying bias components which, in many cases, can be more acceptable than intermodulation distortion. In addition, noise from the envelope detector of the invention cancels at the output of the filter. In contrast, the two outputs of a conventional class-AB splitter contain noise in opposite phases of the input for large signals; such noise does not cancel at the filter's output, and the uncanceled noise can degrade the signal-to-noise ratio of the filter.

[0073] The bias I_{bias} in Figs. 8a, 8b, 9a, 9b, and 25 can be generated using an envelope detector which can be, for example, a current mode envelope detector in accordance with the invention. Fig. 11 provides a block diagram of such a circuit. The output y of the detector is subtracted from the input u of the detector using a differencing block 1106. The output u-y of the differencing block 1106 is fed into an exponentiating block 1102 to produce an exponentiated error u_f. A low pass filter 1104 having a cutoff frequency ω_p filters the exponentiated error u_f to produce the output y.

[0074] To better understand the operation of the envelope detector of Fig. 11, it is useful to consider a case in which the input u is a sine wave having an angular frequency much larger than ω_p, and the output y is less than the envelope of u. During the portions of the

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input cycle in which u exceeds y, the output u_f of the exponential becomes extremely large. Because of the large signal entering the low-pass filter, the output y rapidly increases to reach u. As the cycle proceeds, the input u falls below the output y. The exponentiating block 1102, whose input u-y is now negative, reduces its output u_f to a very small value, close to zero, which in turn causes the output y of the low-pass filter 1104 to drop exponentially at a rate determined by its time constant. Since the low-pass filter's time constant is much longer than the input period, y does not drop appreciably in one cycle of the input u. Therefore, in steady state, the output y stays very close to the peak value of the input u, with a small drop between successive input peaks. If the input amplitude drops appreciably, the error u-y is constantly negative and the input u_f of the low-pass filter is therefore essentially zero. The output y falls exponentially until it reaches the new, reduced, peak value of the input u. On the other hand, an increase in the input amplitude causes the input u_f of the low pass filter to be very large due to the exponentiation of a positive quantity, and y therefore rises rapidly to reach the new peak value. This "fast attack" behavior is desirable, since, in a dynamically biased filter, the bias is preferably kept larger than the input in order to avoid distortion.

[0075] Fig. 12 illustrates an example of a circuit realization, in accordance with the invention, of the envelope detector of Fig. 11. In the detector 1200 of Fig. 12, the input signal and the output envelope are current-mode signals. However, voltage-mode signals can also be received and generated by, *e.g.*, adding simple current-voltage converters. For example, a transconductor such as the circuit of Fig. 1 can be used to convert a voltage-mode signal to a current-mode signal.

[0076] The emitter voltage V_{e121} of transistor Q_{121} in Fig. 12 can be written as:

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$$V_{e121} = V_{err} - V_t \ln (I_{121}/I_s),$$

where I_s is the saturation current of Q_{121}.

[0077] The circuit comprising transistors Q_{121}, Q_{122}, Q_{123}, and Q_{124}, the capacitor C_{126}, and the bias sources I_{121}, I_{122}, and I_{123} acts as a low-pass filter governed by the following equation:

$$\frac{dI_{124}}{dt} = -\frac{I_{122}}{C_{126}V_t} I_{124} + \frac{I_{123}}{C_{126}V_t} I_{121} \exp\left(\frac{V_{bias} - V_{err}}{V_t}\right) .$$

[0078] The last term in the above equation denotes the input to the low-pass filter. V_{err} appears in the argument of the exponential. This circuit can therefore perform the combined functions of the exponentiator 1102 and low-pass filter 1104 of Fig. 11 if V_{err} is made proportional to the error between the input and the output.

[0079] The output I_{124} is subtracted from the input I_{in} at the collector node of Q_{124}. If I_{in} is larger than I_{124}, the collector voltage of Q_{124} increases, and if I_{in} is smaller than I_{124}, the collector voltage of Q_{124} decreases. The voltage swing at the collector of Q_{124} is limited by a voltage-limiter. In the particular circuit of Fig. 12, the voltage-limiting function is performed by diodes D_1 and D_2. The error voltage thus generated at the collector is inverted by the amplifier A — in order to obtain the correct sign for feedback — and fed to the base of Q_{121} as V_{err}.

[0080] In order to tap the output, the bases of Q_{123a} and Q_{124a} are connected to the bases of Q_{123} and Q_{124}, respectively. Transistor Q_{124a} is fabricated with a cross-sectional area α times larger than Q_{124} in order to ensure a safety margin in the bias current fed to the log-

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domain filters. The term "cross-sectional area," as used herein, can include the collector area and/or the emitter area of a transistor, depending on the particular device- fabrication technology used to form the transistors. PNP transistors Q_{127} and Q_{128} are used to mirror αI_{124} as required, thereby providing dynamically controlled bias currents for one or more nodes of a main circuit for which dynamic biasing is desired. An exemplary embodiment of the inverting amplifier A is illustrated in inset 1204 of Fig. 12. The amplifier A includes p-channel FETs F_{12a} and F_{12b} which form a current mirror, as well as amplifying n-channel FETs F_{12c} and F_{12d}. The sources of F_{12c} and F_{12d} are connected by a resistor R_{12a}. The drain of F_{12c} is connected to the bias voltage V_{bias} of the envelope detector through a resistor R_{12b} which serves as an output load for the amplifier. FETs F_{12c} and F_{12d} are biased by bias currents I_{S12a} and I_{S12b}, respectively.

[0081] When the amplifier A is used as part of the envelope detector of Fig. 12, the collector voltage V_{in} of transistor Q_{124} is fed into the gate of n-channel FET F_{12c}. Because the amplifier A operates in a differential mode, its output V_{err} is proportional to the difference between V_{bias} and V_{in}.

[0082] Fig. 12 also illustrates an exemplary embodiment of a feedback arrangement 1202 which can be used to drive bias currents I_{121} and I_{123} through Q_{121} and Q_{123} in a controlled manner. The transistor in Q_{11a} in the feedback arrangement 1202 represents a transistor through which a regulated current is to be driven — *e.g.*, one of the transistors Q_{122}, Q_{123}, or Q_{124} in Fig. 12. The operation of the feedback arrangement 1202 can be readily understood by considering Fig. 23, in which the n-channel FET F_{11}, the NPN transistor Q_{11b}, and current source I_{11} are modeled as a voltage-controlled current source I_{fb}. If the

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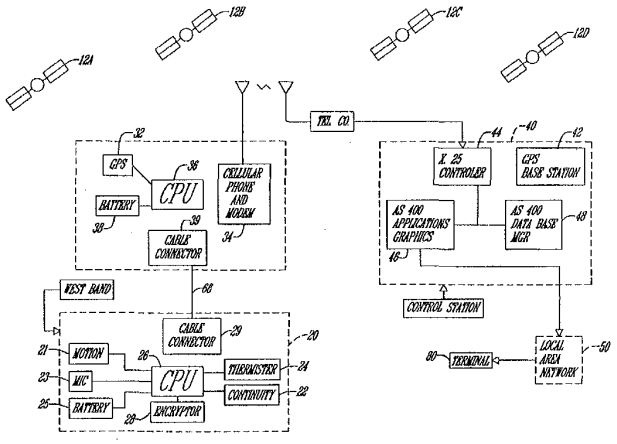
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(54) Title: APPARATUS AND METHOD FOR CONTINUOUS ELECTRONIC MONITORING/TRACKING OF INDIVIDUALS



(57) Abstract: An apparatus and method of monitoring mobile objects or persons utilizing Global Positioning System satellites and cellular telephone communications. The apparatus may include first and second remote units (20, 30) adapted to be worn on the monitored person or objects. These remote units would comprise the position and data sensors (32, 22, 24) as well as the transmitter device (34) to transmit the information back to a central tracking station (40). The remote units (20, 30) may be operative to monitor many data items such as system integrity, motion, temperature, audio, and the like in addition to position. This data would then be transmitted back to a central monitoring station (40) operative to process and display the information. The system is also adapted to monitor persons in hazardous environments such as radioactivity or poisonous gases or even to monitor inanimate objects such as automobiles.

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TITLE: APPARATUS AND METHOD FOR CONTINUOUS ELECTRONIC MONITORING/TRACKING OF INDIVIDUALS

CROSS-REFERENCE TO RELATED APPLICATION

This is a continuation-in-part application of Serial No. 08/367,057 filed December 30,1994.

TECHNICAL FIELD

The apparatus and method of the present invention relate generally to position monitoring. More specifically, the invention relates to a method and apparatus for tracking the position of an individual, monitoring selected bits of data regarding that person, and for real time notification of non-compliance with predetermined parameters.

BACKGROUND OF THE INVENTION

The present invention has great utility in many varied settings. For example, the apparatus may be used in the "house arrest" or "home parole" setting. In that case, it is critical that the person remain at home or within prescribed geographical limits. Alternatively, the whereabouts or medical condition of elderly or infirm persons might be monitored. The present invention provides such a device which is capable of monitoring position as well as certain health-related parameters such as heart rate, blood pressure, or the like. The present invention is not, however, limited to the monitoring of individuals, rather it is applicable to monitoring any mobile object. For example, the present invention can be used to detect and track stolen cars.

The term "environmental information" will be used herein to refer to information which may be gleaned from the person or object wearing the device, or his/its surroundings. Examples of such environmental data may be, but are not limited to, sound, temperature, motion, and the like.

There is a current move in our nation to stem the growth in the crime rate by building more prisons and hence incarcerating more people. Part of this stems from pressure from the public to keep hard-core or habitual criminals locked up for the full length of their sentences. This pressure is balanced against an even stronger push by the public to keep the cost of government down.

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One recent solution to this dilemma has been "house arrest" technology, which allows minor offense sentences to be carried out in the home. The system consists of a transformer which the convicted person must wear which must be present when that person is called by the police to verify presence at home or work. One severe drawback of this process involves use of man-hours and the associated cost of doing on-site inspections to ensure that the monitored persons are actually where they say they are. Additionally, there are several ways to fool the system if this manual checking is not implemented. Consequently, there is some risk that a prisoner could get loose. The cost of "house arrest" is balanced against the cost of housing low risk prisoners. While a net savings is realized, it is not large, and the funding must be justified separately.

Thus, there is a great need for an apparatus which would reduce, eliminate, or postpone the need for more prisons. Such an apparatus would accomplish tightened security of prisoner tracking, with virtually no risk of fooling the system, and would allow limited freedom of prisoners to rehabilitate themselves via controlled community interaction and limited freedom of travel. To state the obvious, a working, taxpaying prisoner who is effectively restrained at little cost to the taxpayer is preferable to incarceration, where no true rehabilitation is accomplished and costs are becoming astronomical. Such a system is implemented with the present invention.

Additionally, some elderly or infirm persons need constant monitoring of their location and/or of certain medical parameters. Such parameters might include blood pressure, heart rate, or the like. The present invention provides a means for accomplishing such a monitoring without the need for constant supervision and for providing immediate "real time" notification of the proper medical authorities. The system also provides a means for monitoring the status of an automobile in order to provide a deterrent to theft. For example, the apparatus can be attached to the car in some "hidden" spot to avoid or decrease the potential for removal. The motion, temperature, and position monitoring functions can then be used to detect theft or attempted theft of the auto. For example, the occurrence of motion or the detection of rising temperature might be indicative of the unauthorized starting of the car. With the position determining function, if the car is stolen, it can be tracked.

The invention disclosed herein overlaps several technical areas involving not only the provision of positioning data remotely of the sensor, but also of providing additional

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remote monitoring of other environmental factors such as temperature, audio signals, blood pressure, heart rate, and the like.

One example of a prior art device providing relative positioning information is Kotoh, U.S. Patent No. 4,673,936 issued June 16, 1987. Kotoh discloses a rescue transmitter apparatus adapted to be worn on a person's wrist. Kotoh's transmitter transmits a microwave signal which may be received by a search and rescue craft. Relative position may be determined by using a directional antenna to determine the direction of the strongest signal. No absolute positioning or other environmental information is available.

Another prior art device is illustrated in Darnell et al., U.S. Patent No. 5,043,736 issued August 27, 1991. Unlike the Kotoh device, Darnell's transmits absolute (i.e., geographical latitude and longitude) position information. Darnell discloses a hand-held apparatus which contains both a GPS receiver as well as a cellular telephone transmitter. The hand-held unit receives the GPS signals, generates a reference timing signal, and identifies the time difference therebetween. As is well understood in the art, this time difference is indicative of the distance between the receiver and the GPS satellite. Thus, from knowing the time differences from a series of satellites, an absolute position may be determined. This time difference information, determined by the hand-held unit, is transmitted to a remotely located base unit. This base unit then uses the time difference information to determine the position of the remote unit. While the Darnell system is adapted to determine and transmit absolute positioning information, no other environmental information is detected or transmitted.

Several prior art devices have been proposed in the field of prisoner monitoring in the house arrest scenario. One of these is Pauley et al., U.S. Patent No. 4,885,571 issued December 5, 1989. Pauley discloses a device (a "tag") which is adapted to be worn on the person subject to the house arrest. The device transmits periodically to a field unit which then communicates with a remotely positioned central processing unit. The communication of information from the "tag" to the field unit consists of an identification signal which is an encoded message identifying the "tag" from which the signal is sent. No other positional or other data is sent. Verification that the person is remaining within the prescribed limits imposed is inferred simply by the fact that the signal from the "tag" is being received by the field unit. Since the "tag" has a limited transmission range, reception of the signal transmitted therefrom by the field unit is possible only when the

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field unit is within the "tag's" transmission range. Thus, no absolute or even relative positioning data is available with the Pauley apparatus. Rather, a simple in-range/out-of-range indication is available.

U.S. Patent No. 5,493,694 discloses a fast response system for a fleet of vehicles. At a selected time, a central station broadcasts an interrogation signal requesting that selected vehicles in a selected group respond with the present location and status of each vehicle. The central station then ceases its broadcasts and waits a certain time interval for the vehicle responses. Using a protocol known by the central station and by each of the vehicle transceivers, each vehicle replies with the requested information during a particular consecutive time slot. Each transceiver has listened to the central station's interrogation signal and knows (1) whether it was one of the transceivers queried, and (2) if it has been queried, what its numerical position in the queue for responding to the query. If a particular transceiver is not among those queried, the transceiver ignores the interrogation signal and waits for the next interrogation signal. In this way, only transceivers whose numbers are broadcast or otherwise identified respond to the central station, and each such transceiver responds only in its allocated time slot.

When the central station receives a call requiring assistance, it broadcasts an incident message that includes the location of the incident and whatever is known about the incident. Each vehicle message unit receives the incident message, determines its present location and the distance from that vehicle to the site of the incident, determines if that vehicle can respond to the incident, and replies to the incident message by transmitting its present location and other pertinent information. The vehicle message unit transmits this reply if, and only if, the distance is less than a predetermined distance to the incident site.

U.S. Patent No. 5,528,248 to Steiner et al. discloses a personal digital location apparatus for displaying the consumer's location on a map. The device is a hand-held apparatus having a GPS antenna and receiver to provide location information, is capable of using standard operating systems to run existing applications, and is capable of running programs written in high level languages to provide the consumer with a display of his location and relative locations and the attributes of map features proximate to the consumer. Nothing in this patent relates to the continuous monitoring and tracking of an individual remote unit by a central control station.

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U.S. Patent No. 5,541,845 to Klein discloses methods for monitoring the adherence of a vehicle to a planned route and/or planned time schedule, within a selected corridor in location and time, where the vehicle follows a selected route. The invention may use GPS, or another location determination system, positioned on the vehicle to determine and store the present location of the vehicle. The vehicle communicates its present location, route status (on route or off route), schedule status (on schedule, ahead or behind schedule), and other relevant information, to a central station from time to time. The processor in the vehicle attempts to locate the vehicle on the route by correlating the route and schedule data with the current time of day and current vehicle position. A snap-to-route command is provided to identify the location on the assigned route that is closest to the vehicle's present location as determined by the on-board location determination system. It should be noted in Figures 4 and 5, steps 39 and 49, that non-adherence to the specified route or failure to meet a specified time schedule will cause the vehicle system to notify the central station.

While this patent discloses an on-board computer which continuously tracks the location of the vehicle within a time/location schedule, and notifies a central station of any "violation" of either the time or location schedule, there is no provision for uploading particular parameters from the central station as to the route or "corridor" to be followed. Second, there is no provision for storage of a "map" of the track of the vehicle throughout the course of a day or selected time period which is subsequently downloaded to the central control station so as to map out the specific time and location of the vehicle along the route.

U.S. Patent No. 5,552,772 to Janky et al. discloses a location determination system used to determine the present location of a firefighter at a fire site or the like. In one embodiment, the firefighter carries a unit that receives signals from a group of sources. A central station interrogates one or more of the units, each selected unit automatically responding by transmitting its location to the central station for further processing, storage or display. The system can accumulate and report on the accumulated time a firefighter is present in one or more designated sub-regions at a site, and can advise a person at the control station that a particular worker should leave a sub-region when an accumulated time exceeds a selected threshold.

The patent discloses another polling type system which requires the central station to interrogate the remote units to determine the location of a firefighter. The remote units

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do not have processors which can store location data, nor upload parameters, nor download map information showing past locations.

U,S. Patent No. 5,568,119 to Schipper et al. discloses a method and apparatus for monitoring the current location of a remote unit. The current location of the unit can be checked at selected time intervals. The device is particularly addressed to "house arrest" situations where an arrestee wears a location determining (LD) unit that receives signals allowing determination of the current location of the LD unit and arrestee. The signal sources may be GPS-type systems or ground base systems. In one embodiment of the invention, the remote unit processes the information to determine the present location of the arrestee and transmits this information to a central station. In another embodiment, the remote unit does not process the information, but rather transmits the information to the central station for further processing to determine the present location of the arrestee. The central station compares the present location of the arrestee with the designated site in its boundary to determine if the arrestee is staying on the designated site. If the arrestee has moved off the site without prearranged permission, or if no intelligible response signal is received at the designated times, the central station promptly notifies the appropriate authorities. The remote unit may contain a tamper detection circuit that transmits an alarm if tampering is detected. Optionally, the remote unit may transmit the present position information in encrypted form.

Figures 6 and 7 both show flow charts of a procedure used to determine the present location of an arrestee, and which include the initial step requiring the central station to transmit an interrogation signal to the remote unit. Thus, these flow charts disclose a polling type system which polls the remote units at desired intervals. The remote units transmit location information, and the central station processes, stores and/or displays the location of the remote unit.

This patent also discloses the periodic modification of parameters to provide "corridors" or timed schedules which the arrestee must follow. This information is processed at the central control station and alarms or warnings are transmitted from the central station for failure to comply with these parameters.

U.S. Patent No. 5,461,390 to Hoshen discloses a locator device useful for house arrests and stalker detection. This device relies on a "polling" type apparatus wherein a polling message is sent from a central location to remote units to determine the location of

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the remote units at the time of "polling". There is no disclosure of any capability of Hoshen to upload parameters to the remote unit, store accumulations of location data as a "map" in the remote unit, nor to download a stored "map" to a central station. In addition, since the Hoshen apparatus is a polling type device, there is no "real time" alarm for violations of preset parameters.

U.S. Patent No. 5,416,695 to Stutman et al. discloses a method and apparatus for alerting patients and medical personnel of emergency medical situations. The patent discloses the use of a host connected by a telephone network to a "subscriber" unit and receives information from a remote patient by a "telemetry" device. The remote telemetry device on the patient collects location information (via GPS) as well as medical information and transmits the information to the host computer. Parameters in the host computer are set, updated, or otherwise changed by the subscriber via the communications network. When the information transmitted from the patient exceeds the set parameters, a warning is sent both to the subscriber and to the patient.

A panic button is provided on the telemetry device permitting the patient to directly contact the host computer and thereby transmit an alert. It is noted that the typical method of providing information from the patients to the host computer is by a "periodic polling" of all of the sources by the host computer. (See column 6, lines 3-5).

U.S. Patent No. 5,416,468 to Baumann discloses a plurality of individual remote units on persons which transmit the location of that person to a "field unit" at periodic intervals. If the information is not received at the field unit within a predetermined time range, an alarm may be triggered. The remote units may include "detectors" which sense environmental conditions and may transmit this data in addition to the location data to the field unit.

However, the Baumann remote unit can only transmit information, and does not know whether it was received by the field unit. Since no information may be received by the remote unit, it cannot receive any instructions as to differing parameters or the like. Finally, the remote unit does not store tracked accumulated information.

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SUMMARY OF THE INVENTION

Consequently, it is a primary objective of the present invention to provide an apparatus and method of determining and displaying the absolute position of an individual remotely therefrom.

It is a further objective to provide an apparatus capable of sensing and transmitting environmental data such as audio, temperature, blood pressure, heart rate, and the like.

An additional objective is to provide an apparatus capable of monitoring and transmitting medical data concerning an individual.

It is another objective to provide an apparatus which may be secured to an automobile in some "hidden" location and utilized to provide a deterrent to theft and a means for detecting a theft or attempted theft and tracking the vehicle thereafter.

A further objective is to provide an apparatus capable of use on persons in hazardous environments to monitor their position as well as the environment surrounding the person such as the level of radioactivity or the presence of poisonous gases or the like.

Yet another objective is to provide an apparatus which is capable of tracking military individuals carrying classified information between military sites such as missile silos and the like.

An additional objective of the present invention is to provide a method and apparatus for monitoring and tracking an individual which will report non-compliance with predetermined parameters in real time.

Still a further objective is to provide an apparatus for continuously monitoring and tracking an individual which will store time-stamped location information between transmissions of data to a host computer.

Yet another objective is to provide a method and apparatus of continuously monitoring and tracking an individual which permits a customer to redefine parameters retained in the remote individual units.

A final objective is to provide an apparatus which, as much as possible, utilizes off-the-shelf components.

An apparatus and method of monitoring mobile objects or persons of the present invention includes a remote unit adapted to be worn on the monitored person or object. These remote units would comprise the position and data sensors as well as the transmitter device to transmit the information back to a central tracking station. The remote units may

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be operative to monitor many data items such as system integrity, motion, temperature, audio, and the like in addition to position. This data would then be transmitted at predetermined intervals to a central monitoring station operative to process and display the information. The remote units have the capability of uploading new or revised parameters from the central tracking station, as well as storing time- stamped location and environmental data between downloads of information to the central tracking station. Additionally, the remote units are capable of reporting non-compliance with the predetermined parameters in "real time".

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a block diagram representation of the major components of the invention.

Figure 2 is a pictorial representation of the overall operational environment of the system.

Figure 3 is a pictorial representation of the cellular bag which would be worn by the individual and its interconnection to the wristband.

Figure 4 is a pictorial representation of internal components of the cellular bag.

Figure 5 is an electrical block diagram representation of the cellular bag components.

Figure 6 is a pictorial representation of the wristband components.

Figure 7 is an electrical block diagram representation of the wristband components.

Figure 8 is a pictorial representation of central tracking station components.

Figure 9 is a schematic drawing showing the relation between the central control station and a customer.

Figure 10 is a schematic diagram showing the method of inputting the identification of specific activities to be monitored at a remote unit

Figure 11 is a schematic diagram showing the process of inputting geographic locations and time constraints for the activities identified in Figure 10.

Figure 12 is a schematic diagram showing the method of uploading parameters to a remote unit.

Figure 13 is a schematic diagram showing the process of downloading monitored information.

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Figure 14 is a schematic diagram showing the display of downloaded information from the remote unit.

Figure 15 is a schematic diagram showing real time notification of non-compliance with a predetermined parameter.

DESCRIPTION OF THE PREFERRED EMBODIMENT

1. GENERAL BACKGROUND AND DESCRIPTION OF OPERATION

The goal of the present invention is to provide a means for tracking or identifying the geographical position of an individual and storing a "history" of that information. Another goal is to provide a means for monitoring certain medical or environmental information regarding an individual. Additionally, in some cases, it may be desirable to provide monitoring of both position and medical or environmental data.

The two most obvious uses for such an apparatus are in the "house arrest" and medical environments. To successfully accomplish these goals, the apparatus should be as small and as passive as possible. That is, no actions should be required of the monitored individual.

To accomplish this goal, the present invention merges two recent developments in navigation and communications, namely the Global Positioning System (GPS) and cellular telephone communications.

The GPS system in general is described well in other literature. Suffice it to say that GPS receivers can monitor from four to eight satellites and accurately determine position to within a meter using differencing techniques. Accuracy of location improves as time passes and averages are taken. The typical receiver updates position every second and hence in one minute can accurately establish position. Initial time to acquire and establish position is longer, but this is done only on initial start-up or after a period of loss of signal for an extended time interval. The prisoner GPS receiver data would be monitored at intervals ranging from "always" to "as required", depending on the rules of enforcement.

The central tracking GPS receiver is used to establish correction data to correct for selective availability introduced error as well as other inherent errors in GPS technology.

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This correction data is constantly recorded with time stamp and is applied to all incoming tracking data from the remote units to correct incoming data for most accurate tracking.

Optionally, each remote unit may carry a receiver which picks up and supplies the GPS receiver with differential correction information. The correction data may be either an FM sub-carrier provider or a government-provided beacon correction information.

Cellular telephones are another recent technological advance greatly enlarging the amount of communication traffic which can be accommodated. As is well understood in the art, the cellular telephone system operates on the principle that numerous "cell sites" are scattered throughout a metropolitan area. Statistically, only a small percentage of telephones will be within a given "cell site" at any one time. Therefore, capacity can be increased by subdividing an area into these small "cell sites."

These technological advances are utilized by the present invention in order to provide the potential for large scale remote monitoring of individuals. The apparatus operates generally as follows. The monitored individual would "wear" a remote unit on his or her person. This remote unit would comprise the "monitoring components" as well as apparatus for transmitting the monitored information and receiving instructions. For example, if position is to be monitored, the remote unit would comprise a GPS receiver processor capable of receiving and processing GPS signals and determining a position therefrom.

Alternatively or additionally, if certain medical or environmental information is to be monitored, the remote unit would include apparatus adapted to monitor the desired parameter such as temperature, motion, heart rate, blood pressure, radioactivity, or poisonous gas level or the like. In either case, the information would be transmitted to a remote central control and tracking station for display using wireless communications, such as a cellular telephone.

It is also contemplated that the remote unit may in fact be subdivided into two separate subcomponents. In the preferred embodiment, these subcomponents would comprise a "wristband" and "cellular bag." The "wristband" would be adapted to be worn on the wrist or around the ankle of the monitored person and would contain sensors to detect the medical or environmental information. The "cellular bag" could be worn around the waist, shoulder, etc., and would contain the apparatus for determining position and for transmitting the data. If the apparatus is to be used to monitor automobiles, the "individual

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worn" components would be secured to the auto, such as to the firewall and/or the steering column.

a. "INDIVIDUAL WORN" COMPONENTS

In the preferred embodiment, the individual worn device consists of an ID bracelet, which contains a unique ENCRYPTION type responder which returns a random encrypted code when queried. It also contains special conductivity wiring and circuits which validate that the unit has not been removed or tampered with and is actually on a warm living body (via thermocouple and resistivity circuits and microphonics).

The ID bracelet connects to a small processor module contained within the "cellular bag" which acts as the overall processor for the prisoner system.

The processor module is worn on the belt, and contains the central processor, the communication equipment, in this case a cellular phone, and the detachable (but wire connected) GPS receiver. The basic function of the processor module is to provide monitoring of the ID bracelet, activation of the GPS receiver, the recording and storage of location data with a time and ID stamp, and control of the cellular phone.

In addition, the processor module has an audible and visual alert which the central processor can activate under pre-programmed rules, or via cellular control, for rule violations or the like.

The basic reporting implemented by the central processor to the prisoner or central control and tracking station includes history of tracking information (central tracking), status of all hardware (central tracking), battery condition (prisoner audible and visual warning and central tracking), rule enforcement status (prisoner audible and visual warning if the rules of compliance are exceeded), and prisoner microphone monitoring.

Memory in the processing means is used for basic machine status logs. Tracking log and rule check logs would be nonvolatile and would remain intact in the event of a system failure to validate a claim of failure by the prisoner.

b. CENTRAL TRACKING STATION COMPONENTS

The central control and tracking station consists of multiple phone lines feeding into a switching hub which in turn feed into an auto-dialing and data switching network, all controlled in the preferred embodiment by two or more IBM AS400-type computers. The first computer acts under the direction of the second to activate connection to the switching

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hub to acquire data or to respond to incoming data from the "individual worn" components, as required.

The first computer establishes and maintains a database on all individuals and the unique rules of compliance associated therewith as well as any violations. The second computer receives information from the first and displays the data graphically under control of monitoring personnel and according to pre-programmed format using a series of display terminals. This format can be tailored to the requirements of the individual monitored. Also controlled from the second computer are manning requirements and inter-departmental dispatch control.

It is anticipated that this system will track up to 4,000 or more prisoners, depending on the mix of types of rules enforcement. More restrictive rules requiring a larger percentage of resources would accommodate fewer individuals. Under minimal rule conditions, it is foreseen that only a few connections a day will provide effective control, as local broad rule enforcement and automatic call-in on violation require a minimum of resource utilization and very little personnel intervention.

c. CUSTOMER LOCATION COMPONENTS

In the preferred form of the invention, the customer may be the Department of Corrections (DOC). The customer is provided with at least one computer workstation and is networked into the central tracking station by a dedicated fiber optic frame relay landline. Obviously, other equivalent means of communication between the customer and the central tracking station are possible, and contemplated by this invention. The customer, using customized software provided on the computer workstation, has immediate access to its database at the central tracking station at any time via the landline. In this way, the customer may access all information relating to the monitoring and tracking of any specific prisoner, and may easily and immediately revise any rules of compliance for a particular prisoner. In addition, any violations of the existing rules of compliance will be transmitted from the central tracking station via the landline to the customer's workstation, in "real time", to permit immediate reaction, if necessary.

d. RULES OF COMPLIANCE

The phrase "rules of compliance" as used herein will refer to the limits imposed on a set of parameters assigned to each monitored individual. The rules allow a very broad range of tracking conditions, involving time, location, observation, and confirmation. In

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the preferred embodiment, these rules would be entered into a customer computer workstation and then networked into the central control and tracking station as described above.

Typical rules of compliance for light enforcement would be to restrict the prisoner to the house during non-working hours, to allow travel to and from work, and limited travel with pre-arranged call-in for permission (hereinafter "inclusion" zones). Under these conditions, the central control tracking station would define the house on the computer to be a set of coordinates with a certain boundary. Actual verification would take place during an initial visit. Likewise, the route to and from work would be defined on the computer as a path with a certain width. Similarly, the workplace is defined by an initial visit.

At this point, the rules of compliance on how tightly the monitored person must stay within these bounds are devised by establishing how often the person will be monitored and what response actions will take place if the person deviates from the plan. The actions are arbitrary and discretionary with the customer. For instance, if the customer is the DOC, it may wish to allow five minutes for the prisoner to self-correct a violation before dispatching an officer. Alternatively, the prisoner may be requested to call in when a violation has occurred. In other more restrictive circumstances, the rules of compliance may require the central control and tracking station to dispatch an officer upon the immediate occurrence of any violation. In some cases, very loose travel rules may apply with the limitation being on not allowing the prisoner to visit certain businesses, such as bars or other undesirable locations (hereinafter "exclusion" zones). These locations can be programmed in, monitored, and reported on. The variations are almost endless and are limited only by the ability of law enforcement to devise workable rules of compliance which make reasonable use of resources, are effective, and are agreeable to the courts.

In the preferred embodiment, certain safeguards are built in which assure security and integrity of the system. The bracelet has security devices built in which allow detection of any tampering and also allow environmental monitoring of audio, personal temperature, impact, motion, and the like. Since a person moves constantly, even when sleeping, GPS and the motion detector combine to provide "dead man" monitoring, which automatically dispatches an officer if a lack of motion is detected for a prolonged period. A random alert call-in may also provide redundant verification. The person could, when

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alerted, call in and enter a code, all under computer control. A human operator would only be alerted if a problem occurred.

In general, rules of compliance would be scripted such that the court or DOC would define a level or class of monitoring, the limits of which could be established by prior agreement interdepartmentally. In addition, the DOC could have a set of discretionary rules which they could apply to fit the enforcement process to the individual. This information would be transferred to the central control and tracking station from the DOC, where a specific case file would be generated. The generated file would be printed as entered and returned to the DOC for validation. After validation, the prisoner would be briefed, trained, and given a printed copy of the rules he would follow, which would be a signed photocopy of the validated DOC copy.

In the non-judicial monitoring situation such as medical monitoring, the functions operate in the same fashion. In the medical monitoring situation, the "rules of compliance" might comprise limits on heart rate, blood pressure, or the like in addition to position monitoring. Any indication that any of the parameters were outside the limits of compliance could then be used to immediately dispatch appropriate medical help.

Alternatively, in the automobile monitoring situation the rules of compliance might be "no motion", "low temperature", etc. Indications of "rising temperature" and "motion" would be indicative of theft.

2. PREFERRED HARDWARE DESIGN

The components comprising the present invention are best illustrated in Figure 1. The major components of the present invention are divided into three categories. The first category includes the remote unit which is worn on the individual's person. The second category includes those components which reside at a central control and tracking station. These two groups of components are telephonically joined by the commercial telephone network, preferably through the widely available cellular telephone system. The third category includes those components which reside at the customer location. As discussed above, the customer location components are networked to the central control and tracking station, preferably via a dedicated fiber optic frame relay landline.

In the preferred embodiment, the remote unit worn on the individual being tracked or monitored is further subdivided into two categories. The first remote unit, referred to as

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a "wristband" 20, may be strapped to the individual's wrist or ankle as desired. This wristband 20 is in turn connected to the second category of individual worn components by a small electrical cable 68. The second remote unit maybe referred to as the "cellular bag" 30.

Cellular bag 30 comprises, among other components, a cellular telephone 34. It is this cellular telephone 34 which allows the remote units to be telephonically linked, through the commercial telephone network 70, to the central control and tracking station 40. As the name implies, the central control and tracking station 40 is the point where the data gathered by the remote units 20 and 30 is collected for display and analysis, and for further distribution to the customer location 90.

As mentioned above, it is anticipated that many persons would be simultaneously monitored. Therefore, a central point such as central control tracking station 40 is the most efficient way in which to simultaneously monitor this plurality of persons. However, a means must be provided for systematically selecting from the incoming signals. Consequently, central control tracking station 40 comprises a communications controller 44 which is adapted to interface several different telephone lines simultaneously on a time multiplex basis. In the preferred embodiment, communication controller 44 is an X.25-500 line, wide band link card. One example of an acceptable X.25 standard card is the PC XNET card manufactured by QST of France. Wide band lines are available from the telephone company.

Central control tracking station 40 further comprises a computer processor which, in the preferred embodiment, is a plurality of stand-alone computer systems 46 and 48, adapted to interface with communications controller 44, receiving the telephonically transmitted data therefrom. It is anticipated that the functions of the two stand-alone computer systems 46 and 48 would be subdivided into applications graphics and database management functions, respectively. For example, the stand-alone computer system 46, responsible for graphics applications, can be used to provide a visual display to the operator of the geographic location of the person being monitored using data terminals in addition to printouts of the various data parameters being monitored. Additionally, computer 46 would be adapted to provide an alert indication to a series of terminals 80 connected through a local network 50, and to work stations 92 at customer location 90, to identify any conditions where the rules of compliance have been exceeded. For example,

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if the remote unit fails to detect motion within a given time, this might be an indication of unconsciousness. Similarly, the individual worn apparatus might be programmed to monitor heart rate or blood pressure. As mentioned above, these items can be assigned tolerance limits within the rules of compliance held in memory of the processor in the cellular bag 30 and received from computers 46 and 48. In the preferred embodiment, terminals 80 may comprise a plurality of work stations (Figure 8). Examples of displays which might be presented are shown and discussed below.

In the preferred embodiment, computer 48 is assigned the functions of database management. As mentioned above, it is anticipated that many persons would be monitored simultaneously by the present invention. For each of these monitored persons, a large group of data parameters would be monitored for compliance within pre-specified tolerance limits, the so called "rules of compliance" discussed above.

Also illustrated in Figure 1 are the major components comprising the wristband 20 and the cellular bag 30. As indicated in the figure, the wristband 20 comprises a central processing unit 26 which has connected thereto a motion detector 21, an audio detector 23, a temperature detector 24, and a continuity detector 22. Also connected to central processing unit 26 is an apparatus for generating an encrypted identification signal 28. The purpose of encryptor 28 is to generate a unique, encrypted identification signal in response to a query from the central processing unit 26 or 36. This provides a means for the system to conduct an integrity check ensuring that the proper wristband is installed. In the preferred embodiment, encryptor 28 comprises a Model 1991 "touch series" of embedded identification chips manufactured by Dallas Semiconductor. In addition to the illustrated sensors, wristband 20 may also include other sensors tailored to the given use environment, such as a blood pressure detector, heart rate detector, a radioactivity detector, or a poisonous gas detector. The wristband could either be equipped with the sensor itself or merely interface with existing sensors.

Motion detector 21 is electrically connected to central processing unit 26. In the preferred embodiment, motion detector 21 is a conventional two-axis, mercury switch, operative to detect motion of the wristband 20 of the system. The purpose for motion detector 21 is out of concern for the safety and well-being of the person being monitored. For example, the database management computer 48 and the central control tracking station 40 check to ensure that the motion detector 21 has detected motion periodically. If

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the wristband 20 remains motionless for an abnormally long period of time, the monitored subject may have lost consciousness and be in need of medical attention.

Similarly, temperature detector 24 is electrically connected to central processing unit 26 and provides a means for monitoring the temperature adjacent wristband 20. It is assumed that the temperature sensed by temperature detector 24 should be approximately at body temperature and a reading to the contrary could indicate that the monitored person is in need of assistance. In the preferred embodiment temperature detector 24 may be a DS1620 thermistor manufactured by Dallas Semiconductor, but there are many suitable substitutes. For example, Analog Devices also manufactures a unit which could also be utilized.

Audio detector 23, also electrically connected to central processing unit 26, provides a means for the central control tracking station 40 to audibly monitor the individual. Thus, if the other environmental sensors indicate that a problem has occurred, the central control tracking station 40 can "switch on" audio detector 23 and attempt to determine the immediate situation. In the preferred embodiment, audio detector 23 is a simple crystal microphone. Switching is accomplished by a relay available in the prototyping area 99 of the CPU board, as discussed below.

The final sensor indicated in Figure 1 connected to CPU 26 is continuity detector 22. The purpose for continuity detector 22 is to determine whether the wristband 20 remains attached to the person and immediately signals any removal or attempted removal thereof. This feature is probably most applicable in the judicial monitoring environment where a house arrest prisoner may desire to remove the wristband 20 such that his flight from the prescribed geographic compliance limits remains undetected by the central control tracking station 40. There are several possible methods of accomplishing continuity detection, including resistivity and capacitance. In the present invention, resistivity is employed although others are equally well-suited.

The goal of maintaining the connection integrity of the wristband 20 is further supported by the above discussed sensors. For example, if the continuity detector 22 for some reason should fail to detect a removal, the thermistor 24 would provide a backup indication since removal of the wristband 20 and the lack of proximity to the person's body would cause the temperature sensed by thermistor 24 to drop. Similarly, removal of the wristband 20 and placement on a stationary surface would be sensed by lack of motion

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detected from sensor 21. Thus it can be seen that the various sensors incorporated in wristband 20 work cooperatively to ensure that the monitored conditions remain within prescribed conformance limits, or that any deviation therefrom is immediately identifiable.

The data values and statuses of the various sensors comprising wristband 20 are monitored and compiled by CPU 26. In the preferred embodiment, the CPU 26 associated with wristband 20 may be a "basic stamp" central processing unit manufactured by Parallax, Inc. This CPU comprises I/O and memory components as well as a 25K EEPROM which can be used to program the CPU. Clearly, many alternative CPUs are available which could perform the same functions, the criterion being one of individual preference so long as the CPU has I/O and memory functions and its physical dimensions will accommodate use in this environment.

The data signals collected by CPU 26 are transmitted to cellular bag 30 by cable 68 connected therebetween using connectors 29 and 39. It is anticipated that cable 68 would be a small co-axial or similar cable capable of establishing data communication therebetween. In some situations, it might also be desirable for cable 68 to comprise a conductor capable of transmitting power from cellular bag 30 to wristband 20. The status of this power line may also be monitored as another means of checking the security of wristband 20.

In some situations, it may be desirable for the connection between wristband 20 and cellular bag 30 to be wireless, thereby permitting a greater range of movement of the individual while maintaining direct monitoring and tracking of the wristband.

The major components of cellular bag 30, as illustrated in the figure, include the Global Positioning System (GPS) receiver 32, the central processor unit 36 and the cellular phone and modem communication apparatus 34. In addition to the components illustrated, bag 30 may also include an ID encryption circuit 84 shown and discussed in connection with Figure 5. The GPS receiver 32 is operative to receive the ranging signals transmitted by global positioning satellites 12a-d which are in geosynchronous orbit about the earth. In the preferred embodiment, GPS receiver 32 is an "Oncore" unit manufactured by Motorola, Inc. As is well understood in the art, GPS receiver 32 is capable of receiving the ranging signals from the GPS satellites and converting this information into a geographical latitude and longitude. This information may then be transferred to and used by CPU 36. In the preferred embodiment, CPU 36 is a "Micro 44E" programmable microcontroller

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manufactured by Blue Earth Research, Inc. In addition to the positioning information from GPS receiver 32, central processing unit 36 may include an interface operative to receive and process the data acquired by the wristband sensors including continuity and other environmental data.

The basic parameters which the CPU 36 may monitor include position determination interval (from one per second to some arbitrary interval), position violation as a function of location and time (broad rules for un-manned tracking), battery condition, ID bracelet status (continuity, etc.), cellular phone availability status (monitor for valid dial tone at programmed interval), valid communications status (code key passing), GPS system status (loss of signal from pre-programmed minimum number of satellites), special rule enforcement and validation (harsh environment check-in procedures), loss of coverage rule enforcement (loss of cellular or GPS time-out), microphone activation (central tracking random or special monitoring rules), and miscellaneous environmental data.

As mentioned, data from wristband 20 is transmitted to cellular bag 30 and central processing unit 36 through cable 68. CPU 36 may include an interface means to facilitate the reception of this data. All of the sensed data, including positioning data from GPS receiver 32 and environmental data from wristband 20 sensors, reside in central processing unit 36. Central processing unit 36 is electrically connected to cellular phone and modem communication apparatus 34. In the preferred embodiment, cellular phone and modem communication apparatus 34 is a model RS 17-1061 cellular telephone and attached data kit 17-1617 manufactured by Radio Shack, but many other suitable alternatives are available. Cellular phone and modem communication apparatus 34 thus allows the positioning and environmental data collected by central processing unit 36 to be transmitted by conventional cellular transmission to the telephone system 70 and then by conventional telephone to central control tracking station 40.

CPU 36 also includes data processing functionality for a variety of purposes. First, various rules of compliance parameters for geographical limits on inclusion zones and exclusion zones, as well as time intervals for downloading of stored information to the control and tracking station, may be uploaded from the central control tracking station 40 via communication apparatus 34. Second, CPU 36 includes memory in which the sensed data, including time-stamped geographical position, is stored until the occurrence of the next scheduled download to the central control tracking station 40. Finally, CPU 36 will

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continuously compare the position data from the GPS receiver with the rules of a compliance data received from central control tracking station 40 and give a "real time" alarm signal upon the violation of any rule of compliance. This alarm signal is immediately transmitted to the central control tracking station 40 for further processing and distribution to the customer location 90. Thus, CPU 36 is not merely a "dumb" transmitter, but is rather an interactive "intelligent" microprocessor.

As noted above, the bag 30 may also include a receiver for differential correction information which is electrically connected to CPU 36. Thus, CPU 36 may make the necessary differential correction of GPS signals to determine position more accurately.

Electrical power for the remote units is primarily provided by battery 38 in bag 30. Battery life would be less with strict rule enforcement, since more frequent transmissions of data are required. Conversely, battery life would be longer with less stringent enforcement, since less frequent transmissions are required. The battery would be of the quick-charge type and removable, with the prisoner responsible for monitoring and replacing as required. The system would give a time warning to the prisoner via lamp 82 indicating pending battery depletion. In the preferred embodiment, an internal buffer battery would supply 5-10 minutes of function without the main battery pack. This interval would give the prisoner time to call central tracking if for some reason battery replacement failed, resulting in an imminent rule violation and requiring field service. In this situation, a lock-down mode is envisioned which would require that the prisoner remain at the last reported position until service arrived.

Figure 2 is a pictorial representation of the environment in which the tracking and monitoring apparatus of the present invention is used. As seen in this figure, the preferred embodiment of the apparatus comprises wristbands 20 and 120 and cellular bags 30 and 130 which are adapted to be worn on the wrist and waist, respectively, of the monitored individuals. As seen in this figure, it is envisioned that the apparatus would be employed on a number of individuals. As mentioned above, bags 30 and 130 receive positioning signals from GPS satellites 12a-d. Cellular bags 30 and 130 also receive environmental data from their respective wristbands 20 and 120. Cellular bags 30 and 130 also receive rules of compliance parameters and other downloading information from control station 40 via the cellular telephone system 71. The accumulated time-stamped position data and various environmental data is then downloaded at desired intervals from the cellular bags

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30 and 130 by the communication apparatus 34 (shown in Figure 1). In the preferred form of the invention, the communication apparatus is a cellular telephone which is linked to telephone central office 70 via a cellular telephone system 71. The telephonically transmitted data would then be available to the central control tracking station 40 and customer location 90 by means of conventional telephone landlines.

Figure 3 is a pictorial representation of the cellular bag 30 and associated external components and the connection to wristband 20. As seen in this figure, the major external identifiable components of cellular bag 30 comprise the waist or shoulder strap 31, the cellular antenna 35, and the GPS receiver antenna 33. The cable 68 is illustrated connecting the cellular bag 30 and the wristband 20 as discussed above. Cable 68 is operative to connect cellular bag 30 and wristband 20 providing communication and/or power therebetween. Lamp 82 is provided on the outside face of bag 30. Lamp 82 may be provided to alert the monitored person to an alert condition such as position violation as well as battery low condition or the like. Speaker 56 is provided to give an audio warning in addition to the visual warning provided by lamp 82. Also shown in the figure is the wrist strap 27 used to maintain the wristband 20 in position. Strap 27 also functions as a continuity strap used in conjunction with continuity detector 22 in order to provide an indication of removal or attempt at removal of the wristband 20. Finally, Figure 3 illustrates one conventional battery charging apparatus 52 with a conventional rechargeable battery 38 installed therein.

Figure 4 is a further enlargement of some of the internal components of cellular bag 30. Illustrated in this figure are the GPS receiver 32, the internal components of the cellular antenna 35, the cellular phone and modem communication apparatus 34, the connection cable 68, the central processing unit 36, and the GPS antenna 33. Also shown are the sources of electrical power for the "individual worn" components, namely, batteries 38 and 58. Finally, the figure illustrates speaker 56 and lamp 82. Speaker 56 and lamp 82 are used to provide an indication to the monitored person that he has exceeded compliance limits. In the "house arrest" situation, depending on the severity of the crime, the individual might be provided a certain limited time to correct the violation prior to action being taken. Speaker 56 and lamp 82 provide him with both a visual and audio indication that this "grace period" has begun.

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Figure 5 is a schematic representation of the major components making up cellular bag 30, showing in particular the electrical interconnections therebetween. Cellular phone and modem communication apparatus 34 is illustrated with the transmit and receive lines to the cellular bag central processing unit 36. Similarly, GPS receiver 32 is shown connected to central processing unit 36 by means of receive and transmit lines. These receive and transmit lines between the cellular phone and modem communication apparatus 34 and GPS receiver 32 establish data communication links with central processing unit 36.

ID encryption chip 84 operates in a fashion similar to ID chip 28 in wristband 20. Namely, it provides a unique identification symbol when requested by CPU 36. Thus, encryption chip 84 provides another layer of security that the proper bag/wristband combination is connected.

Also shown in Figure 5 are the batteries 38 and 58 used to make up the electrical supply for the components comprising cellular bag 30. Figure 5 illustrates the connection 39 associated with cellular bag 30 used to establish data and power communication with wristband 20. Also shown are speaker 56 and light 82 which may be used to provide an "out of compliance" indication as well as a "battery low" indication. Finally, shown as parts of cable connector 39 are jacks 37a and 37b which are used for data reception and power supply, respectively.

Figure 6 is an enlarged pictorial representation of the major internal components of wristband 20. As indicated in this figure, the wristband internal components include microphone 23, central processing unit 26, motion detector 21, identification encryptor 28, continuity detector 22, and thermistor 24.

Microphone 23 is used to allow audio monitoring of an individual in case some discrepancy or abnormality in the monitored data is detected. As described above, the preferred processing unit for CPU central processing unit 26 may preferably be the "basic stamp" CPU manufactured by Parallax, Inc. This CPU has I/O and memory components including a 25K EEPROM. It will be understood by those in the art that the "basic stamp" computer board contains a "scratch pad" or "prototype" area 99 which is adapted to receive the microphone 23 and a relay which is able to switch between transmission of digital information and the audio signal from microphone 23 (see Figure 7 below).

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Identification encryptor 28 may be a Model 1991 "touch series" of embedded identification chips manufactured by Dallas Semiconductor, as shown in Figure 6. Also illustrated in this figure is the cable connector 29 used to connect the wristband 20 to the cellular bag 30 by means of cable 68. As mentioned above, microphone 23 may be a simple crystal microphone which is adapted to be received on the "basic stamp" microcomputer. Thermistor 24 may be a conventional Model DS1620 manufactured by Dallas Semiconductor.

Figure 7 is a more detailed schematic diagram illustrating the data and power communication within the wristband 20. As illustrated in this figure, the central processing unit 26 is electrically connected to temperature sensor 24. Thus, temperature data sensed by sensor 24 may be transmitted to central processing unit 26 for later transmission to cellular bag 30 via cable 68. Additionally, the central processing unit 26 is electrically connected to identification encryptor 28 through receive and transmit lines, as indicated.

As mentioned above, the encryptor 28 is operative to generate and transmit a unique and encoded identification to the CPU 26 which may then be forwarded to the cellular bag 30 and on to the central control tracking station 40. Identification encryptor 28 provides a means for identifying the particular wristband 20 connected to bag 30, preventing the exchanging of wristbands between different monitored individuals or bags. Also shown are the motion detector 21, microphone 23, and continuity detector 22 and their interconnection to central processing unit 26. As mentioned above, the preferred embodiment for the motion detector 21 is a two-axis mercury switch. The resistivity-based continuity detector 22 is made up in part by the band 27 and its interconnection to the wristband 20. Finally, the cable connector 29 for connecting data and power communication cable 68 to wristband 20 from cellular bag 30 is illustrated. As shown in the figure, the cable connector 29 includes both a data line 19a as well as a power line 19b.

As will be understood by those in the art, the "basic stamp" CPU 26 includes a prototype area 99 adapted to switch between various connections for output using a relay switch. In the present invention this switching is used to switch the receive/transmit line 19a to microphone 23 enabling its output

Figure 8 is a pictorial representation of the central control tracking station 40. As illustrated in this figure, the positioning and environmental data are downloaded to the

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central control tracking station 40 by means of the conventional telephone central office 70 through a series of land lines or wide-band co-axial cable 43. This plurality of incoming signals are fed to X25 controller 44. In the preferred embodiment, the X25 controller is a 500-line time demultiplexer similar to that used on commercial and private bulletin boards for interfacing the central control tracking station 40 to a large number of incoming telephone lines. As mentioned above, one suitable controller is the PC Xnet card manufactured by OST. After demultiplexing, the signal may be fed into the application graphics computer 46 and database management computer 48.

As mentioned above, the database management computer 48 in the preferred embodiment would be an IBM AS400 computer. Clearly, many other commercially available computers would be equally suitable. The purpose of database management computer 48 is to collect and manage incoming data from the telephone lines and from various customer locations 90 via land lines 94. The data from database management computer 48 may be directed to applications graphics computer 46, customer location 90, and/or uploaded to the cellular bags.

In the preferred embodiment, graphics computer 46 may also be an IBM AS400. Applications graphics computer 46 processes the data from computer 48 to formulate displays in response thereto. After processing by graphics computer 46, the information is transmitted to a plurality of work stations 80a-c for display to the operators. As mentioned above, the purpose of applications graphics work stations 80a-c is to visually display the data received and in particular to identify any alerts resulting from non-compliance with prescribed limits.

Referring now to Figures 9-15, an example of use of the method and apparatus of the present invention is described in more detail. In this example, the customer is the Department of Corrections (DOC), with the customer location designated generally at 90 and located remote from the central control station 40. As discussed above, central control station 40 is connected to customer location 90 such that information may be easily and accurately transmitted therebetween. Preferably, the connection is by dedicated fiber optic frame relay land line, and the customer location preferably includes a computer work station 92 permitting the receipt and display of information as well as allowing the input of information into the system. It should be understood that more than one customer may be directly connected to central control station 40 throughout the geographic territory. It

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should also be understood that many other means for networking the central control station with the particular customer may be employed within the scope of this invention.

The initial step in the method of the present invention calls for the customer to identify a particular user 60 and the geographic locations of the various activities 62a-62f, which the user will contact. In the case of a "house arrest", these activities may include school 62a, home 62b, a store 62c, various leisure activities 62d, work 62e, and the probation officer at the Department of Corrections 62f. All of these activities are input into the system via work station 92 at the customer location 90, and networked to the central control station 40.

Once the activities have been identified, the customer will enter individual geographic locations and time constraints using work station 92. These locations and time constraints are generally identified as "inclusion" zones 64 or "exclusion" zones 66. Each inclusion zone identifies the geographic parameters of the allowable activities of an individual user 60 (shown as zones 64a, 64b, 64c, 64d, 64e, and 64f, respectively). In addition, corridors 68 are provided between various inclusion zones to permit travel by the user between these zones. An exclusion zone 66 would include locations such as a victim's home, or possibly bars, racetracks, or other identifiable locations for which the particular user 60 is restrained from contact.

Once the data has been entered into the customer computer work station 92, it is networked into the central control station 40 through the fiber optic frame relay line 94. Once the remote unit or cellular bag 30 is activated, the various parameters, or "rules of compliance," are uploaded from the central control station 40 directly to remote cellular bag 30. Preferably, this uploading occurs via cellular telephone towers 96, as described in more detail hereinabove. These parameters may be modified as needed by the customer in the same fashion, with uploads occurring by way of central control station 40 to remote cellular unit 30.

Referring now to Figure 13, the process for downloading standard monitoring and tracking information is shown. Part of the information which is uploaded to remote cellular unit 30 is a schedule identifying the periodic times for the standard download of monitoring and tracking information. As described above, remote unit 30 receives GPS signals from a plurality of satellites 12 to determine the geographic location of the user 60. Typically, the GPS receiver in remote unit 30 will update this position determination every

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second. This position information is continuously recorded with a time stamp and stored within the CPU in remote 30 until the predetermined time for an intermittent standard download of information. Broken line arrows 14 indicate the transmission of GPS signals from satellites 12 to remote unit 30 for the accurate determination of the location of user 60.

The download of data stored in remote unit 30 to central control station 40 is preferably by cellular telephone, and is generally indicated by arrow 16 extending from remote unit 30 through cellular towers 18 to central control station 40. The standard informational downloads are then processed and stored at central control station 40 and transmitted to the customer location 90 at predetermined intervals determined by the customer.

Figure 14 is a schematic diagram showing an example of a standard download of time-stamped geographic locations for a remote unit designated as "ComTrak Unit #9". In this example, the standard download times from the remote unit were determined to be at 9:50 A.M. and 3:50 P.M. on this particular day. Preferably, the information is displayed as a "map" with various landmarks and geographic locations identified thereon for ease of interpretation. In the example shown, activity location 62b (home) and activity location 62e (work) are displayed with time-stamped location information 98 displayed thereon. This stored information, downloaded from the remote unit is processed and stored at the central control station and may be displayed at one of the graphics work stations 80 at the central control station. In addition, the customer may access the information via land line 94 using the customers work station 92 at any time. The accumulated information in the form of a map may be displayed directly on the customer's work station or printed in hard copy form.

While the most conventional use of the system will reside in periodic standard downloads of information from a remote unit 30 to central control station 40 and thence to customer location 90, the present invention also permits "real time" notification of non-compliance with rules of compliance and/or indicative of tampering with the remote unit 30 worn on the person of user 60. Figure 15 is a schematic diagram showing real time notification of a non-compliance violation. In the example shown in Figure 15, user 60 has crossed the geographic boundary into a predetermined exclusion zone 66. The CPU within remote unit 30 is continuously monitoring the user's location (via receipt of GPS signals

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from satellites 12 (with the current rules of compliance parameters uploaded to the remote unit 30). Upon crossing of the boundary of exclusion zone 66, remote unit 30 will immediately transmit a "violation" signal, shown by arrow 100, via cellular towers 96 to central control station 40. The non-compliance violation is immediately processed at central control station 40 and transmitted at work station 92 at customer location 90, so that the customer is immediately notified of the violation. Simultaneously, the customer may provide additional instructions regarding notifications of tampering or non-compliance. In the example shown in Figure 15, the customer has called for the central control station 40 to immediately notify a correctional officer 102 via a conventional pager 104, as shown by arrow 106 transmitted via satellite 108. The downloaded time-stamped geographic location information will provide the customer and the corrections officer with the specific information necessary to correct any non-compliance or tampering violations.

Alternatively, in a medical monitoring environment, the heart rate or blood pressure of a monitored individual might be assigned certain acceptable tolerances. Clearly, these acceptable tolerances would be different for each monitored person. Thus, there is a need for an ability to store these "rules of compliance" for each monitored individual. In the preferred embodiment, this function would be performed by the remote unit 30, and periodically downloaded to the database management computer 48. The database computer 48 is in communication with controller 44 in order to receive the telephonically transmitted data from the remote units. As with the previous example, the periodically downloaded information is time-stamped, to provide a doctor or other medical professional a record or "map" showing the entire accumulated record of information which was stored between the periodic standard downloads. Any occurrence of input data falling outside the acceptable compliance limits would be identified and transmitted as an alert to the graphics computer 46 for display and identification on terminals 80, and to work stations 92, as described above. In this way, the user is not required to push a "panic button", nor wait for the central control station to periodically pull the remote unit to determine whether an emergency condition exists. Rather, a "real time" notification of an emergency condition is automatically transmitted, regardless of the scheduled time for a standard information download.

It is apparent that numerous other modifications and variations of the present invention are possible in view of the above teachings. For example, numerous

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environments exist for use of the present invention and each could have a particular sensor associated therewith. For example, the device could be used to monitor individuals in a radioactive or EMF environment transmitting information as to radioactivity levels or existence of poisonous gases as well as position information. Another use is by military personnel. The device can be used to track individuals, such as middle crews, carrying classified information. Finally, the apparatus can be used in non-human situations such as monitoring cars.

Additionally, as is well understood in the art, many part substitutions are possible while maintaining the desired operation of the apparatus. For example, numerous CPUs are available which could accomplish the tasks equally well as those mentioned above. The same may be said for the discrete components such as microphone, temperature sensor, motion detector, etc. Similarly, a wide variety of computers are available to perform the processing and display functions in the various locations.

Finally, it will be noted that only a few of the useful environments for the present invention have been mentioned. An almost limitless number of situations can be proposed where it is desirable to monitor the position of an individual or object in conjunction with some external data.

Therefore, it is to be understood that the above description is in no way intended to limit the scope of protection of the claims and it is representative of only one of several possible embodiments of the present invention.

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I claim:

1. Apparatus for tracking and monitoring a remote unit from a central control station, comprising: a remote unit having means for determining the geographic position of the remote unit at predetermined time intervals; a programmable central processing unit (CPU) having memory storage, carried on the remote unit, and connected to the position determining means, for receiving position signals from the position determining means, for processing each position signal with a time stamp, and for storing the time-stamped signals in memory; communication means carried on the remote unit and connected to the CPU, for transmitting data from the remote unit CPU to a central control station (CCS) and for receiving data from the CCS and transmitting the received data to the CPU; said CPU programmed to accumulate said time-stamped position signals for a predetermined time interval and to transmit accumulated signals as a download through the communication means to the CCS; said CCS located remote from the remote unit and including communication means for receiving downloads from the remote unit and for transmitting uploads to the remote unit; and said CCS including a programmable computer with memory storage, connected to the CCS communication means, for receiving, processing and storing downloads from the remote unit.

2. The apparatus of claim 1 wherein said computer is further programmed to process set downloads for selective display as a map with the accumulated time- stamped position signals displayed on the map.

3. The apparatus of claim 2 wherein said computer includes display means for displaying a map of a selected download.

4. The apparatus of claim 3 wherein said CCS computer includes input means for enabling personnel to enter data for transmission to the remote unit CPU as an upload, said data including parameters relating to download time intervals.

5. The apparatus of claim 4 wherein said CPU is adapted to store geographic parameters constituting inclusion zones having a boundary, and is operable to compare

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each time-stamped signal with said inclusion zone parameters, said CPU further operable to immediately transmit a "violation" signal to the CCS upon the occurrence of a time-stamped signal indicating the remote unit has traveled beyond the inclusion zone boundary; said CCS computer being operable to receive and process the violation signal and to selectively display the violation on the display means.

6. The apparatus of claim 5 wherein said data for transmission to the CPU has an upload further including geographic parameters relating to boundaries of an inclusion zone.

7. The apparatus of claim 6, further comprising: a computer work station at a customer location, the customer location being remote from the CCS and remote unit; communication means connected to the customer location work station (CLWS) for transmitting data input at the CLWS to the CCS and for receiving, storing and selectively displaying data from the CCS; said CCS communication means including means for transmitting and receiving data from the CLWS; said CCS computer being operable to process data received from the CCS and transmit the data to the remote unit CPU, said data including predetermine parameters; said remote CPU being operable to process data received from the CCS relative to parameters received from the CLWS.

8. The apparatus of claim 7, further comprising: said CCS computer being operable to transmit a "violation" signal received from the remote unit to the CLWS; and said CLWS being operable to receive, process and selectively display a "violation" signal received from the CCS.

9. The apparatus of claim 8 wherein said means for determining the geographic position of the remote unit includes: a receiver for receiving ranging signals from a plurality of global positioning system (GPS) satellites; and said CPU connected to the receiver and operable to process and store the GPS ranging signals and to determine the position of the remote unit therefrom.

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10. The apparatus of claim 9 wherein the communication means on the remote unit includes a cellular telephone electrically connected to the CPU for transmitting and receiving information from the CCS.

11. The apparatus of claim 10 wherein the CCS computer includes a communication controller adapted to interface with a plurality of telephone lines of a telephone network and to receive telephonically transmitted information from the CPU.

12. The apparatus of claim 1 wherein said CCS computer includes input means for enabling personnel to enter data for transmission to the remote unit CPU as an upload, said data including parameters relating to download time intervals.

13. The apparatus of claim 1 wherein said CPU is adapted to store geographic parameters constituting inclusion zones having a boundary, and is operable to compare each time-stamped signal with said inclusion zone parameters, said CPU further operable to immediately transmit a "violation" signal to the CCS upon the occurrence of a time-stamped signal indicating the remote unit has traveled beyond the inclusion zone boundary. Said CCS computer being operable to receive and process the violation signal and to selectively display the violation on the display means.

14. The apparatus of claim 13 wherein said data for transmission to the CPU has an upload further includes geographic parameters relating to boundaries of an inclusion zone.

15. The apparatus of claim 14, further comprising: a computer work station at a customer location, the customer location being remote from the CCS and remote unit; communication means connected to the customer location work station (CLWS) for transmitting data input at the CLWS to the CCS and for receiving, storing and selectively displaying data from the CCS; said CCS communication means including means for transmitting and receiving data from the CLWS; said CCS computer being operable to process data received from the CCS and transmit the data to the remote unit CPU, said data including predetermine parameters; said remote CPU being operable to process data received from the CCS relative to parameters received from the CLWS.

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16. The apparatus of claim 15, further comprising: said CCS computer being operable to transmit a "violation" signal received from the remote unit to the CLWS; and said CLWS being operable to receive, process and selectively display a "violation" signal received from the CCS.

17. The apparatus of claim 5, further comprising: a computer work station at a customer location, the customer location being remote from the CCS and remote unit; communication means connected to the customer location work station (CLWS) for transmitting data input at the CLWS to the CCS and for receiving, storing and selectively displaying data from the CCS; said CCS communication means including means for transmitting and receiving data from the CLWS; said CCS computer being operable to process data received tom the CCS and transmit the data to the remote unit CPU, said data including predetermine parameters; said remote CPU being operable to process data received from the CCS relative to parameters received from the CLWS.

18. The apparatus of claim 17, further comprising: said CCS computer being operable to transmit a "violation" signal received from the remote unit to the CLWS; and said CLWS being operable to receive, process and selectively display a "violation" signal received from the CCS.

19. The apparatus of claim 1, further comprising: a computer work station at a customer location, the customer location being remote from the CCS and remote unit; communication means connected to the customer location work station (CLWS) for transmitting data input at the CLWS to the CCS and for receiving, storing and selectively displaying data from the CCS; said CCS communication means including means for transmitting and receiving data from the CLWS; said CCS computer being operable to process data received from the CCS and transmit the data to the remote unit CPU, said data including predetermine parameters; said remote CPU being operable to process data received from the CCS relative to parameters received from the CLWS.

20. The apparatus of claim 9 wherein said means for determining the geographic position of the remote unit further includes a receiver adapted to receive differential

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correction information, connected to said CPU, said CPU operable to process said GPS signals and differential correction information to determine precise location of the remote unit.

21. A method of tracking and monitoring a remote unit from a central control station, comprising the steps of: providing a remote unit with means for determining the geographic position of the remote unit, and with a central processing unit (CPU) connected to the position determining means; said CPU processing and time-stamping position signals from the position determining means to determine the location of the remote unit at predetermined time- stamped intervals; said CPU accumulating the time-stamped position signals and storing them in memory; said CPU transmitting a set of accumulated time-stamped position signals at a predetermined time interval to a central control station (CCS); and a computer at the CCS receiving, processing, storing and selectively displaying the time-stamped position signals from the remote unit.

22. The method of claim 21 wherein the step of the CCS selectively displaying the time-stamped position signals includes displaying the signals as a map with each time stamp signal displayed as a position on the map.

23. The method of claim 22, further comprising the steps of: inputting parameters in the CCS computer relating to transmission time intervals for the CPU; transmitting the parameters to the CPU; and the CPU receiving and processing the parameters for subsequent transmissions.

24. The method of claim 23, further comprising the steps of: inputting parameters in the CCS computer relating to geographic inclusion zones with a boundary; transmitting the parameters to the CPU; the CPU receiving and processing the geographic parameters; and the CPU comparing each time-stamped position signal with the geographic parameters and transmitting a "violation" signal to the CCS upon the occurrence of receiving a position signal which falls outside the inclusion zone.

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25. The method of claim 24 further comprising the step of the CCS computer receiving, processing and selectively displaying a "violation" signal from the CPU.

26. The method of claim 25, further comprising the steps of: providing a customer location work station (CLWS) remote from the CCS; inputting parameters into the CLWS; transmitting the parameters to the CCS; the CCS receiving, processing, storing and transmitting the parameters received from the CLWS to the remote unit CPU; and the CPU receiving, processing and storing of the parameters from the CCS.

27. The method of claim 26, further comprising the steps of: said CCS computer transmitting a "violation" signal to the CLWS upon receipt of a "violation" signal from the CPU; and the CLWS receiving and selectively displaying a "violation" signal.

28. The method of claim 27 wherein the step of providing position determining means includes providing the remote unit with a receiver for receiving ranging signals from a plurality of GPS satellites.

29. The method of claim 28 wherein the step of transmitting accumulated signals from the CPU includes transmitting the signals over a cellular telephone to a telephone network and thence to a communication controller at the CCS computer.

30. The method of claim 28 wherein the step of providing position determining means includes providing the remote unit with a receiver for receiving differential correction information signals, and includes the step of the CPU processing ranging signals from GPS satellites and correction information signals to determine the precise position of the remote unit.

31. The method of claim 21, further comprising the steps of: inputting parameters in the CCS computer relating to transmission time intervals for the CPU; transmitting the parameters to the CPU; and the CPU receiving and processing the parameters for subsequent transmissions.

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32. The method of claim 31, further comprising the steps of: inputting parameters in the CCS computer relating to geographic inclusion zones with a boundary; transmitting the parameters to the CPU; the CPU receiving and processing the geographic parameters; and the CPU comparing each time-stamped position signal with the geographic parameters and transmitting a "violation" signal to the CCS upon the occurrence of receiving a position signal which falls outside the inclusion zone.

33. The method of claim 32 further comprising the step of the CCS computer receiving, processing and selectively displaying a "violation" signal from the CPU.

34. The method of claim 33, further comprising the steps of: providing a customer location work station (CLWS) remote from the CCS; inputting parameters into the CLWS; transmitting the parameters to the CCS; the CCS receiving, processing, storing and transmitting the parameters received from the CLWS to the remote unit CPU; and the CPU receiving, processing and storing of the parameters from the CCS.

35. The method of claim 27, further comprising the steps of: said CCS computer transmitting a "violation" signal to the CLWS upon receipt of a "violation" signal from the CPU; and the CLWS receiving and selectively displaying a "violation" signal.

36. The method of claim 21, further comprising the steps of: inputting parameters in the CCS computer relating to geographic inclusion zones with a boundary; transmitting the parameters to the CPU; the CPU receiving and processing the geographic parameters; and the CPU comparing each time-stamped position signal with the geographic parameters and transmitting a "violation" signal to the CCS upon the occurrence of receiving a position signal which falls outside the inclusion zone.

37. The method of claim 36 further comprising the step of the CCS computer receiving, processing and selectively displaying a "violation" signal from the CPU.

38. The method of claim 37, further comprising the steps of: providing a customer location work station (CLWS) remote from the CCS; inputting parameters into the CLWS;

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transmitting the parameters to the CCS; the CCS receiving, processing, storing and transmitting the parameters received from the CLWS to the remote unit CPU; and the CPU receiving, processing and storing of the parameters from the CCS.

39. The method of claim 38, further comprising the steps of: said CCS computer transmitting a "violation" signal to the CLWS upon receipt of a "violation" signal from the CPU; and the CLWS receiving and selectively displaying a "violation" signal.

40. The method of claim 21, further comprising the steps of: providing a customer location work station (CLWS) remote from the CCS; inputting parameters into the CLWS; transmitting the parameters to the CCS; the CCS receiving, processing, storing and transmitting the parameters received from the CLWS, to the remote unit CPU; and the CPU receiving, processing and storing of the parameters from the CCS.

41. The method of claim 40, further comprising the steps of: said CCS computer transmitting a "violation" signal to the CLWS upon receipt of a "violation" signal from the CPU; and the CLWS receiving and selectively displaying a "violation" signal.

42. Apparatus for monitoring a remote unit from a central control station (CCS), comprising: a remote unit having means for sensing environmental information, said environmental information selected from the group consisting of audio, temperature, motion, position, heart rate and blood pressure data; said remote unit including a central processing unit (CPU) with memory storage and connected to the sensing means for receiving and processing the environmental information at predetermined intervals and for time stamping the processed information; said CPU operable to accumulate the time-stamped information for a predetermined interval, and to transmit the accumulated information through a communication apparatus to the CCS; and said CCS located remote from the remote unit and including a computer with a communication apparatus for receiving and transmitting information to the CPU, operable to receive, process, store and selectively display accumulated time-stamped information from the CPU.

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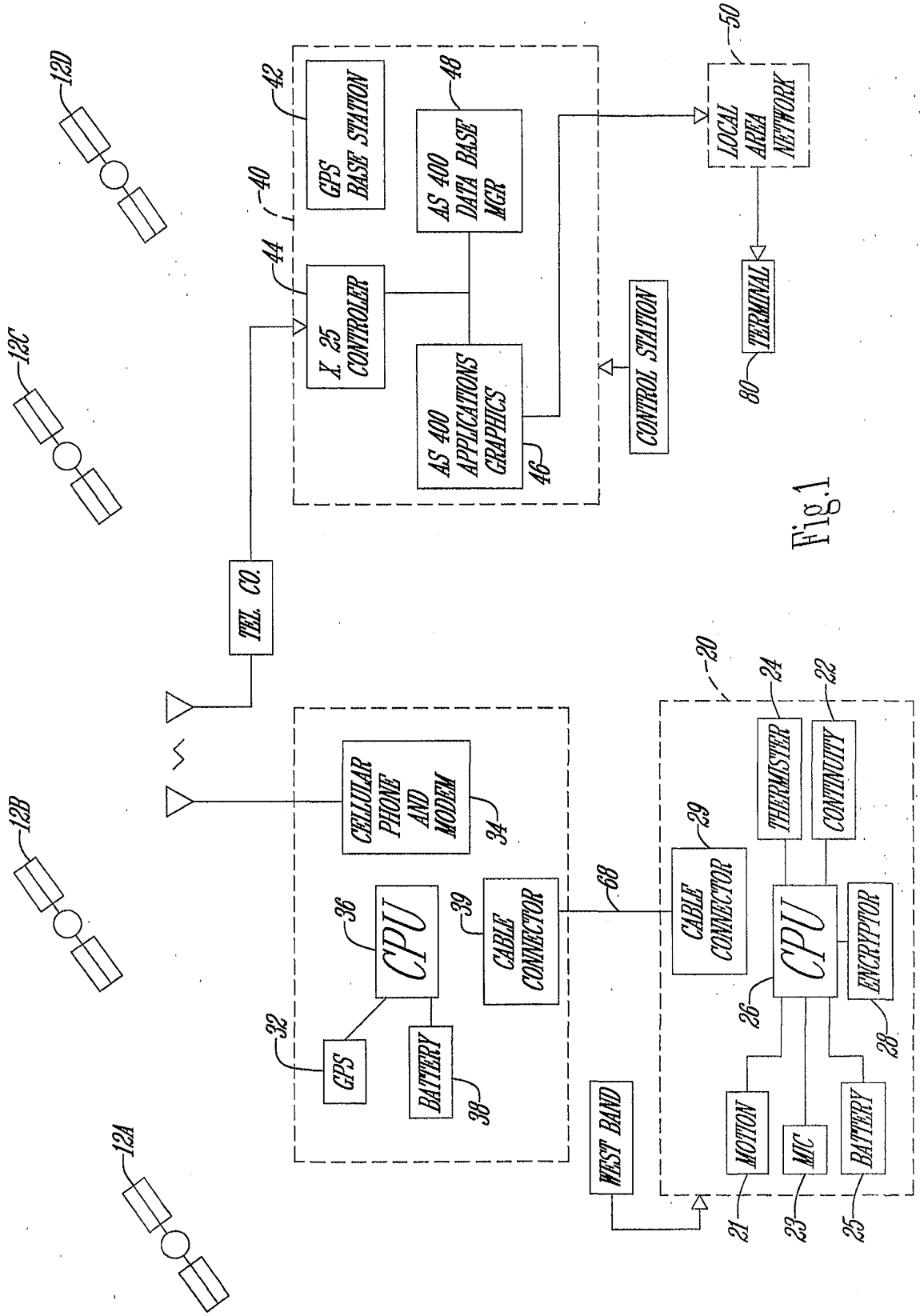


Fig.1

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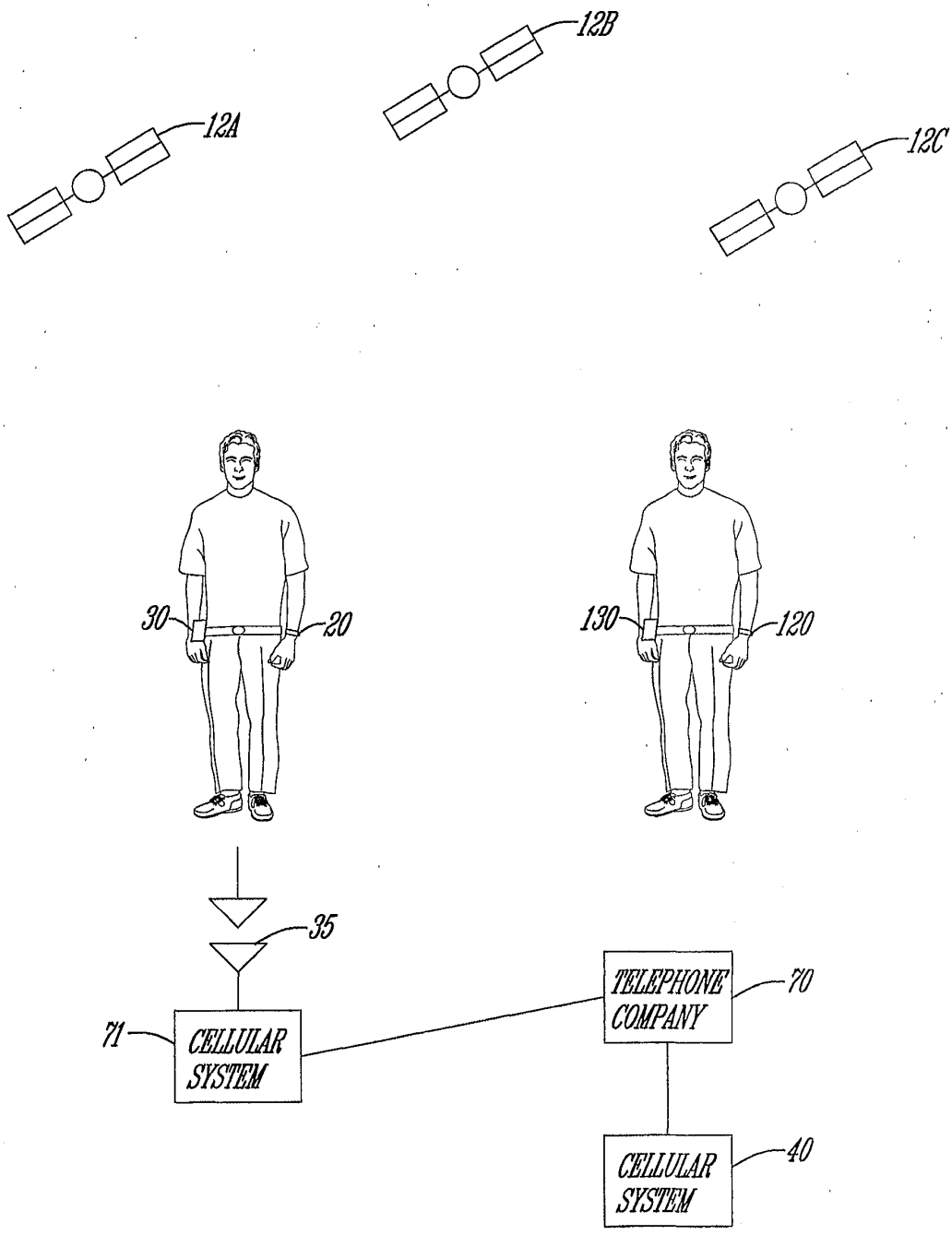


Fig.2

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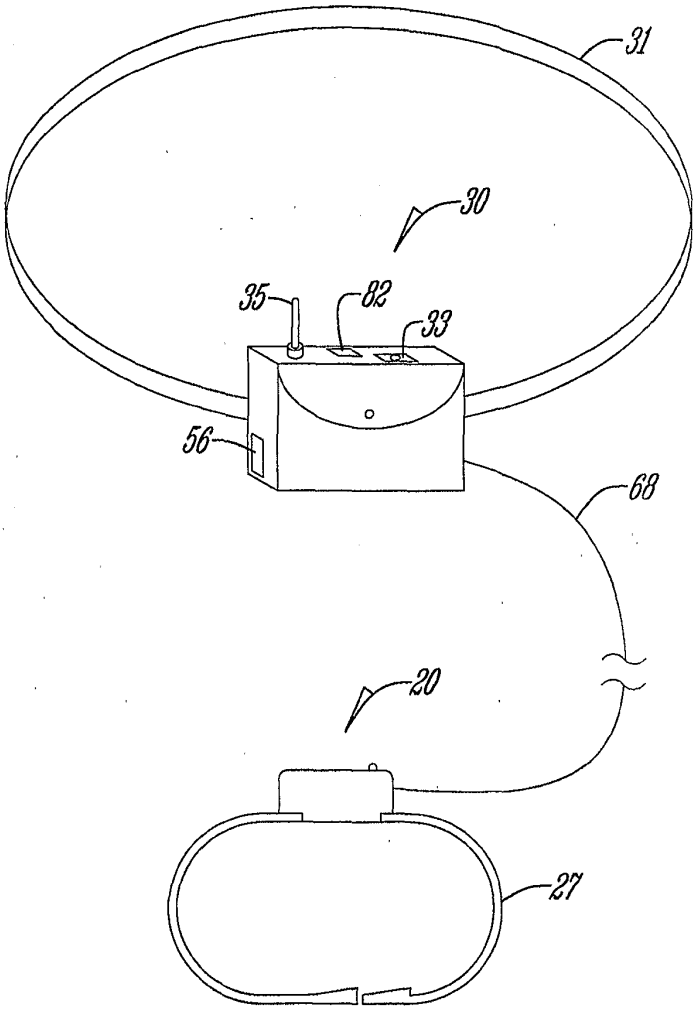


Fig.3

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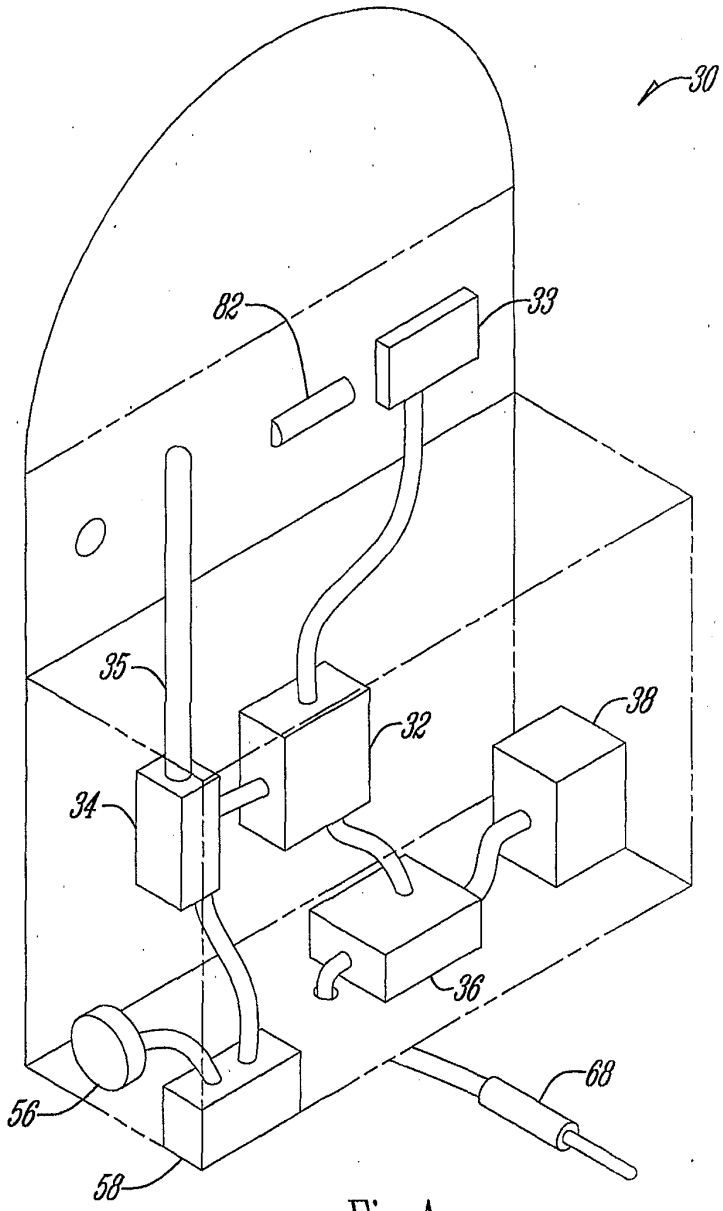


Fig.4

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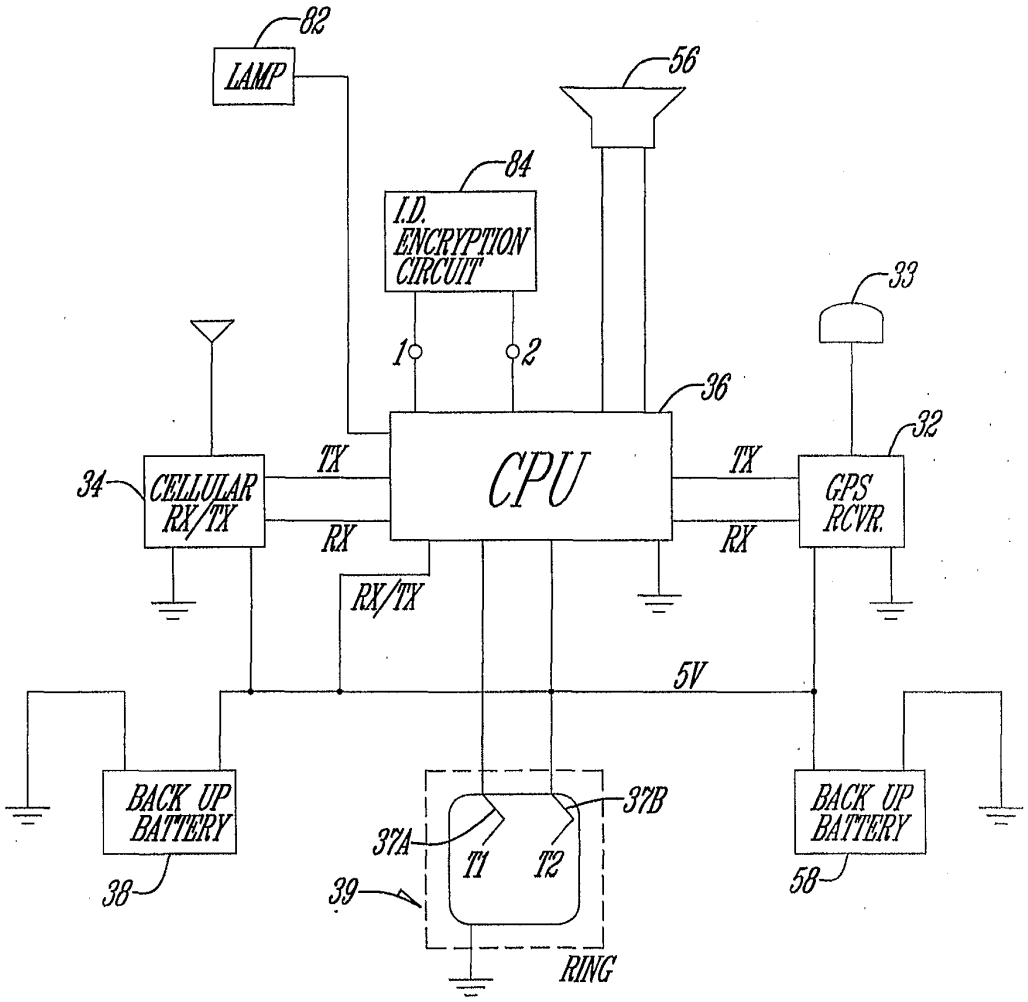


Fig.5

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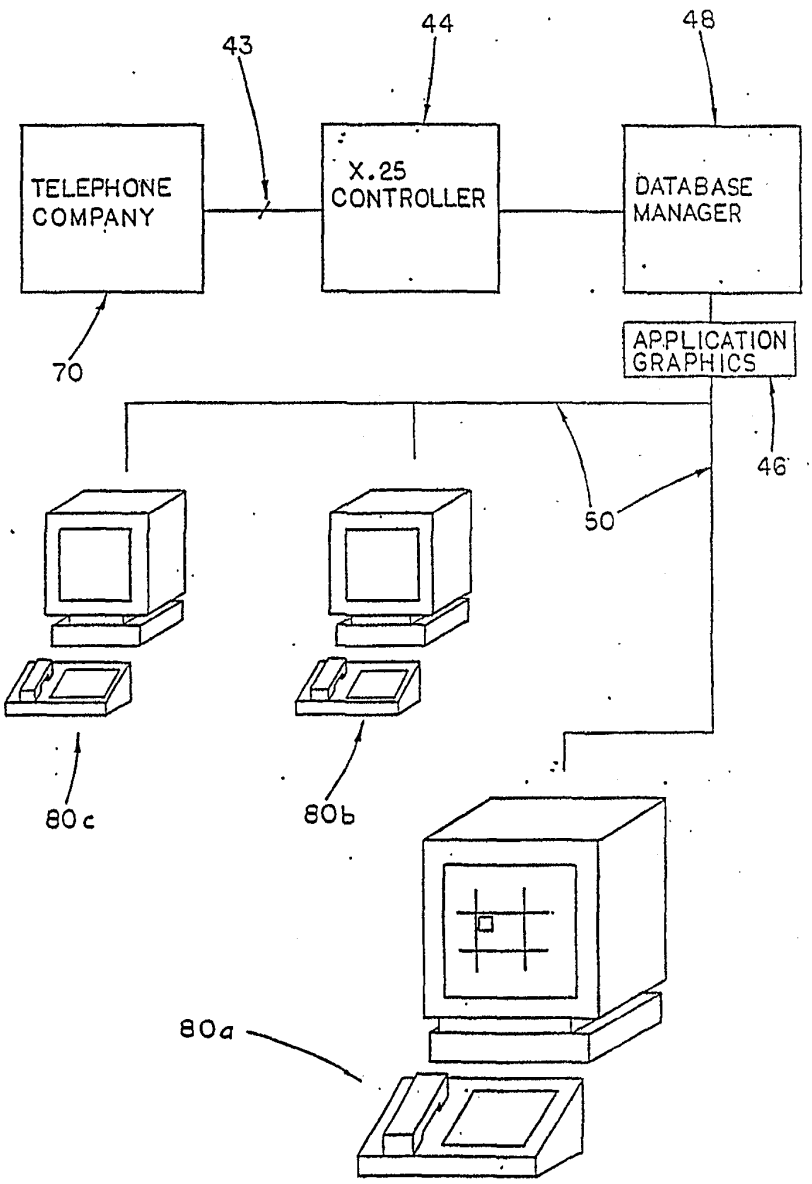


FIG. 8

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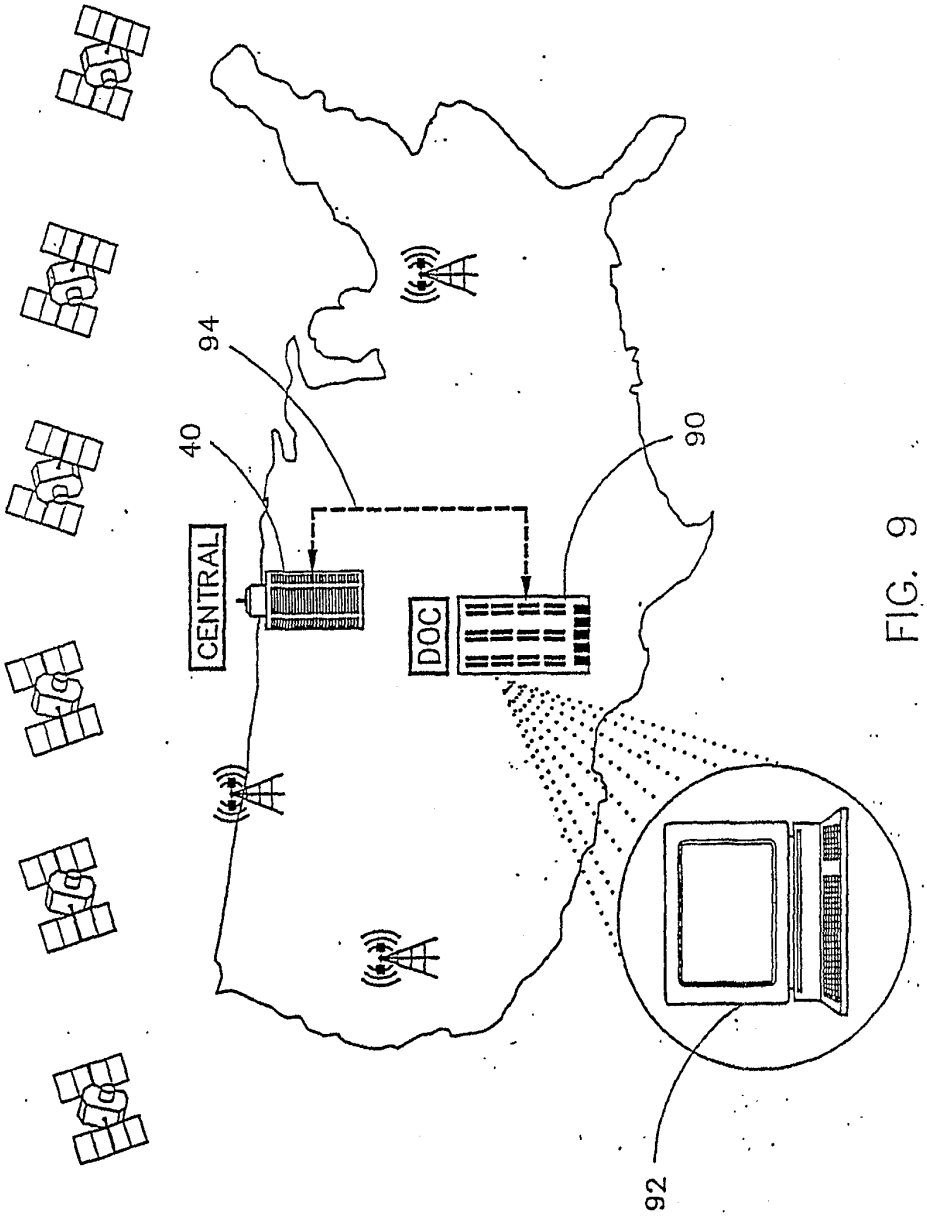


FIG. 9

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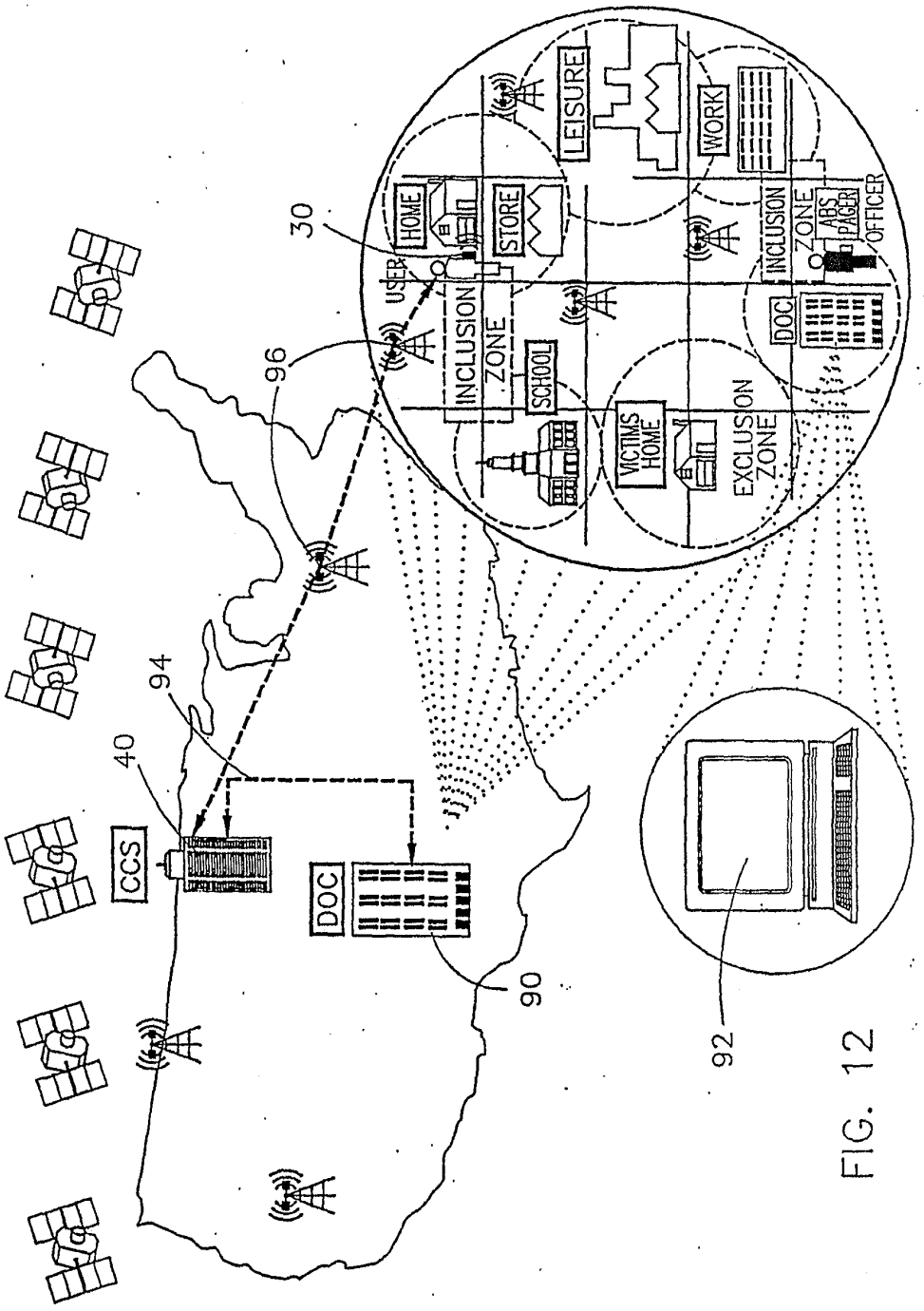


FIG. 12

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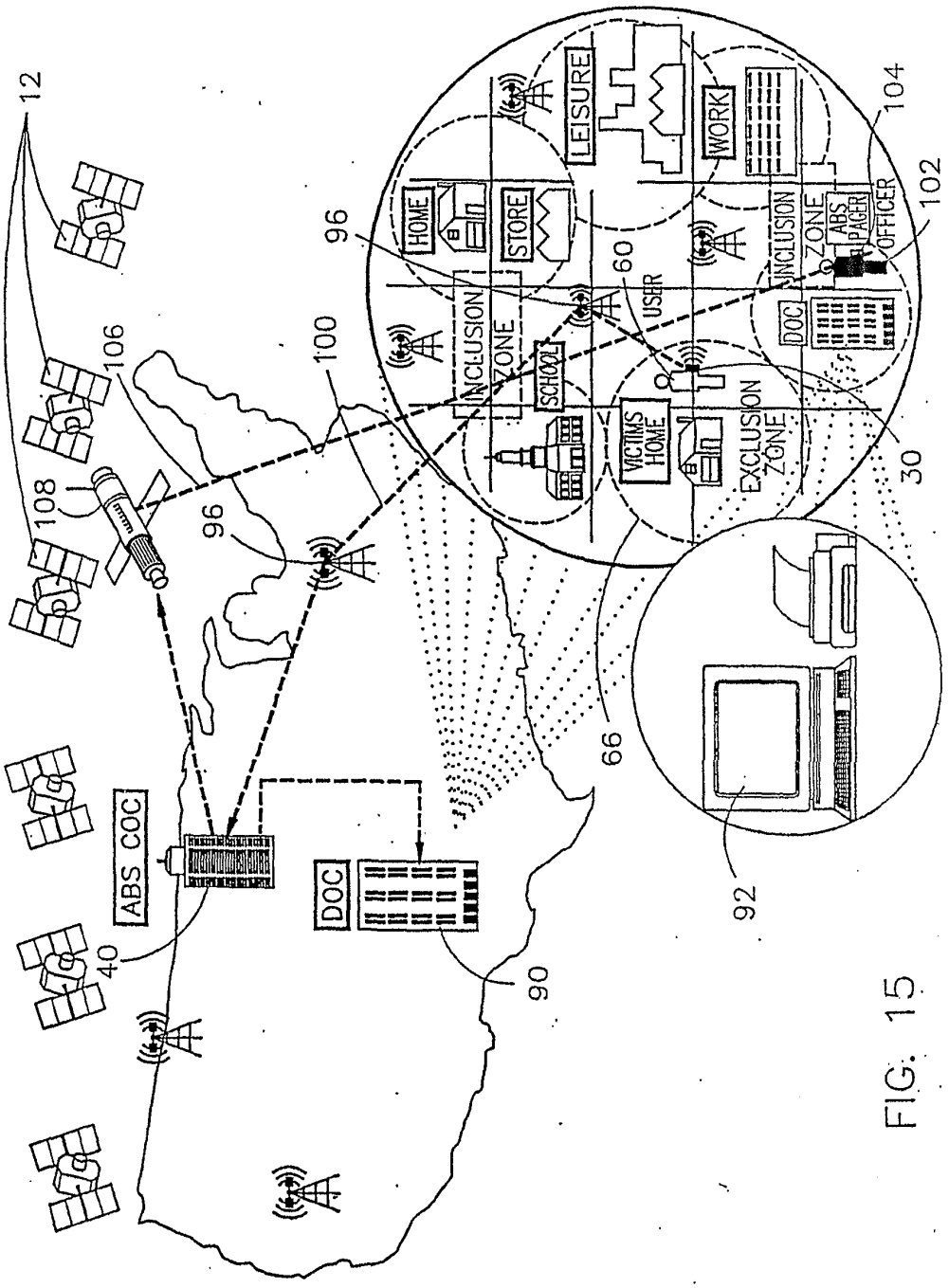


FIG. 15

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INTERNATIONAL SEARCH REPORT

Ir tional Application No
PCT/US 00/04705

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G01S5/14 G08B21/00

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 G01S G08B

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, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 731 757 A (LAYSON JR HOYT M) 24 March 1998 (1998-03-24) abstract; figures 1,6,7 column 2, line 46 -column 3, line 27 column 6, line 17 -column 8, line 42	1,2, 13-16, 21,22, 36-39,42
Y	US 5 652 570 A (LEPKOFKER ROBERT) 29 July 1997 (1997-07-29) abstract; figures 7,11 column 7, line 58 - line 60 column 9, line 10 - line 37 column 10, line 9 - line 24	1,2, 13-16, 21,22, 36-39,42

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
9 October 2000	16/10/2000

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	Niemeijer, R

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ormation on patent family members

International Application No
PCT/US 00/04705

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5731757 A	24-03-1998	AU 4146997 A	06-03-1998
		GB 2330676 A,B	28-04-1999
		WO 9808204 A	26-02-1998
US 5652570 A	29-07-1997	NONE	

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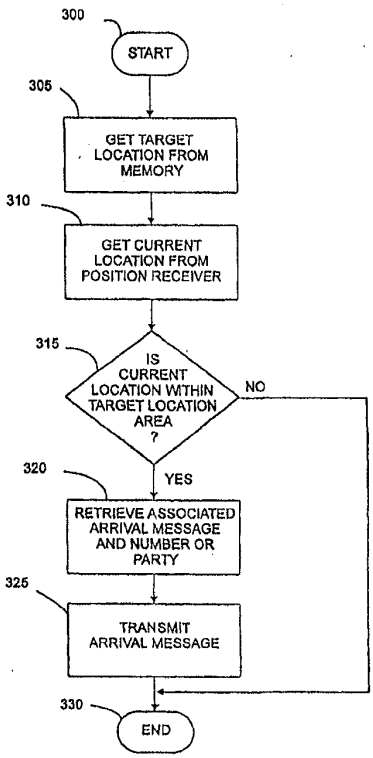
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(54) Title: CELLULAR PHONE THAT DISPLAYS OR SENDS MESSAGES UPON ITS ARRIVAL AT A PREDETERMINED LOCATION

(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 digital signal processor 124 is passed to the modulator 126. The modulator 126 converts the signal to a form that is suitable for transmission on a RF carrier.

The receiver 140 includes a demodulator 142, a digital signal processor 144, and a digital to analog converter 146. Received signals are passed to the demodulator 142, which extracts the transmitted bit sequence from the received signal. The demodulator 142 passes the demodulated signal to the digital signal processor 144 which decodes the signal, corrects channel-induced distortion, and performs error detection and correction. The digital signal processor 144 also separates control and signaling data from speech data. The control and signaling data is passed to the control unit 102. Speech data is processed by a speech decoder and passed to the digital-to-analog converter 146. The digital-to-analog converter 146 converts the speech data into an analog signal which is applied to the speaker 114 to generate audible signals which can be heard by the user.

The control unit 102, such as a programmed microprocessor, functions to coordinate the operation of the transmitter 120 and the receiver 140. Memory 150 stores the program instructions and data needed by the control unit 102 to control the communications terminal 100. The functions performed by the control unit 102 include power control, channel selection, timing, as well as a host of other functions. The control unit 102 inserts signaling messages into the transmitted signals and extracts signaling messages from the received signals. The control unit 102 responds to any base station commands contained in the signaling messages, and implements those commands. When the user enters commands via the keypad 108, the commands are transferred to the control unit 102 for action.

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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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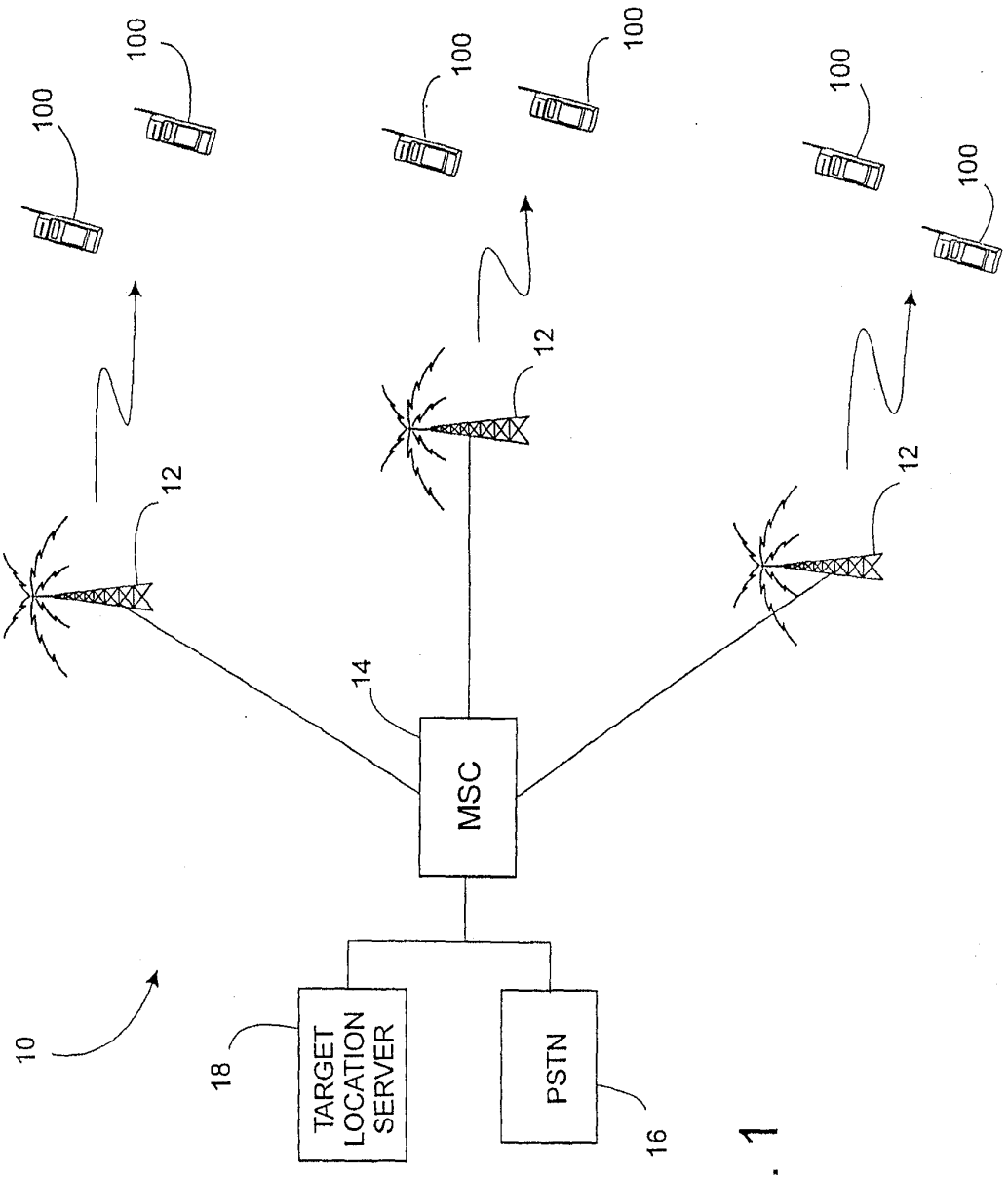


FIG. 1

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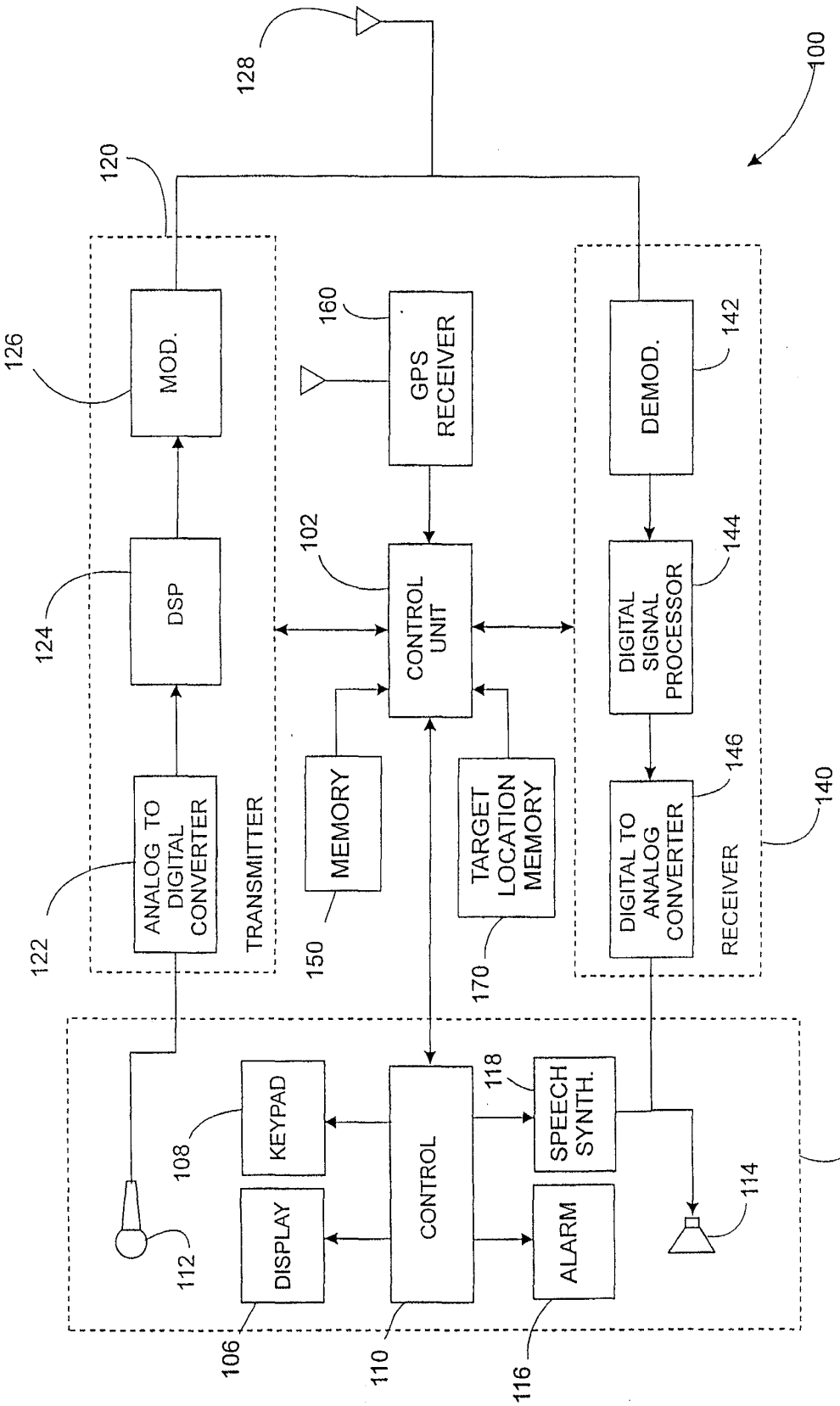


FIG. 2

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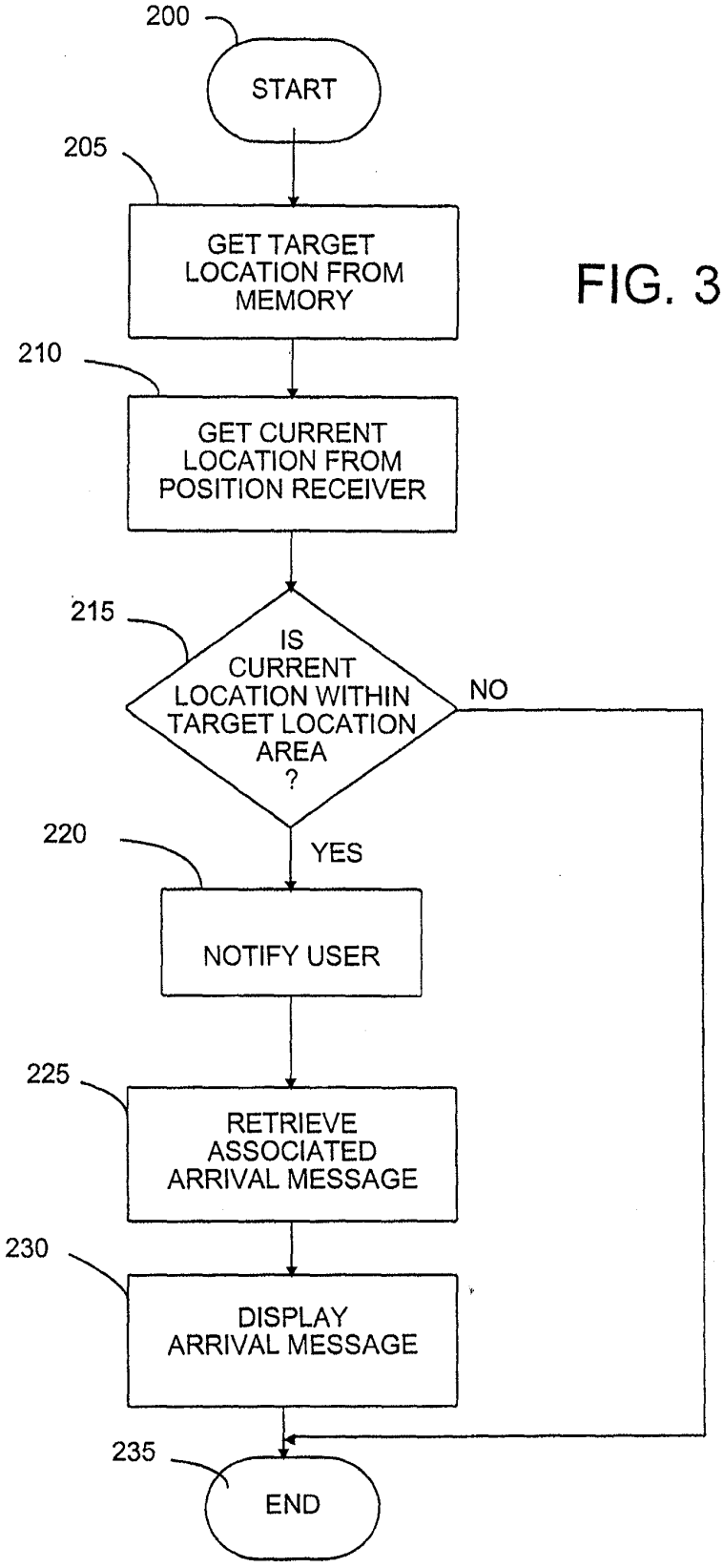


FIG. 3

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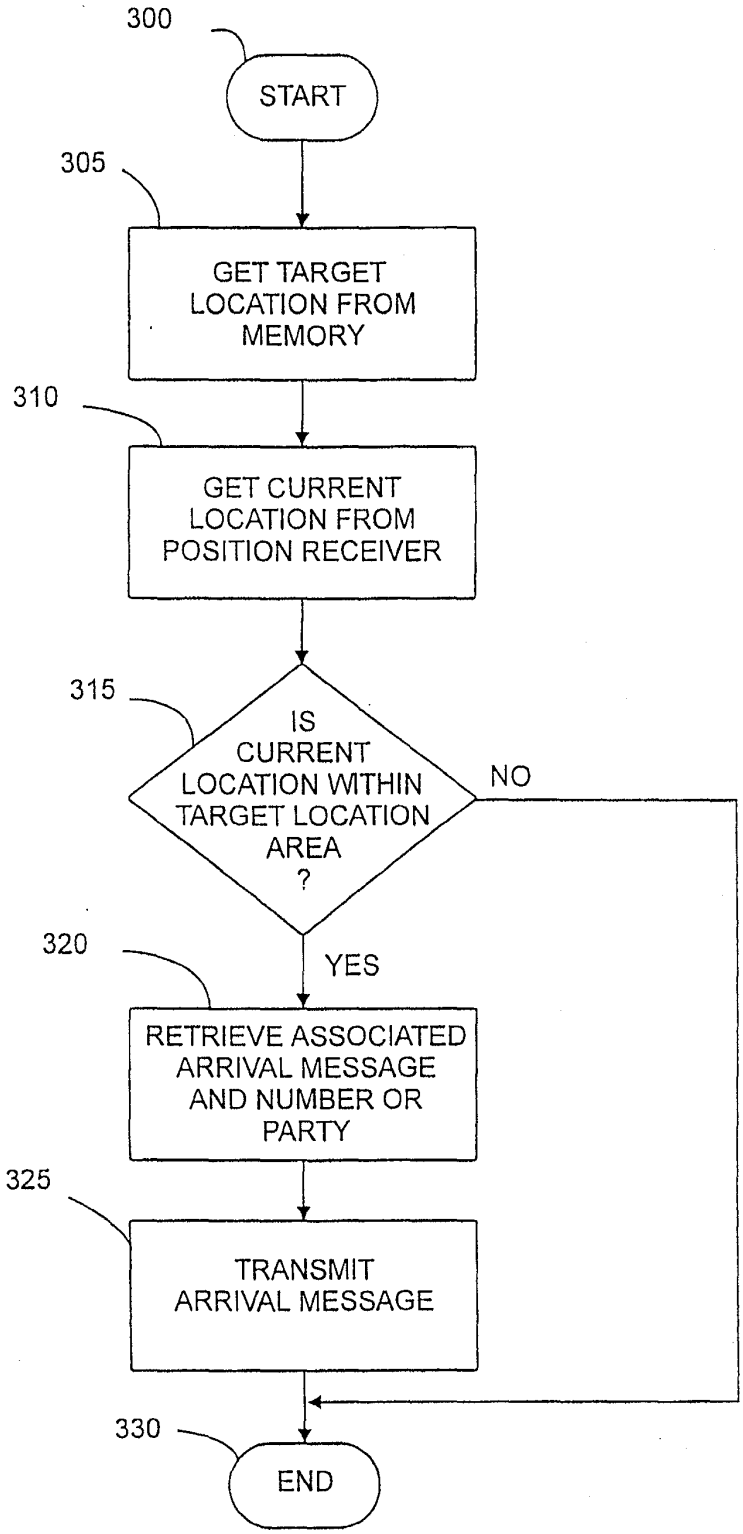


FIG. 4

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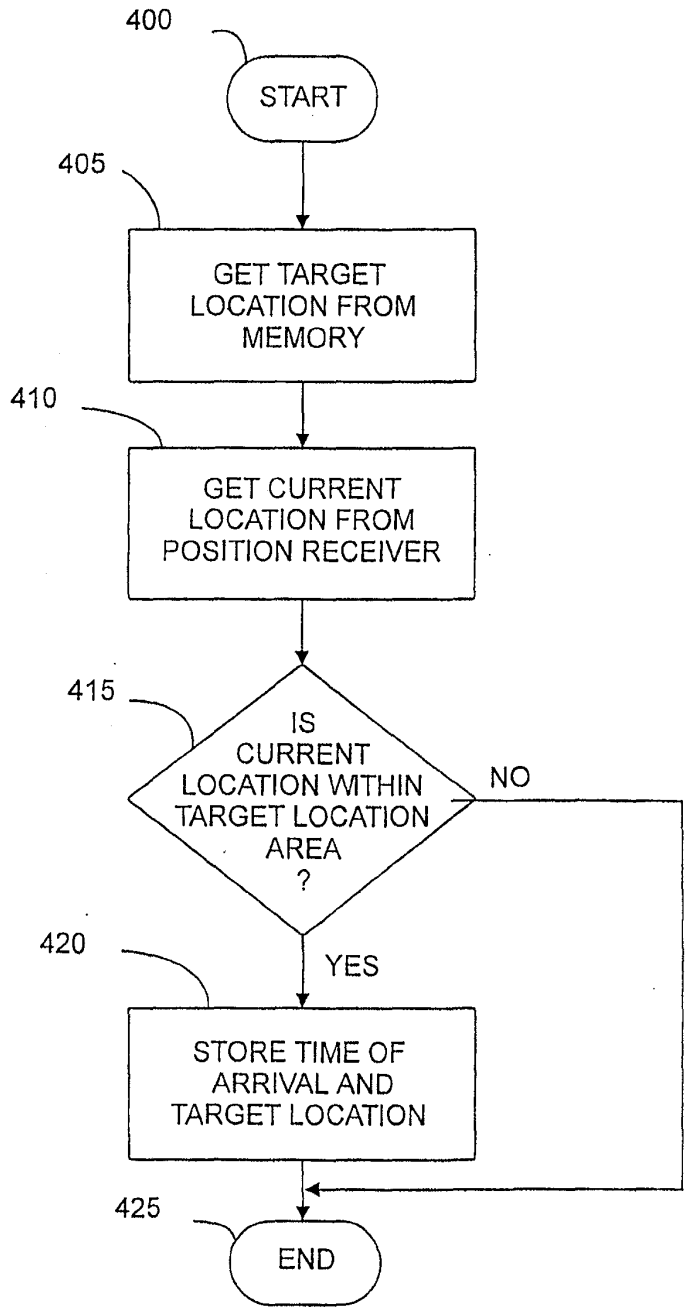


FIG. 5

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INTERNATIONAL SEARCH REPORT

	National 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
X	US 5 444 444 A (ROSS JOHN) 22 August 1995 (1995-08-22) column 3, line 25 - line 55; claim 11 column 4, line 35 -column 6, line 2	1-22
X	EP 0 881 848 A (CASIO COMPUTER CO LTD) 2 December 1998 (1998-12-02) column 11, line 50 -column 14, line 28	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.

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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

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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.
A	WO 98 16076 A (AT & T WIRELESS SERVICES INC) 16 April 1998 (1998-04-16) page 2, line 6 - line 11	8

1

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INTERNATIONAL SEARCH REPORT

Information on patent family members

I. ational Application No
PCT/US 99/30389

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0874529 A	28-10-1998	JP 10294967 A	04-11-1998
		CN 1197343 A	28-10-1998
US 5444444 A	22-08-1995	US 5648770 A	15-07-1997
		AU 5538094 A	12-12-1994
		GB 2293071 A,B	13-03-1996
		WO 9427264 A	24-11-1994
		US 5673305 A	30-09-1997
EP 0881848 A	02-12-1998	JP 10336326 A	18-12-1998
		CN 1201346 A	09-12-1998
WO 9816076 A	16-04-1998	US 5946615 A	31-08-1999

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FR cited Ref 12

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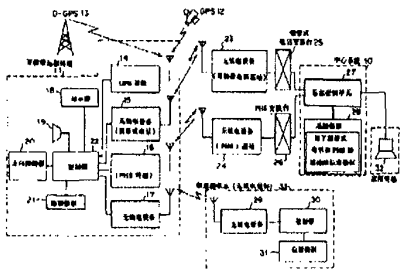
代理人 于 静

权利要求书 4 页 说明书 17 页 附图页数 10 页

[54]发明名称 位置信息管理系统

[57]摘要

一种位置信号管理系统，其中，一个可携带远程终端包括多种定位装置，这些定位装置用来根据GPS定位、根据携带式电话的或PHS的基站定位、根据一个无线电信标定位、及根据一个方向探测器独立地定位，从而在任何地方都能导航可携带终端的持有者。可携带远程终端的持有者能通过询问一个中心系统，知道类似持有这样一种可携带远程终端的第三方的位置；并且他/她能监督，例如，老人、儿童、或滑雪场中滑雪者的行动。



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权 利 要 求 书

1.一种位置信息管理系统，其中，来自定位系统的信息在一个信息终端中获得，并在一个中心系统中处理，以便管理关于信息终端位置的信息，该位置信息管理系统包括：

多种定位系统；及

一个信息终端，用来自动地把处于不适用状态的任何所述定位系统，转换到所述诸定位系中适用的一个，以便利用该适用的定位系统获得其当前位置。

2.根据权利要求 1 所述的位置信息管理系统，其中，所述信息终端包括一个内装的设备，该设备探测所述信息终端的运动方向和运动速度，并且即使当所有所述定位系统都成为不适用的时候，所述信息终端也能独立探测和显示其当前位置。

3.根据权利要求 1 所述的位置信息管理系统，其中，第三方能通过中心系统获得所述信息终端的持有者位置。

4.根据权利要求 3 所述的位置信息管理系统，其中，第三方是所述信息终端的持有者。

5.根据权利要求 3 或 4 所述的位置信息管理系统，其中，监督所述信息终端持有者当前位置的运动，并且当所述信息终端的所述持有者在预定时间段内没有离开同一地点时，就根据所述持有者已发生不寻常情况的判断，发出警报。

6.根据权利要求 1 所述的位置信息管理系统，其中，所述信息终端把目的地的位置信息发送给中心系统，借此按要求自动地从所述中心系统下载适当比例的地图数据，地图数据包含所述信息终端的当前位置和目的地位置，并借此显示所述地图数据。

7.根据权利要求 1 所述的位置信息管理系统，其中，所述信息终端以 IC 卡的形式，保存其持有者想在其中移动的区域的最少地图数据。

8.根据权利要求 1 所述的位置信息管理系统，其中，所述信息终端在一个确定的时间段内保存从中心系统下载的地图数据，并且当以前所需的地图数据又成为必需时，就从保存在所述信息终端的地图数据中查

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询并显示。

9.根据权利要求 8 所述的位置信息管理系统，其中，所述信息终端把用来保存较高使用频率的地图数据的时间段，设置得比确定时间段长。

10.一种信息终端，能与用来管理位置信息的中心系统通信，并且从一个定位系统获得信息，以便显示关于信息终端位置的信息，该信息终端包括：

多种定位系统使用接口装置；和

控制装置，用来自动地把处于不适用状态的任何定位系统，转换为所述诸定位系统中适用的一个，以便利用适用的定位系统获得所述信息终端的当前位置。

11.根据权利要求 10 所述的信息终端，还包括一个内装的设备，该设备探测所述信息终端的运动方向和运动速度，并且其中，即使当所有所述定位系统都已成为不适用时，所述信息终端也能独立地确定和显示其当前位置。

12.根据权利要求 10 所述的信息终端，其中，第三方能通过中心系统获得所述信息终端持有者的位置。

13.根据权利要求 12 所述的信息终端，其中第三方是所述信息终端的持有者。

14.根据权利要求 12 或 13 所述的信息终端，其中监督所述信息终端持有者的当前位置运动，并且当所述信息终端的所述持有者在预定的时间段内没有离开同一地点时，就根据所述持有者已经遇到异常情况的判断，发出警报。

15.根据权利要求 10 所述的信息终端，其中，所述信息终端把目的地的位置信息发送给中心系统，借此按要求从所述中心系统自动地下载适当比例的地图数据，地图数据包含所述信息终端的当前位置和目的地的位置，并借此显示所述地图数据。

16.根据权利要求 10 所述的信息终端，其中，所述信息终端以 IC 卡的形式保存其持有者想在其中运动的区域的最少地图数据。

17.根据权利要求 10 所述的信息终端，其中，所述信息终端在一个

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确定的时间段内保存从中心系统下载的地图数据，并且当以前所需的地图数据又成为必要时，就在所述信息终端保存的地图数据内查询，并显示。

18.根据权利要求 17 所述的信息终端，其中，所述信息终端把用来保存较高使用频率的地图数据的时间段，设置得比确定时间段长。

19.根据权利要求 10 所述的信息终端，其中，所述信息终端是一种携带式电话类型的终端，在该终端中，一根用于定位系统的天线布置在一个用于所述信息终端的输入按钮部分的盖内。

20.一种可携带无线电终端，包括：

位置信息获得装置，用来得到当前位置信息；和

按照另一个设备通过无线电信道所进行的所述位置信息请求，把所述位置信息获得装置得到的位置信息，通过无线电信道发送给该另外的设备的装置。

21.根据权利要求 20 所述的可携带无线电终端，还包括用来根据目的地的位置信息，显示包含目的地的地图的装置。

22.根据权利要求 21 所述的可携带无线电终端，其中，显示装置显示一张适当比例的地图，该地图包含所述可携带无线电终端的当前位置和所述目的地。

23.根据权利要求 20 所述的可携带无线电终端，还包括：

连接于另一个设备的装置，用来获得第三方的位置信息；和

用来输出获得的第三方的位置信息的装置。

24.一种可携带无线电终端，包括：

位置信息获得装置，用来根据来自卫星的无线电波，获得当前位置信息；

用来通过一个无线电信道把所述可携带无线电终端与一个中心相连接的装置，该中心管理多个可携带无线电电话终端的当前位置信息；

在该中心通过连接装置，登记由所述位置信息获得装置得到的当前位置的装置；及

用来通过所述连接装置，从所述中心获得第三方可携带无线电终端的当前位置的装置。

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25.根据权利要求 24 所述的可携带无线电终端，其中，一根用于所述位置信息获得装置的天线，布置在用于所述可携带无线电终端的输入按钮部分的盖内。

26.根据权利要求 24 所述的可携带无线电终端，还包括用来显示一张地图的装置，该地图包含获得的第三方所述可携带无线电终端的当前位置。

27.根据权利要求 26 所述的可携带无线电终端，其中，显示装置显示一张适当比例的地图，该地图包含所述可携带无线电终端本身的当前位置，和所述第三方的所述可携带无线电终端的所述当前位置。

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说　　明　　书

位置信息管理系统

本发明涉及一种位置信息管理系统，更详细地说，涉及一种用来管理行人位置信息的系统。

如今，一种其中在汽车内安装终端、以便显示汽车当前位置的汽车导航系统已经付诸实用并投放市场。根据该汽车导航系统，任何人都能到达目的地，而不会走失，即使在他/她第一次访问的区域也是如此，因为以当前位置显示他的/她的周围环境的地图。

汽车导航系统执行从卫星接收的无线电波的处理，以便按照纬度和经度获得当前位置，并从一个存储设备读出含有获得的纬度和经度的地图信息。

这种汽车导航工作，用于导航汽车行驶。还有一种已经开发和销售的系统，其中，个人持有或携带一个便携式终端，在该终端上显示他/她的当前位置和适当地图信息，以便为这个人导航。

该个人导航系统还执行从卫星接收的无线电波的处理，以便按照纬度和经度获得当前位置，并以当前位置显示存储的地图信息。

其中以这种方式通过从卫星接收无线电波来确定当前位置的系统，称作“GPS（全球定位系统）”。

同时，在上述的导航系统中，通过捕获来自卫星的无线电波，获得当前位置。因此，该系统具有这样的缺点，在不能从卫星接收到任何无线电波的地方，就不能工作。

此外，在用来导航一个人的移动的系统中，该人持有或携带的终端往往尺寸会有些大，因为一个用于存储地图信息的CD－ROM或类似器件会装在其中。

本发明的目的在于，提供一种使用能力更高的位置信息管理系统。

根据本发明，来自一个定位系统的信息在一个信息终端中获得，并在一个中心系统中处理，以便管理关于信息终端位置的信息，在这样一

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种系统中，一种位置信息管理系统的特征在于：采用了一种信息终端，该信息终端适于使用多种定位系统，并自动地从任何无效状态的定位系统，变到一个有效的定位系统，从而通过使用有效的定位系统，获得其当前位置。

而且，一种用于本发明的信息终端是这样一种终端：它能与用来管理位置信息的一个中心系统通信，并从一个定位系统获得信息，从而显示关于信息终端位置的信息；该信息终端的特征在于：适于使用多种定位系统，并自动地从任何无效状态的定位系统，变到一个有效的定位系统，从而通过使用该有效的定位系统，获得该信息终端的当前位置。

另一方面，在本发明中的一种可携带无线电终端的特征在于：它包括用来得到当前位置信息的位置信息获得装置；和遵照由另一个设备经无线电信道所做的位置信息请求，把位置信息获得装置得到的位置信息，经该无线电信道传输给这个另外的设备的装置。

在另一个方面，一种可携带无线电终端的特征在于它包括：用来根据来自卫星的无线电波，得到当前位置信息的位置信息获得装置；用来经一个无线电信道把可携带无线电终端与一个中心相连接的装置，该中心管理多个可携带无线电话终端的现行位置信息；用来在该中心，经该连接装置，登记由该位置信息获得装置得到的现行位置信息的装置；及用来从该中心经该连接装置获得可携带无线电终端的当前位置的装置。

以这种方式，根据本发明，导航功能等不会由于诸定位系统中任何二个失效而变成无效，而且利用任何一种方法都能获得和显示位置信息而不会失败。因此，该位置信息管理系统具有高的使用性能。

特别是，根据本发明，信息终端或可携带终端可以包括一个用来独立判断其本身位置的方向探测器。这样，即使在GPS和其他定位系统都不适用的情况下，也只要仅知道起点就能使用导航功能。

而且，可携带终端或信息终端具有以IC卡等的形式保存终端本身所需的最少地图数据的功能，借此能减少从中心系统下载的次数。况且，IC卡还用作可取出的存储媒体，借此能使终端本身在尺寸上小于采用CD－ROM驱动器的情形。

本发明的系统能够提供大量的其他服务，这将结合如下的附图用实

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例来描述。

图 1 是方块图，表示根据本发明的一种位置信息管理系统的系统构造；

图 2 是用来获得位置信息的控制过程的系统变化的流程图，该控制由图 1 中所示的一个控制器（22）来进行；

图 3 是在显示于可携带终端上的地图数据与显示单元的显示屏幕之间的关系说明图；

图 4 是在获得一个当前位置并在其后显示一个地图的情况下的流程图；

图 5 是流程图，表示用来查询可携带终端持有者的位置的一个查询系统的一般过程，该查询系统使用了本发明的系统；

图 6 是流程图，表示在本发明的系统用于诸可携带终端之间的位置信息获得的情况下的过程；

图 7A 和 7B 是用来解释图 6 中所示过程中的一个中心系统的过程图；

图 8A 和 8B 是流程图，表示在一个可携带终端侧监视一个第三方的过程；

图 9A 和 9B 有一个表示一个显示实例图，该显示实例呈现在本发明系统中的一个可携带终端的显示屏幕上；及

图 10A － 10D 是表示本发明各个可携带终端的外观实例图。

图 1 是方块图，表示实施本发明的一种位置信息管理系统的系统构造。

本发明的系统包括：一个中心系统 10，以统一的方式管理信息；一个可携带远程终端 11，由个人携带；一个卫星 12，用于为一个 GPS 服务；一个无线电波发射塔 13，用于为一个 D － GPS（差分 GPS）服务；及一个信息提供点（无线电信标）33，通过无线电波确定可携带终端 11 的位置。

可携带终端 11 包括：一个 GPS 天线 14 的各个接收器，用于一个可携带电话的无线电设备 15、用于一个“PHS”的无线电设备 16、和用来从无线电信标 33 接收无线电波的无线电设备 17。各个接收器从相应

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的无线电波发射站接收无线电波，并把它们发送给一个控制器22。（顺便说明，首字母缩略语“PHS”代表“个人手持电话系统”，在日本和一些其他国家已标准化成一种数字式移动终端通信系统。下文我们主要称之为PHS，但本发明并不限于PHS，而是各种数字式移动终端通信系统都能适用）。

控制器22通过利用在从各个无线电波中得到的诸位置信息项中的最高精度位置信息，获得可移动终端11的当前位置，并且通过给一个显示单元18提供当前位置和周围区域的地图，让可携带终端11的持有者知道获得的当前位置。标号19表示一个扬声器，该扬声器在向可携带终端11的持有者发出警报的情况下使用。在可携带终端11中，最少量的地图信息，例如持有者经常去的地方的地图信息，被存作地图数据21。在可携带终端11位于地图数据21的极限范围内的情况下，控制器22读出地图数据21，并把它发送给显示单元18。而且，存储在可携带终端11的地图数据21，应该最好通过安装一种可取出存储媒体，如IC卡或小型卡，来实现。这样，只需建立持有者想去地区的最少地图数据，而不需要没有必要的大存储容量。因此，该实施例具有能减小可携带终端11的尺寸的优点。

在可携带终端11中的一个方向探测器20用来独立地探测可携带终端11的运动，并在还没有无线电波到达可携带终端11的情况下，确定其当前位置。方向探测器20包括一个回转罗盘和一个加速度传感器。控制器22通过处理来自方向探测器20的信息，计算可携带终端11的运动方向和运动距离，并把算出的当前位置输出给显示单元18。特别是在采用一个三维陀螺仪和以三维布置加速度传感器的情况下，能够计算三维的可携带终端11的运动方向和运动距离。因此，在这种情况下，在还没能接收到无线电波的情形下，可携带终端11能独立地实现导航。

中心系统10经一个携带式电话交换台25连接到无线电设备（一个携带式电话基站）23上，并且还经一个PHS交换台26连接到无线电设备（一个PHS基站）24上，并提供与可携带终端11的位置信息交换等。在中心系统10中的一个信息提供单元27，保存含有携带式电话和PHS基站23和24的位置数据的地图数据28。在保存在可携带终端11中的

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地图数据21不足以显示当前位置的情况下，中心系统10把地图数据28送给可携带终端11，以便允许显示当前位置。当可携带终端11由于不能接收来自GPS12和D－GPS13的无线电波的原因，而必须由最近的携带式电话基站23或PHS基站24的地点找到其位置时，就分别使用携带式电话或PHS基站23或24的位置数据。

另外，信息提供单元27经一个网络或类似设备与一个家用终端32相连接。这样，提供可携带终端11的位置信息，以便探测，例如，持有可携带终端11的老人或孩子。

使用信息提供点（无线电信标）33，为的是在来自GPS12、D－GPS13、携带式电话基站23和PHS基站24的信号不适用的情况下，可携带终端11可以获得当前位置。信息提供点33包括无线电设备29，一个控制器30和位置数据31。位置数据31是配置信息提供点33处的纬度和经度存储数据，并且从无线电设备29经控制器30传送给可携带终端11。在可携带终端11侧。根据由信息提供点33传送的纬度和经度，获得当前位置。

图2是流程图，表示由图1中所述的控制器22所进行的，用于位置信息获得的系统转换控制过程。

通过使用GPS、携带式电话、PHS和无线电信标系统的任何一个，可携带终端11能获得位置信息。位置信息的精度，按照来自GPS12的位置信息，来自携带电话基站23和PHS基站24的信息，及来自无线电信标33的信息的顺序下降。因此，定位系统或设备以这样一种方式依次向较低精度的位置信息自动地转换，从而首先使GPS用于当前位置获得，如果GPS不适用，然后再使用第二最高精度的系统。

在图2的步骤S1，首先确定是否收到了来自GPS的信号。如果来自GPS的信号是可接收的，则使用GPS确定可携带终端（图1中的11）的位置（步骤S5）。

如果在步骤S1不可接收来自GPS的信号，则控制过程的流程前进到步骤S2，该步骤用来判断PHS的或携带式电话系统的基站位置是否适用。PHS的或携带式电话系统的基站位置可以以这样一种方式得到：使信号从可携带终端发送到最近的基站，已接收到该信号的基站向中心

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系统 10 发送一个信号，和来自基站的信号已经到达处的中心系统，把已接收到从可携带终端发送的信号的基站的位置，送回可携带终端。当确定持有可携带终端的人位于基站位置附近时，最靠近可携带终端的基站位置被认为是可携带终端持有者的位置。

因而，在步骤 2 发现 PHS 的或携带式电话系统的基站位置的情况下，在步骤 S6 使用上述的基站获得可携带终端或其持有者的位置。

在步骤 2 没有发现 PHS 的或携带式电话系统的基站位置的情况下，如在 PHS 的和携带式电话系统的服务区域外部电话通信是不可能的情况下，在步骤 S3 判断是否能接收来自无线电信标 33 的信号。诸无线电标记布置在城镇的每个主要或重要地点处，并产生指示相应地点的纬度和经度的无线电信号。

如果可携带终端能从无线电信标接收到无线电波，则在步骤 S7 使用无线电设备 17 从无线电信标接收的信号。更准确地说，可携带终端或其持有者的当前位置被认为基本上与最近无线电信标的纬度和经度相同，并同样显示在显示单元 18 上。

然而，如果来自无线电信标的无线电波也不可在步骤 S3 接收，则定位被认为是不可能的，并且对于这一结果向持有者呈现显示（步骤 S4）。

在步骤 S4 确定了定位是不可能的情况下，把图 1 中的方向探测器 20 用来计算，离开上次测得的可携带终端的位置的地方的运动方向和运动距离。根据计算出的运动方向和运动距离，判断可携带终端的当前位置，并把该当前位置显示在显示单元上。

图 3 表明在要显示在可携带终端 11（在图 1 中表示）上的地图数据与显示单元 18 的显示屏幕的关系。

图 3 的左部表明实际呈现的屏幕显示与获得的地图数据之间的关系。地图数据包括保存在可携带终端中的数据和从中心系统 10 下载的数据。地图数据项按照预定的纬度和经度极限划分成若干块，并通过把各个块附加上号码来管理，如该图的右部分所示。

利用实例，在图 3 中所示的情况下，装有在比实际显示屏幕大的范围内的地图数据以便显示，并显示按照纬度和经度用（x_1, y_1）和（x_2,

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y_2）限定的范围。如在图 3 右部的表中所看到的那样，装载的地图数据对应于地图号 1。这里，纬度范围是从 x_1 到 x_2，而经度范围是从 y_1 到 y_2。

当已经发现当前时间可携带终端的纬度和经度时，就参考图 3 右部所示的表，并装载其纬度和经度范围包含可携带终端的当前纬度和经度的地图数据。

当可携带终端的当前位置变化到装载地图数据的末端时，就装载下一个地图。设置地图数据项，从而使诸地图的边缘相互重迭，并且至少两个地图数据项含有靠近地图数据末端当前位置的纬度和经度。在当前位置靠近地图数据末端和要装载的地图数据项的每一项都不明确的情况下，计算可携带终端持有者至此时为止已前进或运动的方向，并装载前进方向上的前一个地图。而且，在可携带终端接通时可携带终端的位置已经在地图数据的末端处，且不知道持有者至此时为止的前进方向的情况下，举例来说，就可以一次装载小号码的地图，以便得到前进方向，于是在可能需要时就装载相邻区域的下一个地图。

顺便说明，为了覆盖比作为图 3 中例子的显示屏幕大的范围，不必总是准备地图数据，而是可以通过较小划分区域的事先管理和接合多个地图数据项，良好地显示显示屏幕覆盖的区域地图，以便把接合的地图数据项输出给显示屏幕。还是在这种情况下，把带有接合在一起的多个地图数据项的地图数据设置成比显示屏幕大一些，并且在可携带终端的持有者位置变化的时刻，装载新的地图数据。

图 4 是流程图，表示在获得当前位置和显示地图情况下的处理流程。

图中的地图数据显示流程由可携带终端 11 的控制器 22 进行。首先，在步骤 10 可携带终端 11 的使用者指示控制器 22 显示其当前位置，然后，在步骤 S11 从 GPS 得到当前位置。这里，如同参照图 2 所描述的那样，在用 GPS 不能得到当前位置的情况下，就根据 PHS 的或携带式电话系统的基站位置得到当前位置。而且，在这种基站位置不适用的情况下，就使用无线电信标。更进一步，在不能使用无线电信标的情况下，就使用可携带终端 11 方向探测器 20，由上次得到的位置信息计算持有者的前进方向和运动距离，并估计当前位置。在这时，呈现显示如下结

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果：不能获得当前位置，且由方向探测器20估计出当前位置。

当在步骤S11已经获得当前位置时，就执行下一个步骤S12，以判断包含当前位置的地图是否包括在存储在可携带终端11中的地图数据21中。如果含有当前位置的地图包括在存储在可携带终端11中的地图数据21中，则流程前进到步骤S15，在该步骤与当前位置一起显示地图。

相反，如果包含当前位置的地图不包括在存储在可携带终端11中的地图数据21中，则在步骤S13，控制器22把当前位置通知中心系统10。在中心系统10中，查找含有接收的当前位置的数据。可携带终端11从中心系统10中下载含有当前位置的地图数据（步骤S14）。在步骤S15，地图显示在可携带终端11的显示单元18上，并把当前位置同时显示在该地图中。把下载的地图数据作为可携带终端11的地图数据21存储在一个存储器中。此后，流程返回步骤S11，并且继续进行当前位置的获得和地图与当前位置的显示。

例如通过事先在可携带终端11中提供一个显示终止按钮，并自在压下按钮的条件下中断图4的流程，可以很快结束显示当前位置的操作。另外，可以通过直接断开可携带终端11的电源，来很快结束显示操作。

顺便说明，在获得地图数据的情况下，每次都下载经常使用的地图数据是效率不高的。因此，除了地图号和纬度与经度之外，还把显示屏幕上的显示次数和最新存取的日期和时间一起记录在地图数据21中，地图数据21保存在可携带终端11中。地图数据保存在可携带终端11中一个预定的间段，并且因为受限制的存储容量，擦除从最新存取的日期和时间起已经过去一个预定时间段的地图数据。因而，通过参照显示屏幕上的显示次数，不擦除地保存在预定时间段内超过预定次数显示的地图数据。以这种方式，避免了相同地图数据的频繁下载，并且能有效地利用可携带终端11的存储容量。

图5是流程图，表示用来查询可携带终端持有者位置的一个查询系统的一般过程。

该查询系统通过使用本发明的系统来实现。该查询系统可以用于一个人，如一位老人，其目的地是未知的，而且其行动需要监护。因而，不仅能用于老人的行动监护，还能用于儿童。

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首先，可携带终端11（如在图1中所示）通过使用GPS等以固定的时间段有规律地获得当前位置，以便找到其当前时间的位置。因而，在步骤20如所表示的那样，判断是否固定的时间段已经过去，并且在步骤S21，可携带终端把获得的当前位置发送给中心系统10。

在中心系统中，每当接收到从可携带终端送出的当前位置时，就记录（步骤S22）。这样，在任何时候都知道可携带终端持有者已经走过的路线。

这里，在持有者在可携带终端侧没有获得当前位置的情况下，执行从中心系统侧向可携带终端11发出呼叫的过程，以便获得当前位置（定时询问）。

当家用终端32的使用者需要知道可携带终端11的持有者现在在什么地方时，他/她就请求中心系统报告可携带终端持有者的位置（步骤S23）。在这里，通过可携带终端的ID号、电话号码、或类似号码，确认可携带终端的持有者。在接收到来自家用终端的当前位置获得请求时，中心系统判断该呼叫是否能到达可携带终端（步骤24）。根据可携带终端是否已经送出用于回答从中心系统发送的呼叫信号的应答信号，来判断是否能到达。

在步骤S24已经判断不可能到达的情况下，在步骤S28，中心系统由至今可携带终端的路线推断其速度和方向，并参照记录估计可携带终端的当前位置；并且中心系统工作，以便把估计的位置显示在家用终端上（步骤S27）。在这时，还呈现显示呼叫不能到达可携带终端处的结果。这样，家用终端的使用者就会理解显示的位置是估计的。

在另一方面，在步骤S24已经判断呼叫到达是可能的情况下，中心系统就命令可携带终端发送一个指示其当前位置的信号。当可携带终端接收到该命令时（步骤S25），就经中心系统向家用终端发送一个当前位置信号（步骤S26）。在家用终端中，在一个显示单元上能观察到已经从可携带终端经中心系统向该家用终端发送的当前位置信号（步骤S27）。

顺便说明，在中心系统中估计可携带终端的当前位置的方法，可以举例说明如下：

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在这样一种情况下，其中，在可携带终端的持有者利用某种交通工具在很长距离的运动期间，通过靠近窗口偶尔接收的GPS信号或在中转时接收的GPS信号的推断，可以估计可携带终端的运动方向和速度，并且由运动方向和速度能估计当前位置，尽管GPS信号不总是都能接收到的。

另外，在这样一种情况下，其中，在持有者在汽车中的行驶期间，即使用类似于上述情况的GPS信号的间断接收，也能计算可携带终端的运动方向和速度，并且根据其趋势或通常的区域，结合天气预报中的台风路线，由运动方向和速度能预计当前位置，尽管GPS信号不总是都能接收到的。

以这种方式，使用家用终端的监护人仅通过使老人或儿童携带可携带终端，就能容易地监视可携带终端持有者的当前位置。因此，查询系统能非常有效地用作监视系统。

图6是流程图，表示在本发明的系统用于获得可携带终端之间的位置信息的情况下的诸过程。

图5中所示的系统对应于由家用终端获得可携带终端位置信息的情形。相反，在图6中所示的应用实例中，在可携带终端11（如在图1中所示）之间获得位置信息项，从而使可携带终端的持有者能相互知道其他持有者在什么地方。

在图6中表明的过程流程中，假定可携带终端11的具体持有者想知道设为是第三方的另一个持有者的当前位置，并且假定他/她通过中心系统10在他/她自己的可携带终端11的显示单元18上显示第三方的位置。

首先，第三方携带的可携带终端通过使用GPS、PHS、携带式电话系统或无线电信标，连续地获得其当前位置。而且，在这个可携带终端中，判断是否已过去一个固定的时间段（步骤S30），并且在每个固定的时间段内把获得的当前位置发送给中心系统（步骤S31）。在中心系统中，记录从第三方送出的当前位置（S32），并且在任何时候都知道第三方已走过的运动路线。这里在图6的流程图中，在携带相同结构可携带终端11的具体持有者侧，没有提及把当前位置传送给中心系统的步骤。因此，原因是仅描述具体持有者知道第三方当前位置的诸过程。

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在实际中，具体持有者的可携带终端也在每个固定的时间段把其当前位置发送给中心系统，并且还把其当前位置变化记录在中心系统中。因而，由具体持有者执行的图 6 中的诸过程，能类似地由第三方为该具体持有者执行。

想知道第三方当前位置的具体持有者，指示他/她自己的可携带终端系统，以显示其相对于第三方的位置（步骤 S33）。这样，具体持有者的可携带终端就请求中心系统，获得第三方的位置（步骤 S34）。在这时，具体持有者需要识别第三方，并且利用第三方可携带终端的 ID 号、电话号码或类似号码以便识别。在从具体持有者接收到获得第三方现行位置的请求时，中心系统检查呼叫是否能到达被识别的第三方的可携带终端（步骤 S35）。如以前所述，根据第三方的可携带终端是否应答从中心系统发送的呼叫信号，来检查是否可能到达。

在到达是不可能的情况下，中心系统利用以前记录的现行位置变化，检查被识别的第三方的速度和前进方向，并由此估计第三方的现行位置（步骤 S39），并把指示这一估计位置的信号发送给具体持有者的可携带终端。具体持有者的可携带终端接收该信号（步骤 S40），其次通过使用 GPS、PHS 的或携带式电话系统的基站、或无线电信标，获得其自己的位置（步骤 S41）。以后将解释接着发生的步骤。

在另一方面，在第三方的到达是可能的情况下，中心系统请求第三方的可携带终端发送一个指示其当前位置的信号（步骤 S36）。第三方的可携带终端通过使用 GPS、PHS、携带式电话系统和无线电信标的任何一个，获得其当前位置（步骤 S37），并把其当前位置的信号发送给中心系统（步骤 S38）。中心系统把第三方当前位置的信号发送给具体持有者的可携带终端。这样，具体持有者的可携带终端接收第三方的当前位置信号、步骤 40，其次获得其自己的当前位置（步骤 S41）。

在已经通过来自第三方的发送或通过中心系统中的估计发现第三方的当前位置、且已经发现具体持有者自己的当前位置的情况下，控制器 22 判断能够显示第三方和具体持有者的位置的地图是否包括在存储在具体持有者的可携带终端中的地图数据 21 中（步骤 42）。在存储有能进行这种显示的地图数据时，就显示地图数据，并且在地图上显示具体持

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有者和被识别的第三方的位置（步骤 S45）。

在显示操作结束之后，为了连续显示相对位置起见，在具体持有者的可携带终端中的处理流程返回步骤 S34，以便重复地获得和显示第三方和具体持有者自己的当前位置。

在另一方面，在适于显示识别的第三方和具体持有者位置的地图不包括在存储在具体持有者的可携带终端中的地图数据中的情况下，这个可携带终端向中心系统发送一个指示第三方和具体持有者当前位置的信号（步骤 S43）。中心系统根据第三方和具体持有者的当前位置信号，查询同时能够显示第三方和具体持有者当前位置的地图数据，并把同时能够显示两者位置的地图数据发送给具体持有者的可携带终端（步骤 S44）。在具体持有者的可携带终端中，显示从中心系统送到该处的地图数据，并且在其上显示第三方和具体持有者的位置（步骤 S45）。

以这种方式，用本发明的系统，能够知道要查询的第三方的位置，不仅对于家用终端，而且对于一个可携带终端，都能保证确定实际要查询的老人或儿童的位置。因而，能有效地进行对老人和儿童的查询。

图 7A 和图 7B 用来解释在图 6 的处理流程中中心系统执行的过程。

图 7A 的流程图表明，在第三方和具体持有者的现行位置已经从可携带终端 11 发送到中心系统 10（如在图 1 中所示）的情况下中心系统 10 执行的处理。

在接收到确定第三方和具体持有者的两点的当前位置时（步骤 S50），中心系统由两点的位置计算两点间的直线距离（步骤 S51）。当已经计算出两点间的直线距离时，参照图 7B 所示的表确定地图的适当比例（步骤 S52）。根据确定的地图比例，查询包含两点的地图（地图 S53）。在找到包含两点的地图时，中心系统把这张地图发送给已经把两点位置发送到这里的可携带终端（步骤 S54）。在已经发送两点位置的可携带终端中，根据中心系统在步骤 S54 发送的地图数据，呈现一种显示。

图 7B 表明在图 7A 中的步骤 S52 所用的一个表的一个实例。在图示中，直线距离与地图种类之间的对应不是严格对应的，并且介绍图 7B 只是为了说明。

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在中心系统中，为了覆盖各个区域存储有多种比例的地图数据项。在图 7B 的实例中，存储了 1 比 10,000 、 1 比 20,000 、 1 比 50,000 和 1 比 100,000 四种比例范围的地图。直线距离是指要知道相对位置的两点间的距离，并且以千米为单位表示。

在图 7B 的实例中，当两点间的直线距离在 0 千米与 100 千米之间时，使用比例 1 比 10,000 的地图。在从以这种方式来使用比例 1 比 10,000 地图的表中阅读时，中心系统按照纬度和经度，从比例 1 比 10,000 的地图数据中，查询包含发送的两点当前位置的地图，并把这张地图发送给已经发送两点间直线距离的可携带终端。

根据附属到地图数据上的纬度和经度极限，判断两点是否都包含在同一张地图中。举例来说，如同参照图 3 所描述的那样，地图数据包括几个单独的地图数据项，每一个地图数据项覆盖预定的极限，并且每个单独的地图数据包括指示由地图数据本身覆盖的纬度和经度极限的数据。因而，首先选择诸单独地图数据项的一个，并判断两点位置的纬度是否包含在选得地图数据项覆盖的纬度极限内。如果包含了两点位置的纬度，则其次判断两点位置的经度是否包含在选得地图数据项所覆盖的经度极限内。以这种方式，能够判断两点是否包含在单个单独的地图数据项中。

这同样适用于其他比例的地图。图 7B 所示的表说明：当两点间的直线距离在 100 千米与 200 千米之间时，查询比例 1 比 20,000 的地图数据；当直线距离在 200 千米与 500 千米之间时，查询比例 1 比 50,000 的地图数据；及当直线距离是 500 千米或更大时，查询比例 1 比 100,000 的地图数据。当然允许以与以上实例中提及的比例不同的比例，准备地图数据项，并在表中登记以便使用。

图 8A 和 8B 是流程图，表示在可携带终端侧用来监督第三方的过程。

图 8A 表明用来启动监督过程的处理流程。

可携带终端 11（如图 1 中所示）的使用者指定要监督的地点，和其间第三方不运动的时间段，以便在该使用者的可携带终端上设定用来监督第三方行动的指令（步骤 S60 ）。要监督的地点或者可以由地区名称

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或者可以由纬度和经度指明。在要监督的地点用地区名称指明的情况下，事先在可携带终端中准备一个用来把地区名称与相应地区的纬度和经度极限相联系起来的表。当已经输入了任何地区名称时，就获得相应地区的纬度和经度极限，并且从在可携带终端中存储的地图数据21中查询、或者从中心系统10下载相应的地图数据。

当对于要监督的指明地点，已经得到相应的地图数据时，就把相应的地图数据显示在显示单元18上（步骤S61）。使用者还在显示的地图上，例如通过用矩形封闭要监督的区域，来指明该区域，以便确定要监督的地点（步骤S62）。在用矩形封闭该区域的情况下的一种指明方法可以是：事先给可携带终端的显示单元提供一个触摸屏幕，并且通过用笔或类似物体触摸这些位置来指明矩形的对角线位置。

当要监督的区域已经由矩形指明时，就获得和记录指明区域的纬度和经度（步骤S63）。由于在显示单元上显示的地图上指明该区域，所以能容易地以这样一种方式获得指明区域的纬度极限和经度极限，从而在可携带终端侧，当矩形绘在显示器上时，在地图上平行于纬度和经度线形成矩形侧。

当已经获得指明区域的纬度和经度时，设定监督的时间段（步骤S64）。

图8B表明用来监督第三方行动的过程流程。

当已经开始监督过程时，首先判断是否已经过去了作为用来获得第三方当前位置的时间间隔的固定时间段（步骤S65）。在没有过去固定时间段的情况下，等待固定时间段的过去。在另一方面，在已经过去固定时间段的情况下，获得要监督第三方的当前位置（步骤S66）。当已经获得当前位置时，与上次的位置相比较，以便判断当前位置是否与上次的位置相同（步骤S67）。

如果获得的当前位置与上次位置不同，则清除一个用来计数时间段或计数次数的计数器，在该时间段、或计数次数期间，第三方处在相同的位置（如同在每个预定时间段计数的那样）（步骤S71）。相反，如果获得的当前位置与上次的位置相同，则增加用来计数时间段的计数器的内容，在该时间段、或时间段的次数期间，第三方处在相同的位置（步

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骤 S68）。在增加之后，判断计数器的总量是否已经超过初始设定（在图 8A 中的步骤 S60）的预定值（步骤 S69）。在计数器内容不大于预定值的情况下，处理流程返回步骤 S65，以便继续监督。

在另一方面，在计数器的总量大于预定值的情况下，判断要监督的第三方是否在监督区域内，及当前时间是否落在监督时间段内（步骤 S70）。在第三方不在监督区域内，或者当前时间没有落入监督时间段内的情况下，清除计数器的计数值（步骤 S71），并且从步骤 S65 重复处理。此外，在第三方位于监督区域内、且当前时间落在监督时间段内的情况下，判定要监督的第三方不一定长期呆在同一地点，并且可能发生了异常情况，就发出警报（步骤 S72）。

在监督者必须迅速知道如下事实，例如，在滑雪区的滑雪者由于受伤躺在地上，且他/她要迅速处理这种问题的情况下，至此描述的监督过程是有效的。然而，在这一过程中，误报警的可能性是很大的，除非高精度的定位系统，如 GPS，是适用的。更具体地说，在使用 PHS 的或携带式电话系统的基站的情况下，仅能把第三方的位置定作基站的位置。因此，即使当第三方实际上有一点运动时，他/她也可能被判断成站在同一位置。这在根据无线电信标定位的情况下也同样是真实的。因而，理想的是，应该在能最大限度使用 GPS 的条件下，进行第三方异常情况的监督。

图 9A 和 9B 表示诸显示实例，这些实例呈现在本发明系统中可携带终端 11（如表 1 中所示）的显示屏幕上。

图 9A 举例说明了字符显示。

显示 1 表示 GPS 中的卫星捕捉状态。作为实例显示项描述的是“卫星捕捉状态”、“捕捉的卫星数目”和“可捕捉卫星的数目”。“捕捉的卫星数目”是实际上正在从其接收无线电波的卫星的数目，而“可捕捉卫星的数目”是鉴于可携带终端的当前纬度和经度在理论上应该是可捕捉的卫星数目。此外，“卫星捕捉状态”表示来自卫星的无线电波的接收状态。举例来说，这样规定“卫星捕捉状态”，从而使当“捕捉的卫星数目”达到“可捕捉卫星数目”的 80 %时，就确定是“良好”状态。另外，通过计算包含在每种无线电波中的噪声与无线电波主要信号的比

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值，可以很好地确定“卫星捕捉状态”。

显示 2 表示可携带终端的当前位置。根据 GPS 显示当前纬度和经度。而且，使用至少三个卫星进行三点测量，并且还能显示当前位置的高度。

显示 3 表示可携带终端的目标位置。“目标位置”是，例如，可携带终端的持有者想去的指定地点的位置。在这种情况下，当持有者在地图上指明一个确定位置时，可携带终端从地图得到指定地点的纬度和经度，并根据当前位置计算指定地点的方位。显示 3 表示这些实际的数值。就是说，作为实例显示项给出了目标点的纬度和经度及根据当前位置的方位。

显示 4 表示对目标点的导航。作为实例显示项给出的是至目标点的距离和方位、及可携带终端的运动速度。关于至目标位置的距离，当表示当前位置和指定的目标位置时，终端自动地根据两点的纬度和经度差计算该距离。关于方位，用在终端中安装的方向探测器 20 得到可携带终端当前前进的方向，和根据当前位置和目标位置计算的至目标位置的方向（括号中表示的数字），并显示他们。通过方向探测器 20 的内装加速度传感器还能计算可携带终端的运动速度，并显示计算结果。

图 9B 举例说明简化的曲线显示。

显示 1 表示卫星的捕捉状态。这里，用字符显示捕捉的卫星数目和可捕捉的卫星数目，并且还用曲线图像显示捕捉的卫星和没有捕捉的卫星，以便区别。

显示 2 表示可携带终端的当前位置。用数字显示当前纬度、经度和高度，并且使用简单的曲线图像，与从导航开始位置起的路线一起，显示当前位置。尽管在显示 2 中没有表示，这里实际显示了一张地图，并且可携带终端的持有者能知道他/她所在的区域。

显示 3 表示目标位置和导航。目标纬度、经度、方位和矩离及当前方位和速度表示为字符信息。在显示 3 的下部绘出的曲线图像是罗盘图案，以便利于目标方向和当前前进方向的理解。一个白色箭头表示当前前进方向，而一个黑色箭头表示目标位置的方向。

图 10A － 10D 是表示本发明各个可携带终端的外观的实例。

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图 10A 和 10B 举例说明携带式终端的外观。图 10A 是主视图，而图 10B 是侧视图。

一个用来显示导航信息、一张地图等的显示屏幕 50 提供在终端的正面，而一个 GPS 天线 51 安装在其侧部。GPS 天线 51 可以是内装型的，或者是使用 PC 卡槽或类似结构在后来安装的结构。而且，GPS 天线 51 最好应该具有这样一种结构，其安装部分能柔性地运动，以便捕捉来自卫星的无线电波，并且在终端的任何姿态都可以面朝上。顺便说明，终端具有装在其中的通信功能，所以能与中心系统通信。然而，没有通信功能，根据 GPS 的导航仍是可能的。

图 10C 和 10D 举例说明携带式电话类型终端的外观。

图 10C 表明翻板（盖子）54 关闭时的状态。一个显示屏幕 52 提供在终端的正面。导航信息和地图显示在显示屏幕 52 上。一个 GPS 天线 53 布置在翻板 54 内，并且能捕捉来自卫星的无线电波，以便把当前位置信息等供给终端的持有者。

图 10D 表明翻板 54 被打开的状态。当翻板 54 被打开时，输入按钮 55 成为可见的，并且能用来给出输入，以便进行电话呼叫和接收导航服务等。在翻板 54 的底座处有一个送话口。这样，翻板 54 反射人的声音，以便把声音发送给送话口。

以这种方式，把 GPS 天线 53 装成一个部件，如翻板 54，其中几乎不包括电路，借此能安装 GPS 功能，而不增大终端的尺寸。

根据本发明，能够提供一种高使用能力的位置信息管理系统；其中，能监督，例如，老人或儿童的行动；其中，持有可携带终端的人能够相互获得位置信息；以及，其中，能迅速知道持有可携带终端的人的异常情况。

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说 明 书 附 图

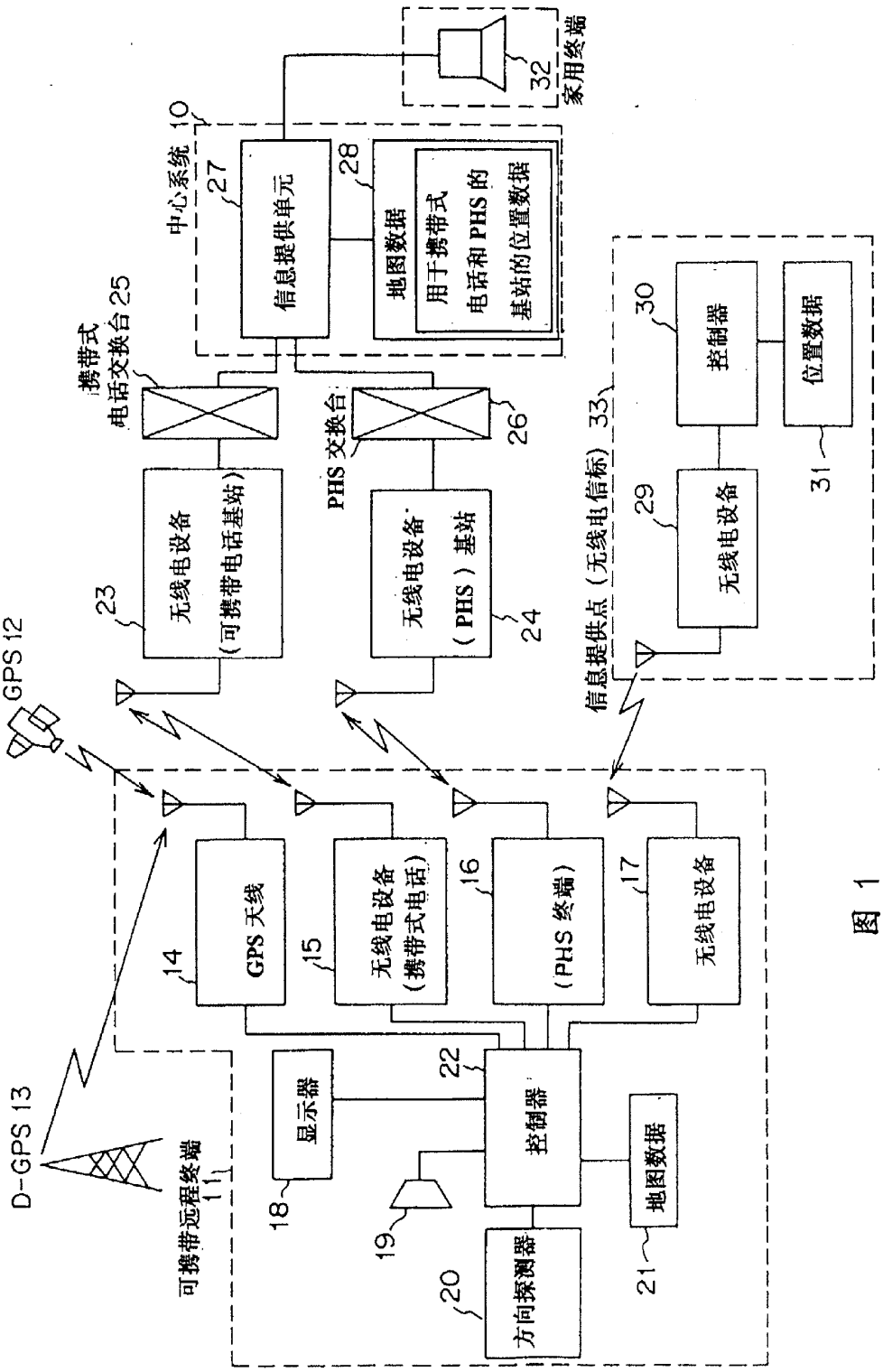


图 1

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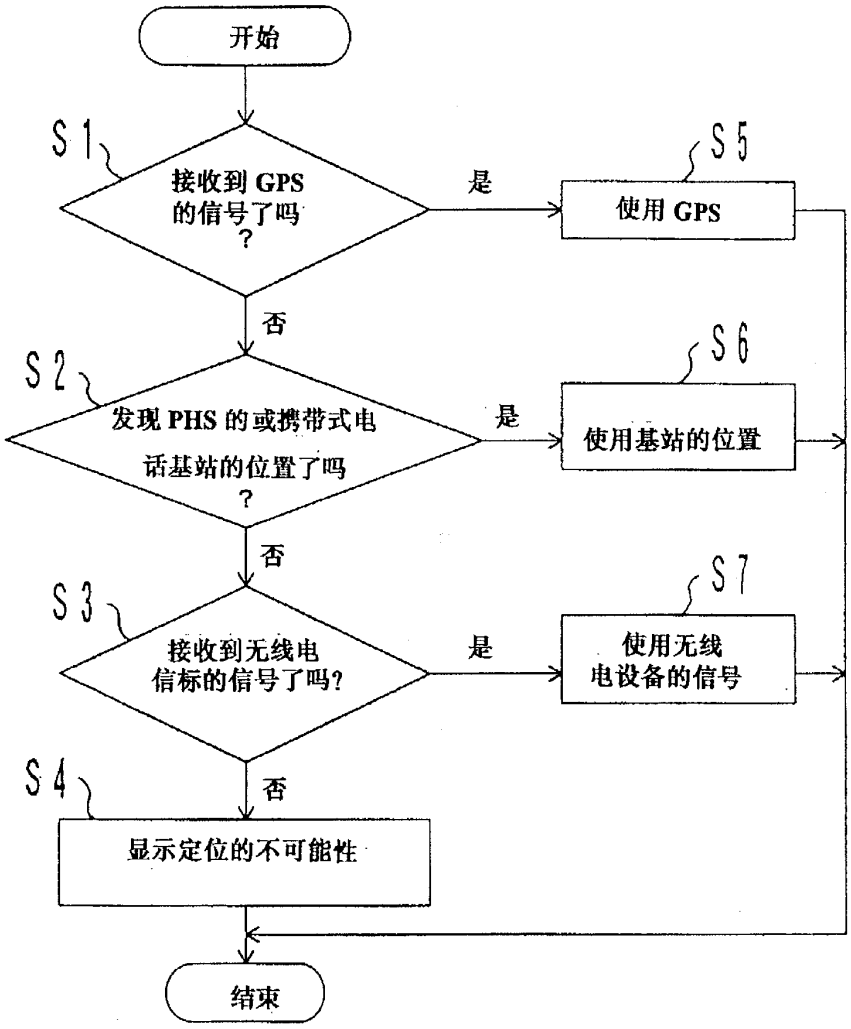
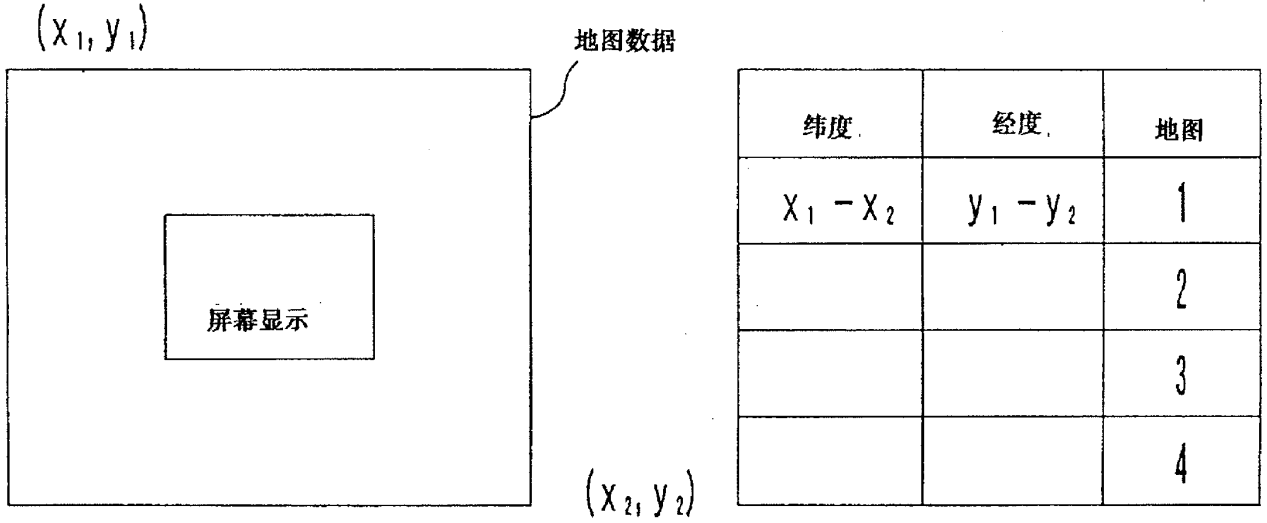


图 2

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纬度	经度	地图
$x_1 - x_2$	$y_1 - y_2$	1
		2
		3
		4

图 3

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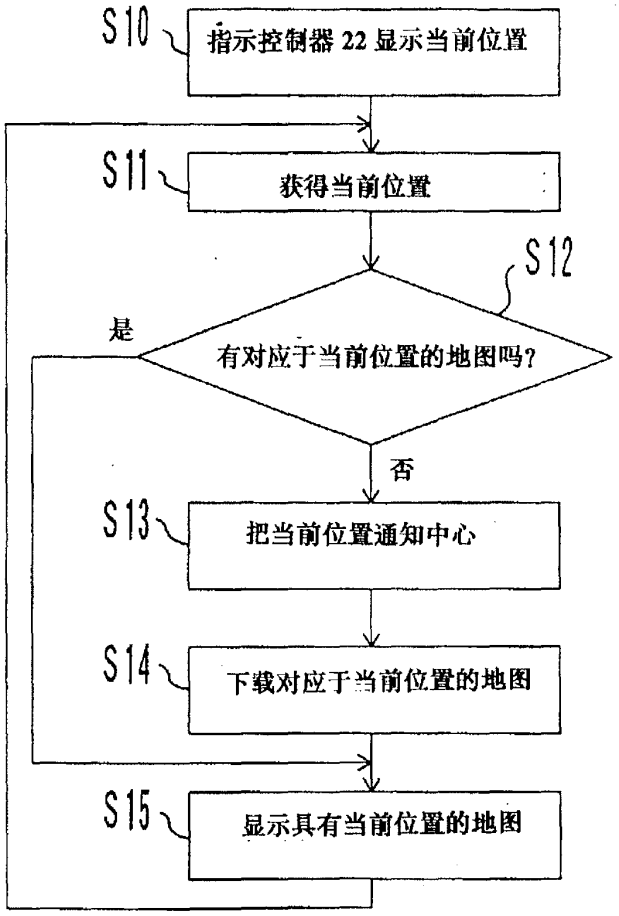


图 4

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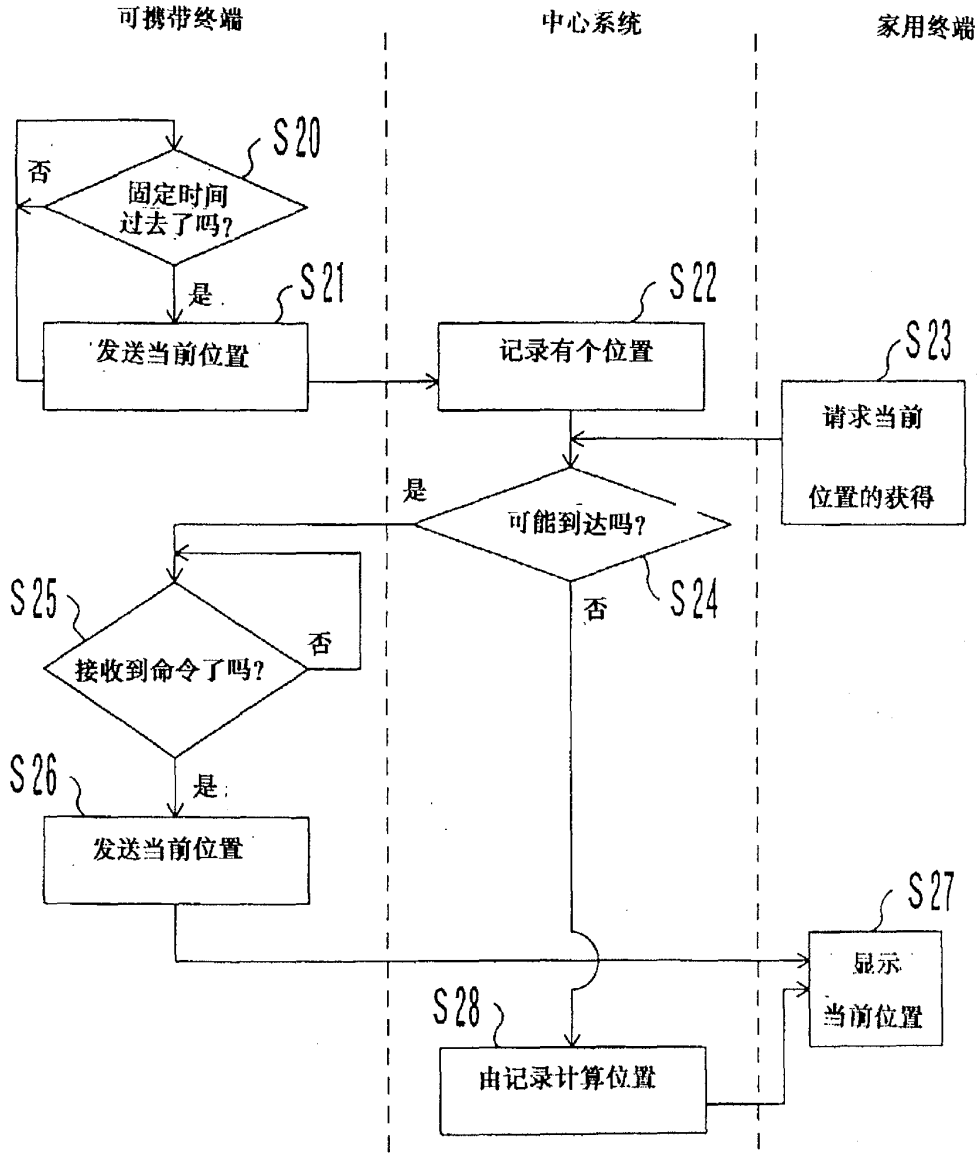


图 5

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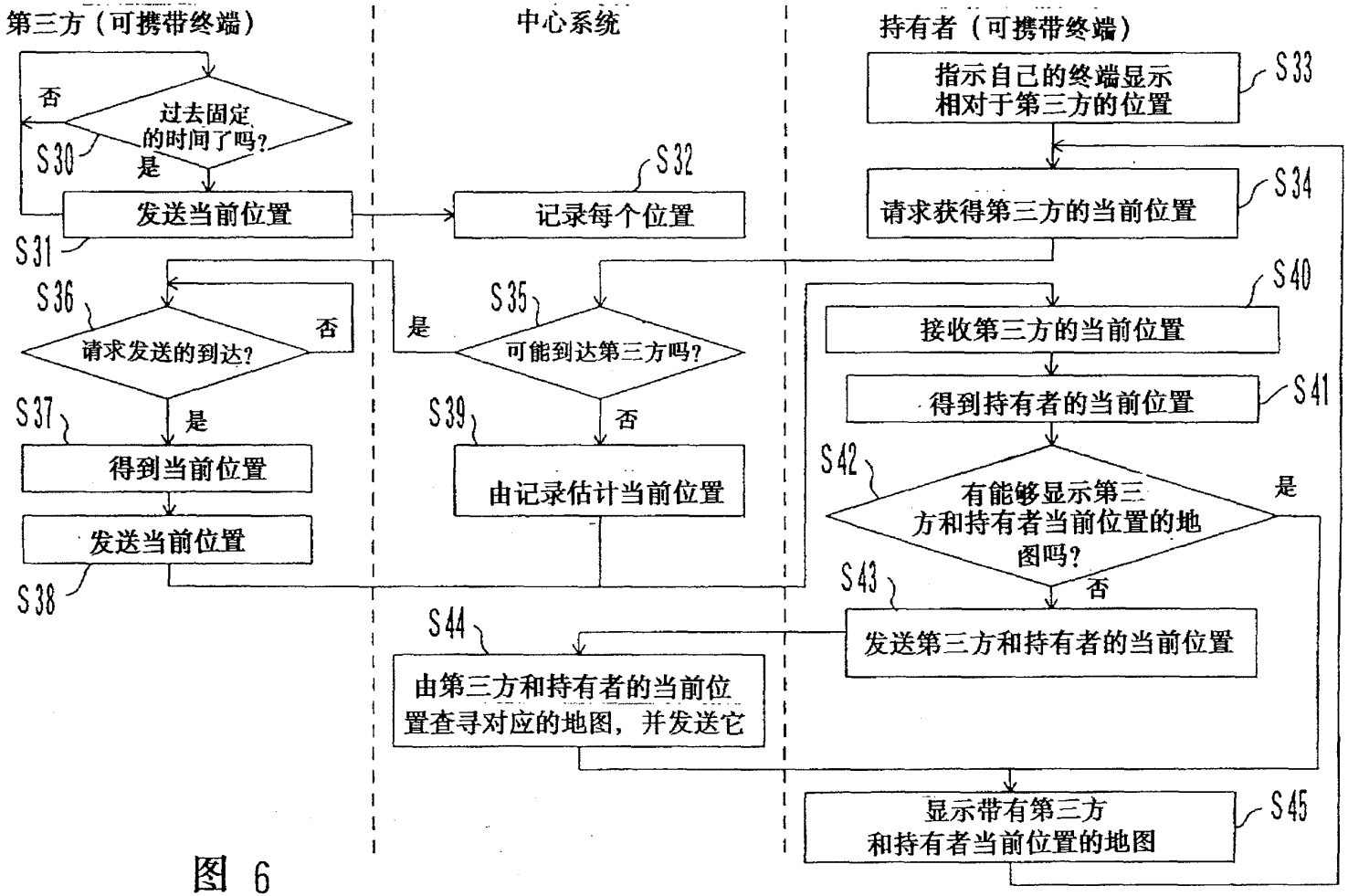


图 6

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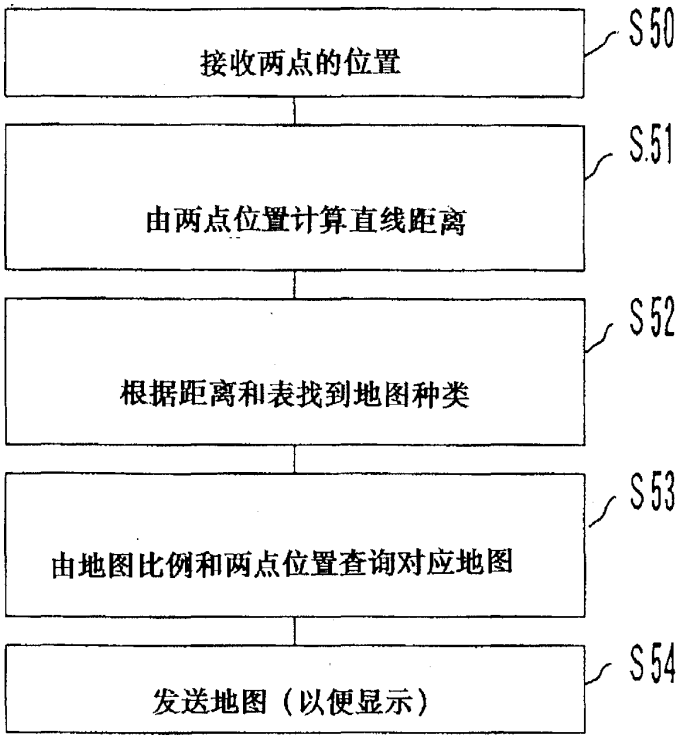


图 7 A

直线距离（千米）		比例
5 0 0		1 比 100,000
2 0 0	5 0 0	1 比 50,000
1 0 0	2 0 0	1 比 20,000
0	1 0 0	1 比 10,000

图 7 B

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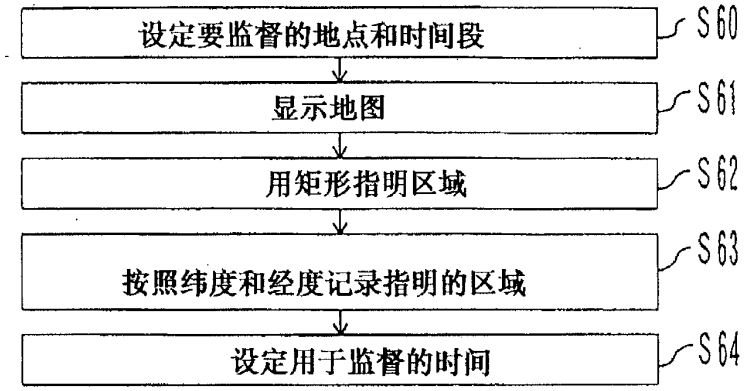


图 8 A

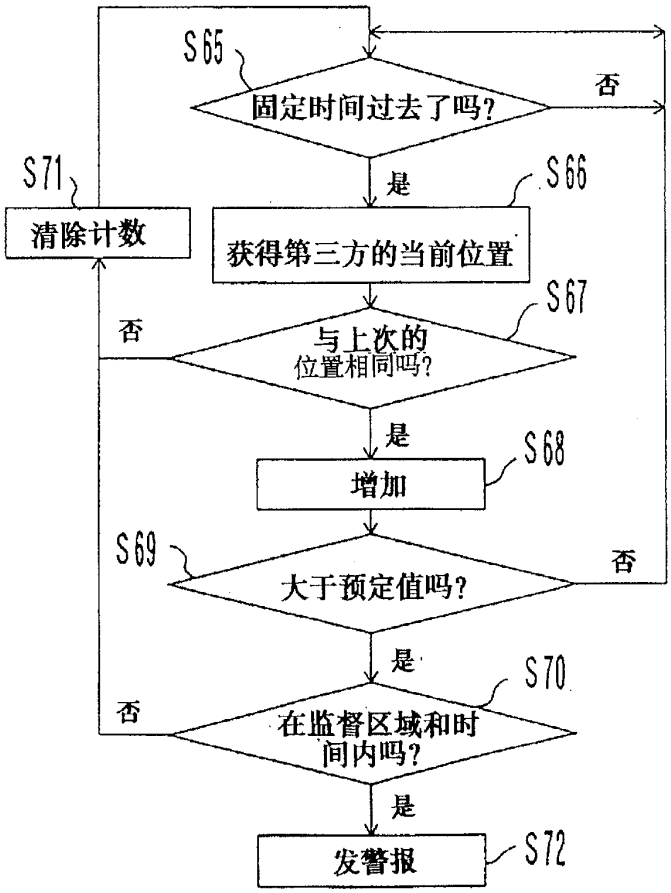


图 8 B

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图9A

(1) 卫星捕捉状态

卫星捕捉状态 : GOOD

捕捉的卫星数目: 6

可捕捉卫星的数目: 8

(2) 当前位置显示

当前纬度 : 40°00.000

经度 : 150°00.000

高度 : 500 m

(3) 目标位置显示

目标纬度 : 50°00.000

经度 : 140°00.000

方位 : 335°00

(4) 导航显示

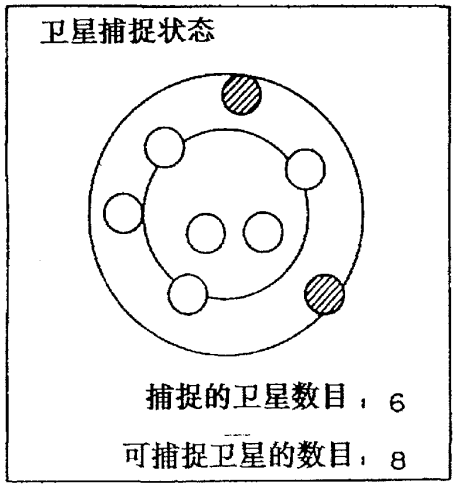
目标距离 : 15.00 km

方位 : 0°00 (335°00)

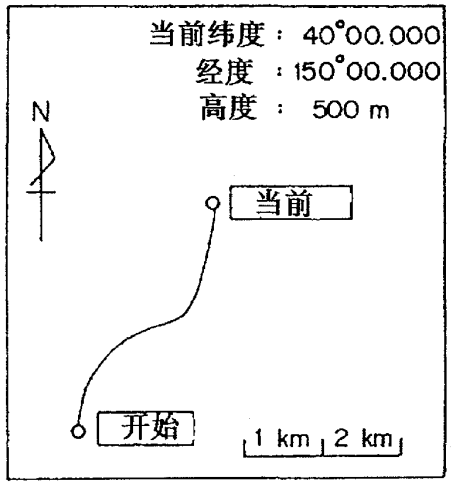
速度 : 30 km/h

图9B

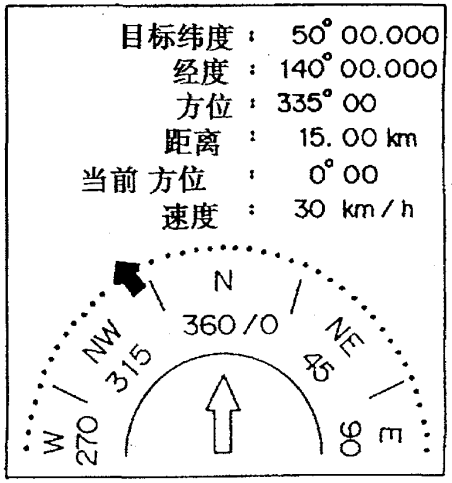
(1) 卫星捕捉状态



(2) 当前位置显示



(3) 目标位置导航显示



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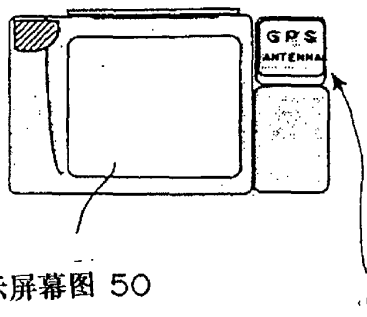


图10A



图10B

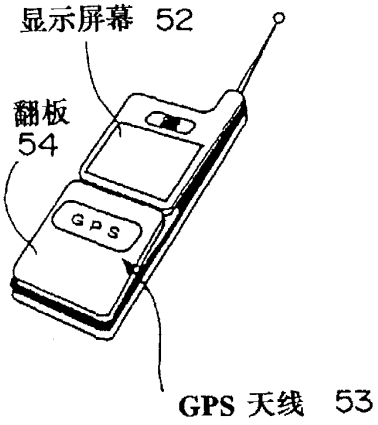


图10C

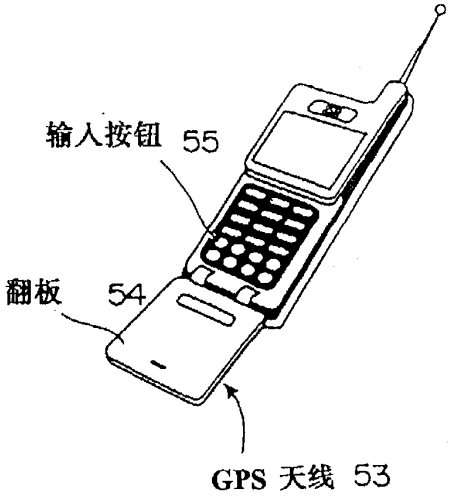


图10D

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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.

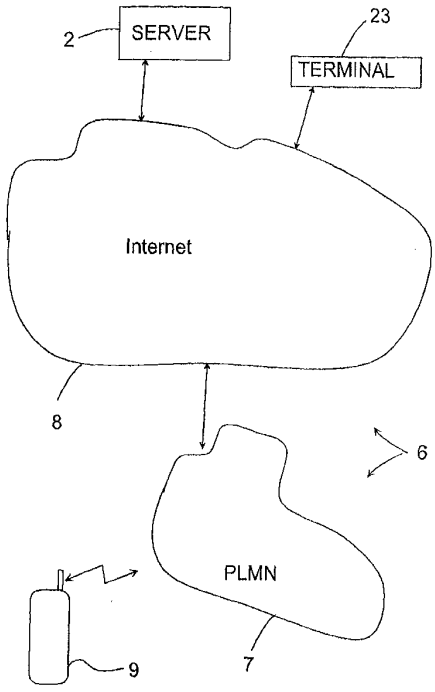


Fig. 1

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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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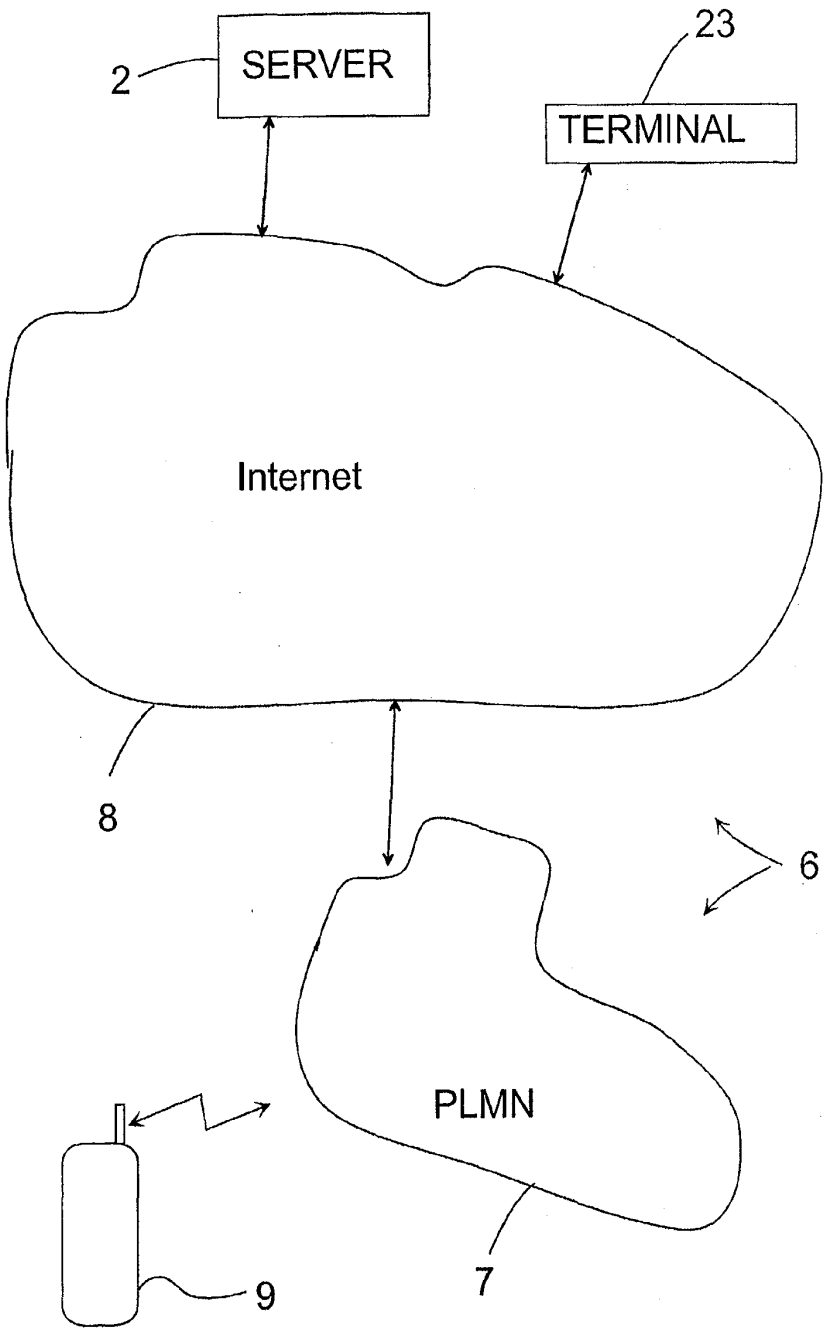


Fig. 1

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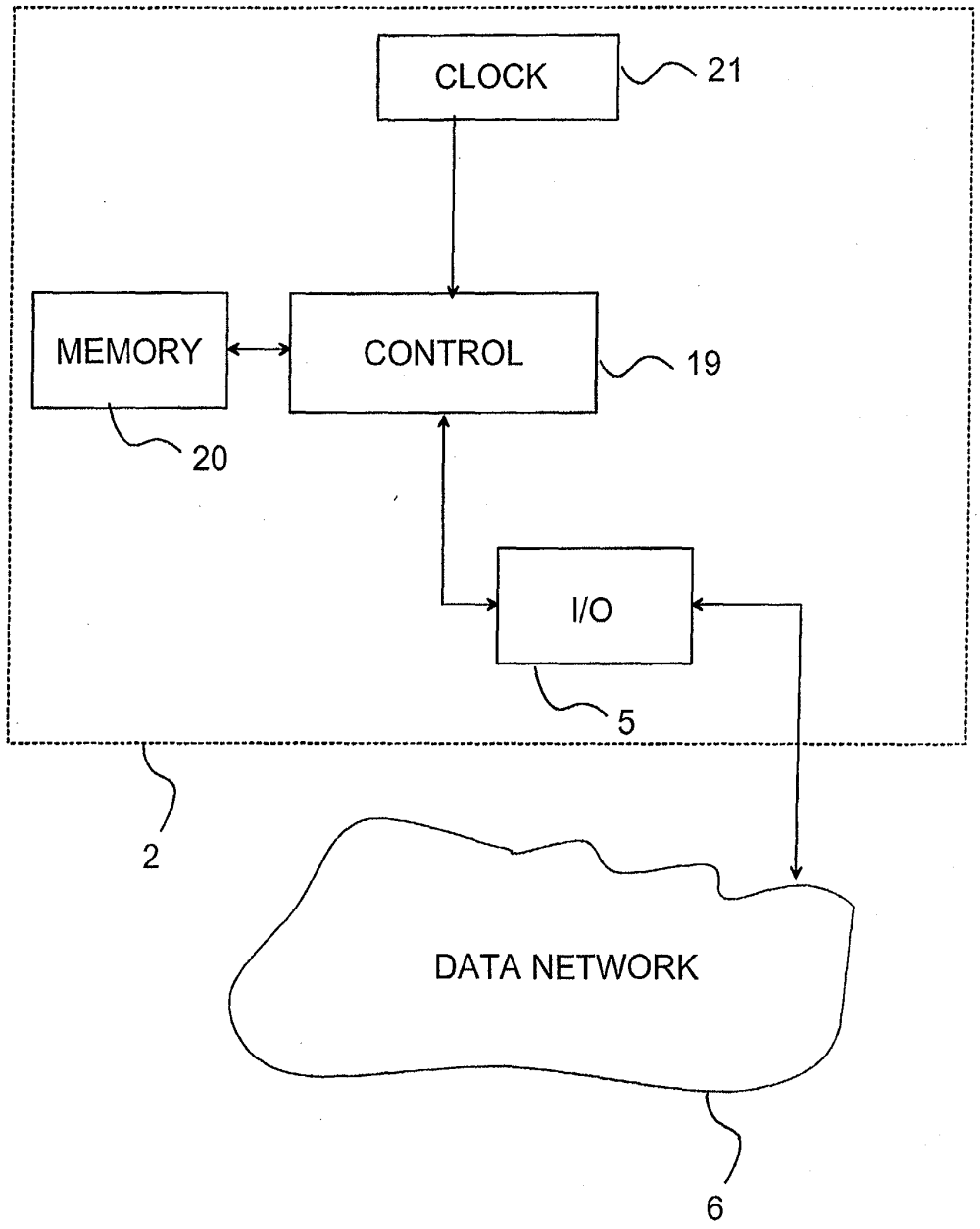


FIG. 2

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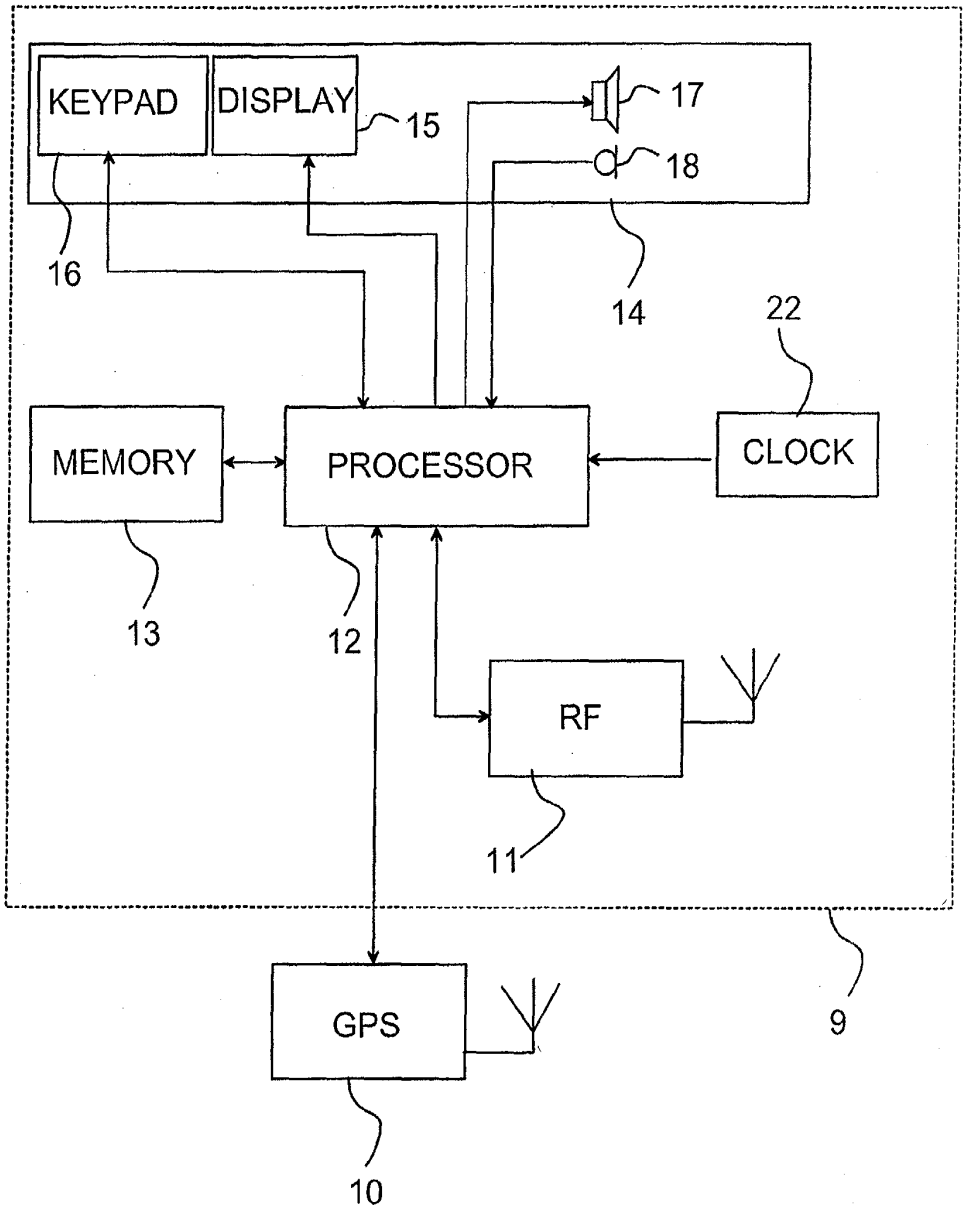


FIG. 3

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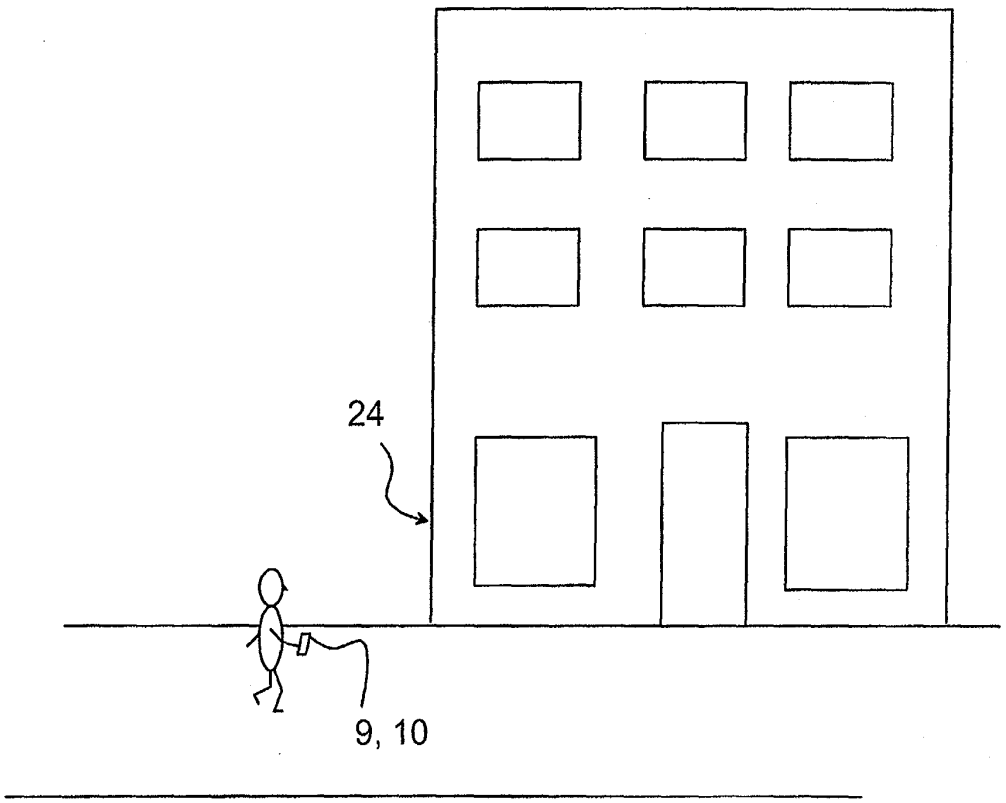


FIG. 4

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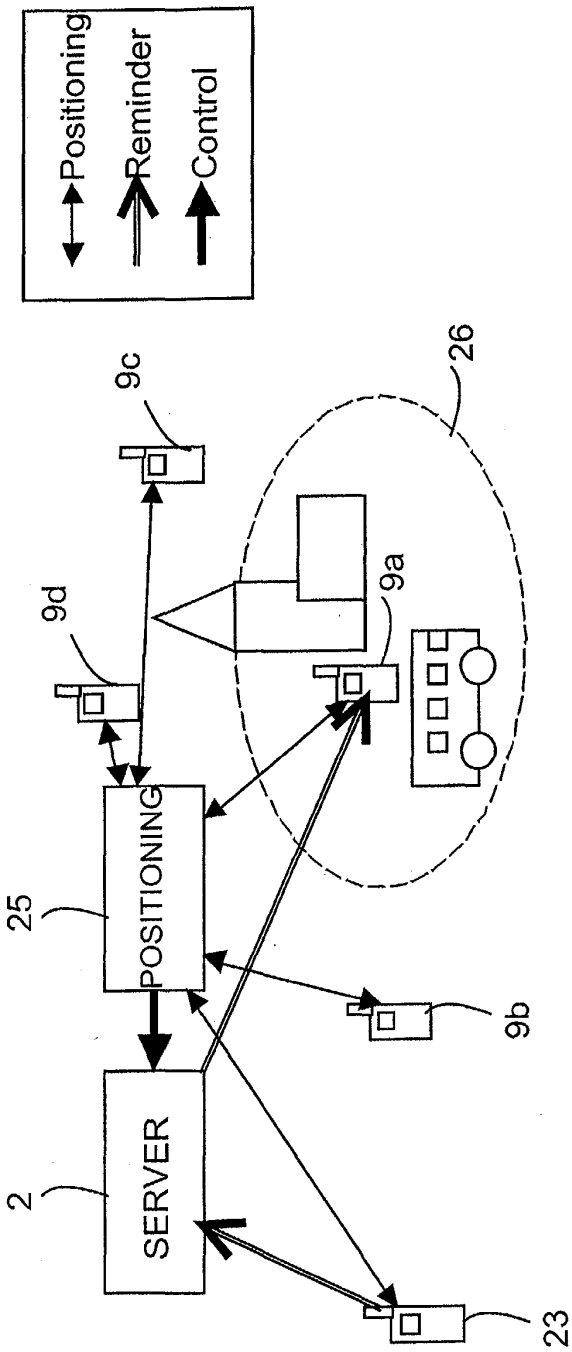


FIG. 5

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(56) Documents Cited

GB 2283873 A	GB 2025185 A	GB 1528180 A
EP 0766096 A2	EP 0601293 A2	EP 0528090 A1
EP 0006448 A1	WO 97/01104 A1	WO 95/27219 A1
WO 95/17685 A1	WO 92/13284 A1	WO 83/02501 A1
US 5548822 A	US 5519403 A	US 5504991 A
US 5461390 A	US 5389934 A	US 5327144 A
US 4806940 A		

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INT CL[6] G01S, H04Q

(54) Abstract Title
Position determination, processing and display

(57) A position information management system in which a portable remote terminal (11) includes a plurality of kinds of positioning means (12,13,23,24,33) for positioning based on a GPS, positioning based on a portable-telephone or PHS base station, positioning based on a radio marker, and independent positioning based on a direction detector, one of which is used so that the holder of the portable remote terminal can navigate anywhere. The holder of the portable remote terminal can know the position of a third party similarly holding such a portable remote terminal, by inquiring of a central system (10), and he/she can supervise, for example, activities of an old person, a child, or a skier in a skiing area. Further, only the map data of a district which is often used by the holder is stored in the portable remote terminal. In this regard, when the holder is in a district not contained within the retained map data, he/she downloads corresponding map data from the central system and uses the downloaded map data.

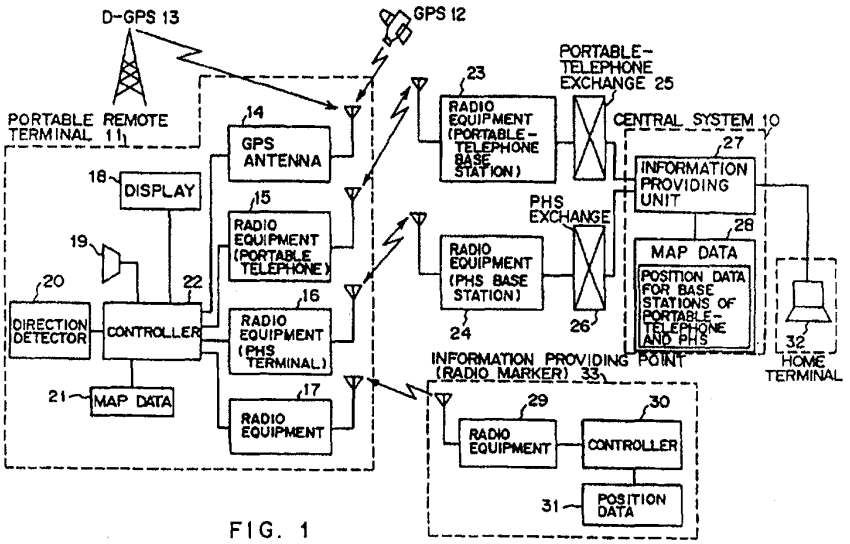


FIG. 1

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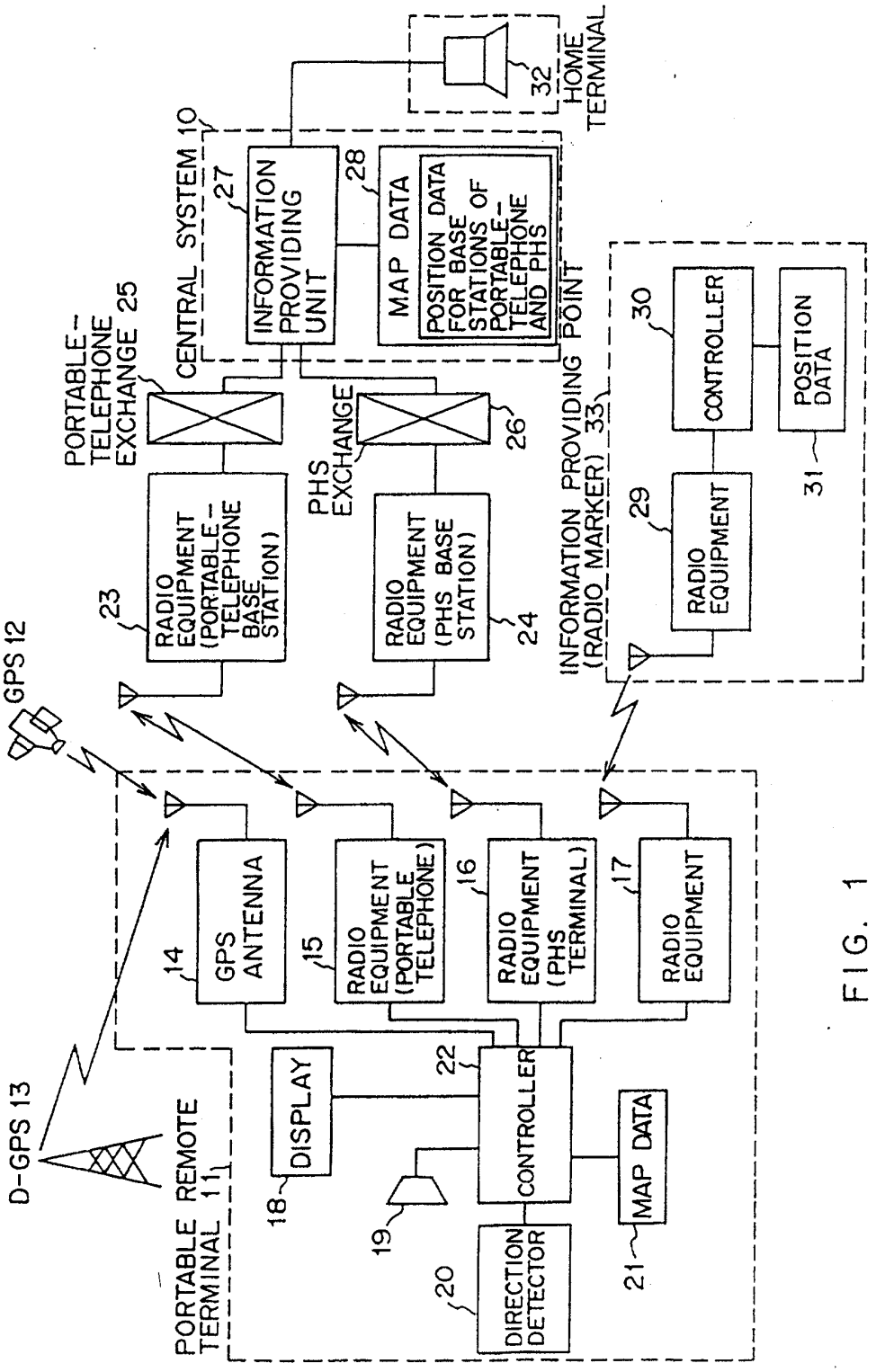


FIG. 1

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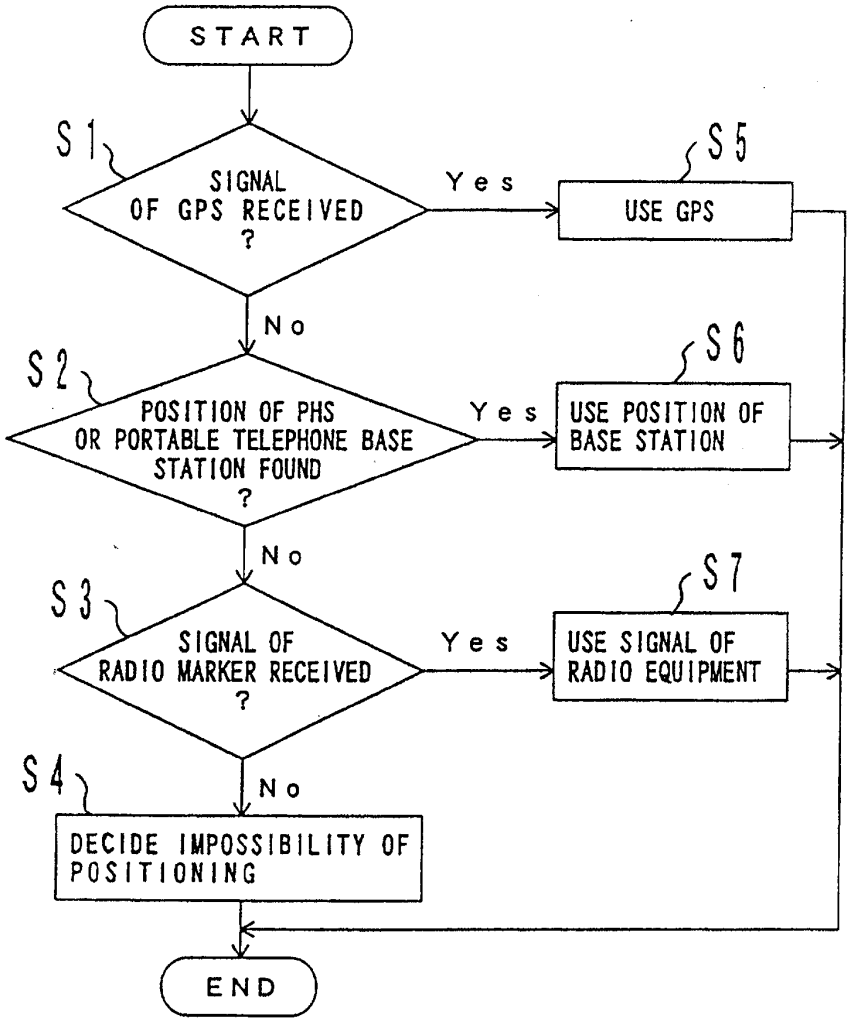
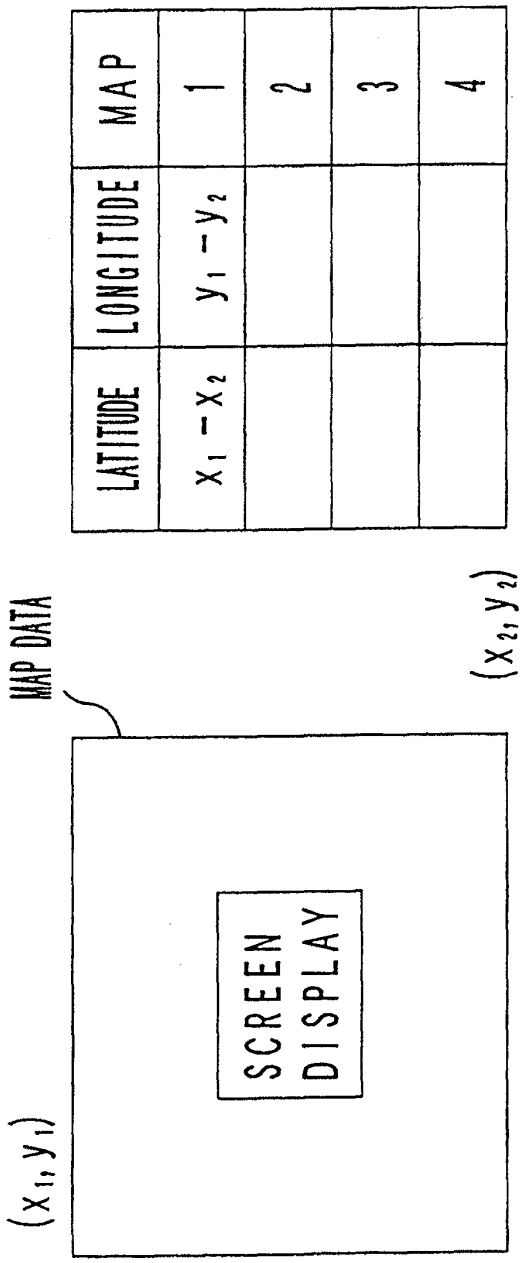

START
S1
SIGNAL OF GPS RECEIVED ?
Yes
S5
USE GPS
No
S2
POSITION OF PHS OR PORTABLE TELEPHONE BASE STATION FOUND ?
Yes
S6
USE POSITION OF BASE STATION
No
S3
SIGNAL OF RADIO MARKER RECEIVED ?
Yes
S7
USE SIGNAL OF RADIO EQUIPMENT
No
S4
DECIDE IMPOSSIBILITY OF POSITIONING
END

FIG. 2



LATITUDE	LONGITUDE	MAP
$x_1 - x_2$	$y_1 - y_2$	1
		2
		3
		4

FIG. 3

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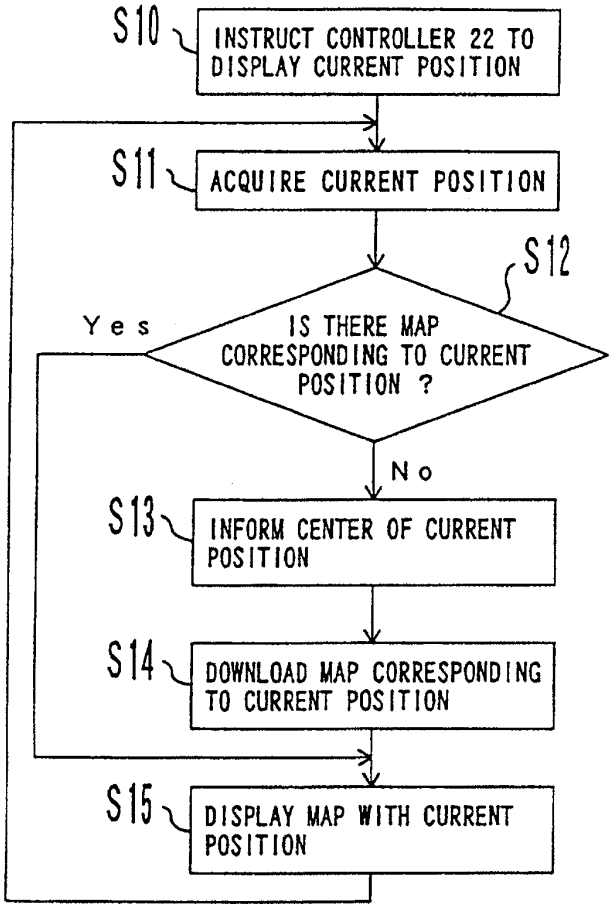

S10
INSTRUCT CONTROLLER 22 TO DISPLAY CURRENT POSITION
S11
ACQUIRE CURRENT POSITION
S12
IS THERE MAP CORRESPONDING TO CURRENT POSITION ?
Yes
No
S13
INFORM CENTER OF CURRENT POSITION
S14
DOWNLOAD MAP CORRESPONDING TO CURRENT POSITION
S15
DISPLAY MAP WITH CURRENT POSITION

FIG. 4

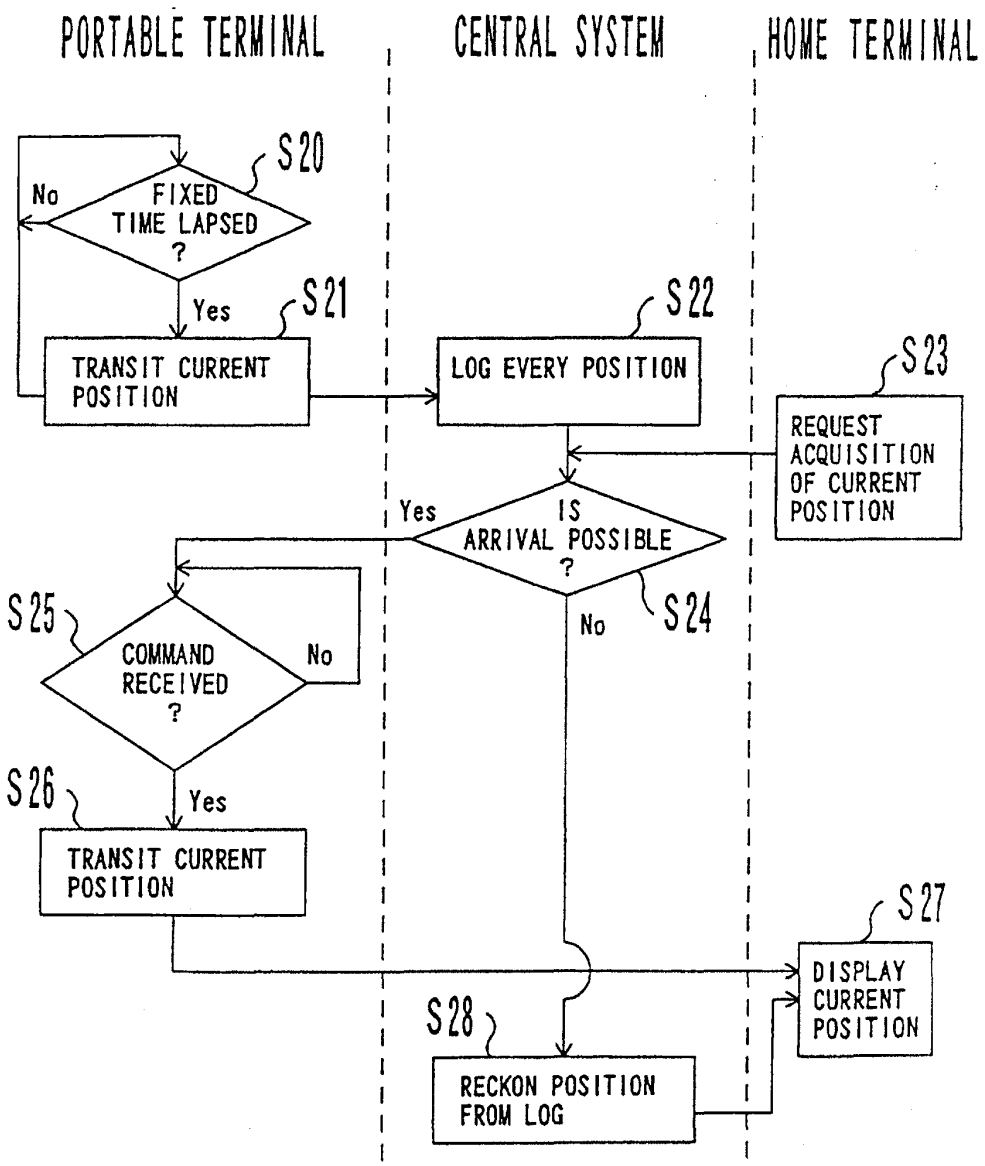


FIG. 5

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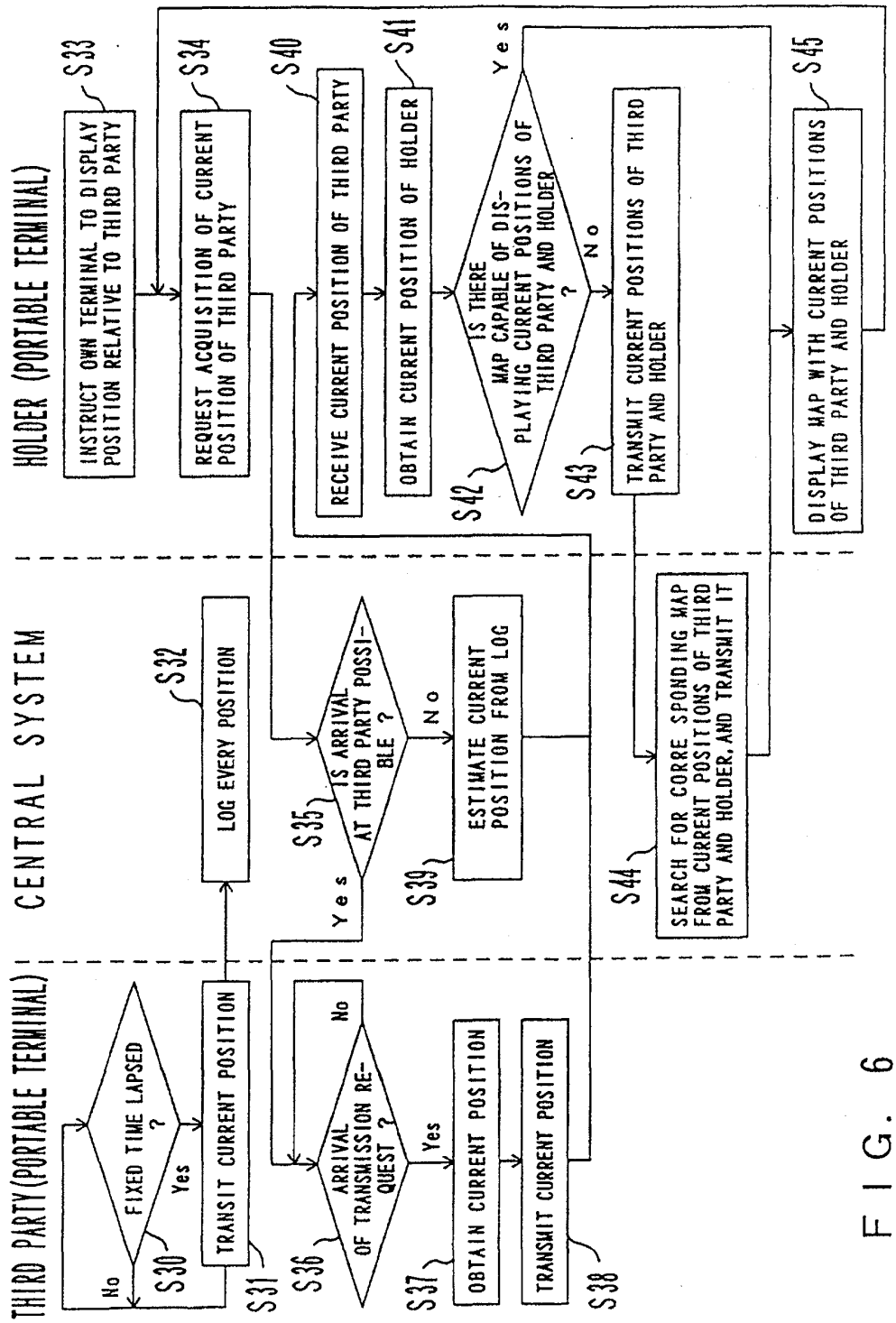


FIG. 6

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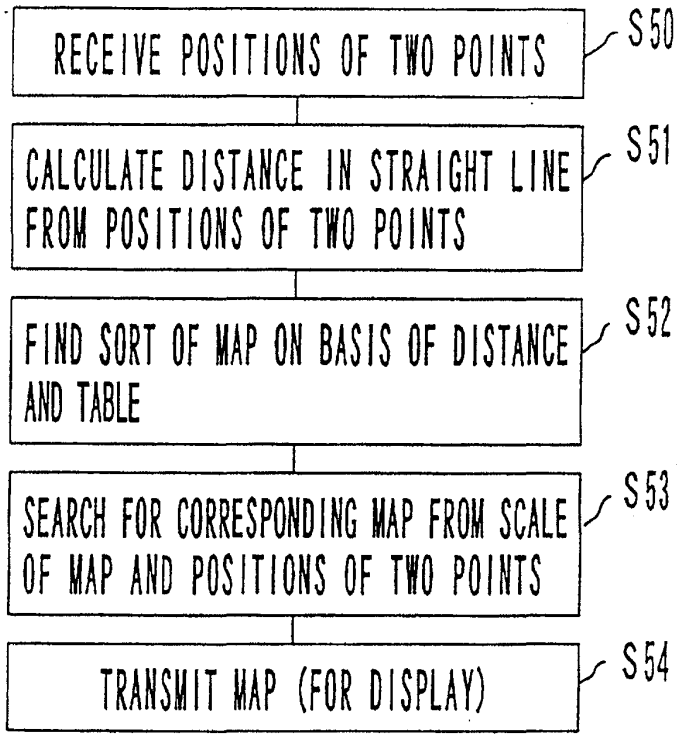


FIG. 7A

DISTANCE IN STRAIGHT LINE (km)		SCALE
500		1 TO 100,000
200	500	1 TO 50,000
100	200	1 TO 20,000
0	100	1 TO 10,000

FIG. 7B

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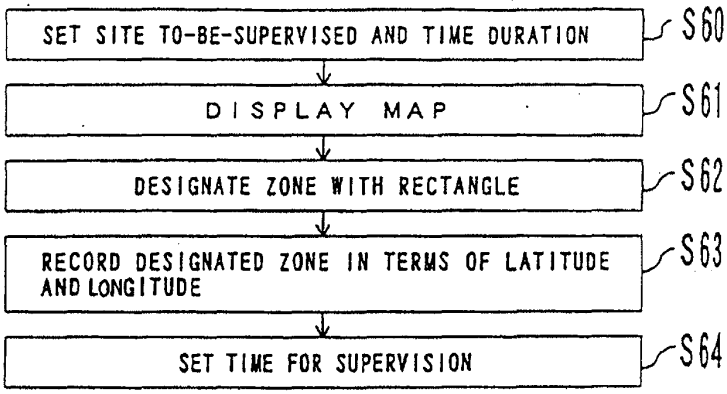


FIG. 8A

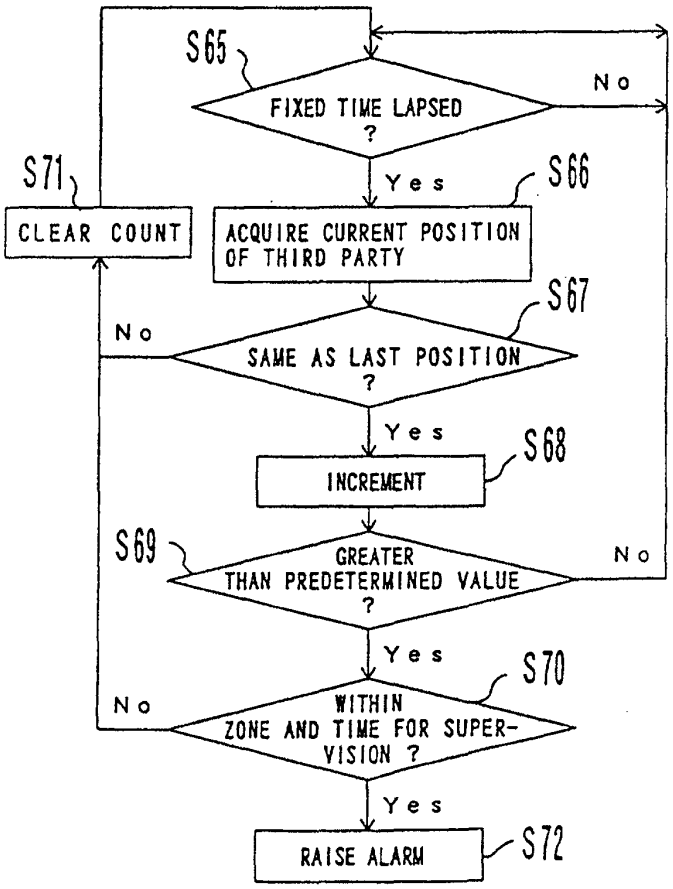


FIG. 8B

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FIG. 9A

(1) SATELLITE CAPTURE STATE

SATELLITE CAPTURE STATE	: GOOD
NUMBER OF CAPTURED SATELLITES	: 6
NUMBER OF CAPTURABLE SATELLITES	: 8

(2) CURRENT POSITION DISPLAY

CURRENT LATITUDE	: 40°00.000
LONGITUDE	: 150°00.000
ALTITUDE	: 500 m

(3) TARGET POSITION DISPLAY

TARGET LATITUDE	: 50°00.000
LONGITUDE	: 140°00.000
AZIMUTH	: 335°00

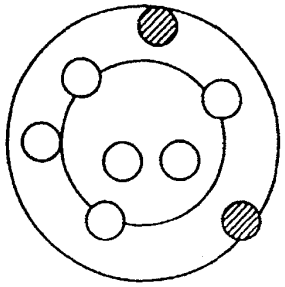
(4) NAVIGATION DISPLAY

TARGET DISTANCE	: 15.00 km
AZIMUTH	: 0°00 (335°00)
SPEED	: 30 km/h

FIG. 9B

(1) SATELLITE CAPTURE STATE

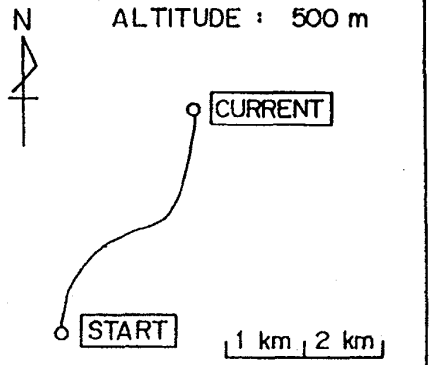
SATELLITE CAPTURE STATE



NUMBER OF CAPTURED SATELLITES	: 6
NUMBER OF CAPTURABLE SATELLITES	: 8

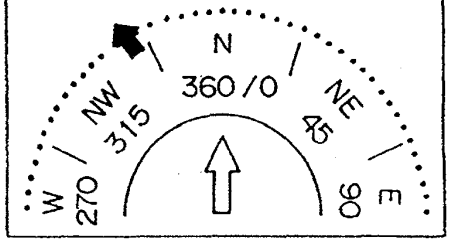
(2) CURRENT POSITION DISPLAY

CURRENT LATITUDE	: 40°00.000
LONGITUDE	: 150°00.000
ALTITUDE	: 500 m



(3) TARGET POSITION · NAVIGATION DISPLAY

TARGET LATITUDE	: 50°00.000
LONGITUDE	: 140°00.000
AZIMUTH	: 335°00
DISTANCE	: 15.00 km
CURRENT AZIMUTH	: 0°00
SPEED	: 30 km/h



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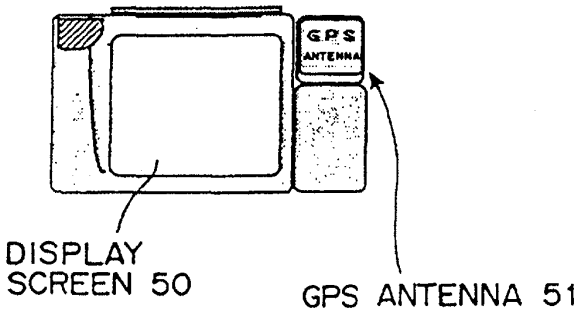


FIG. 10A

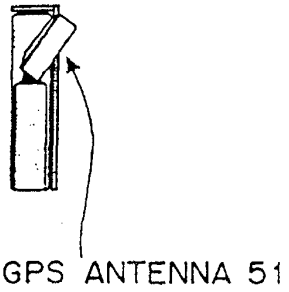


FIG. 10B

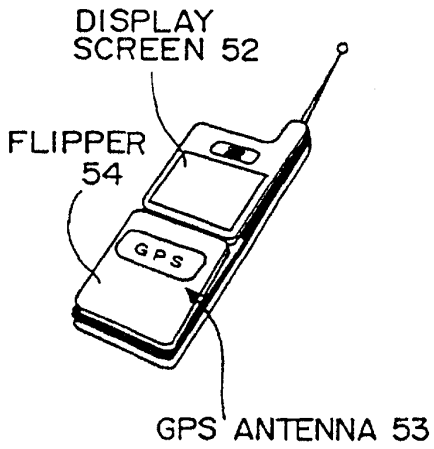


FIG. 10C

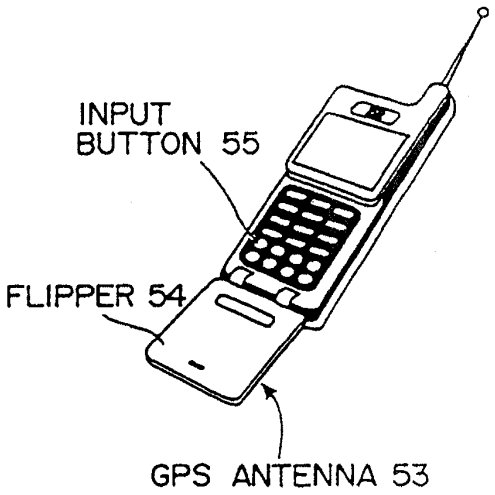


FIG. 10D

Position Information Management System

The present invention relates to a position information management system, and more particularly to a system for managing the position information of individuals such as pedestrians.

Nowadays, a car navigation system wherein a terminal is mounted in an automobile so as to display the current position of the automobile has been put into practical use and put on the market. According to the car navigation system, anybody can reach a destination without getting lost even in an area which he/she visits for the first time, because the map of his/her surroundings is displayed with the current position.

The car navigation system executes the processing of receiving radio waves from satellites so as to acquire the current position in terms of a latitude and a longitude, and reading out map information which contains the acquired latitude and longitude, from a memory device.

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Such a system operates to aid navigation when driving an automobile. There has also been developed and put on sale a system wherein a person holds or carries a terminal of a portable type, on which his/her current position and pertinent map information are displayed so as to aid navigation of the person.

The personal navigation system also executes the processing of receiving radio waves from satellites so as to acquire the current position in terms of a latitude and a longitude, and displaying the stored map information with the current position.

The system wherein the current position is determined by receiving radio waves from satellites in this manner, is called the "GPS (Global Positioning System)".

In the navigation system as stated above, the current position is acquired by catching radio waves from satellites. Therefore, the system has the disadvantage of failing to operate in a location where radio waves cannot be received from any of the satellites.

Besides, in the system for navigating the movements of a person, the terminal to be held or carried by the person tends to be somewhat large in

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size because a CD-ROM or the like for storing map information is built therein.

Accordingly, it is desirable to provide a position information management system of higher serviceability.

According to the present invention, in a system wherein information from a positioning system is acquired in an information terminal and is processed in a central system so as to manage information on a position of the information terminal, a position information management system is characterized by employing an information terminal which is adapted to utilize a plurality of kinds of positioning systems and to automatically change from any of the positioning systems in an unavailable state, to an available one of the positioning systems, so as to acquire a current position thereof by the use of the available positioning system.

Further, an information terminal for use in the present invention is one which can communicate with a central system for managing position information, and which acquires information from a positioning system so as to display information on a position of

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the information terminal, and is characterized by being adapted to utilize a plurality of kinds of positioning systems, and to automatically change from any of the positioning systems in an unavailable state, to an available one of the positioning systems, so as to acquire a current position of the information terminal by the use of the available positioning system.

Alternatively, a portable radio terminal in the present invention is characterized by comprising position information acquisition means for obtaining current position information; and means for transmitting the position information obtained by the position information acquisition means, to another equipment through a radio channel, in compliance with a request for the position information made through the radio channel by the other equipment.

In another aspect, a portable radio terminal is characterized by comprising position information acquisition means for obtaining current position information on the basis of radio waves from a satellite; means for connecting the portable radio terminal through a radio channel with a center which manages current position information of a plurality of portable radio telephone terminals; means for

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registering the current position information obtained by the position information acquisition means in the center through the connection means; and means for acquiring a current position of the portable radio terminal of a third party from the center through the connection means.

In this way, according to the present invention, a navigation function etc. does not become unusable for the reason that any of the positioning systems is unavailable, and the position information can be acquired and displayed by any method without fail. Therefore, the position information management system is high in serviceability.

Especially, according to the present invention, the information terminal or portable terminal can comprise a direction detector for independently reckoning its own position. Thus, even in a case where the GPS and other positioning systems are not available at all, the navigation function can be utilized as long as merely a starting point is known.

Moreover, the portable terminal or information terminal is endowed with the function of retaining the minimum map data required of the terminal itself, in the form of an IC card, etc., whereby the number of times of downloading from the central system can be

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decreased. Also, the IC card is employed as a detachable storage medium, whereby the terminal itself can be made smaller in size than in case of employing a CD-ROM drive.

The system of the present invention can offer a large number of other services, which will be exemplarily described in conjunction with the drawings below.

Reference will now be made, by way of example, to the accompanying drawings in which:-

Fig. 1 is a block diagram showing the system architecture of a position information management system embodying the present invention;

Fig. 2 is a flowchart of a system change over control process for acquiring position information, the control being performed by a controller (22) shown in Fig. 1;

Fig. 3 is a diagram showing the relationship between map data to be displayed on a portable terminal and the display screen of a display unit;

Fig. 4 is a flowchart in the case of acquiring a current position and then displaying a map;

Fig. 5 is a flowchart showing the general process of an inquiry system for inquiring about the position of the holder of a portable terminal, the inquiry

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system utilizing the system of the present invention;

Fig. 6 is a flowchart showing processes in the case where the system of the present invention is applied to the position information acquisition between portable terminals;

Figs. 7A and 7B are diagrams for explaining the process of a central system among the processes shown in Fig. 6;

Figs. 8A and 8B are flowcharts showing a process for supervising a third party on the side of a portable terminal;

Figs. 9A and 9B are diagrams each showing a display example which is presented on the display screen of a portable terminal in the system of the present invention; and

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

Fig. 1 is a block diagram showing the system architecture of a position information management system embodying the present invention.

The system embodying the invention comprises a central system 10 which manages information in unified

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fashion, a portable remote terminal 11 which is carried by a person, a satellite 12 which is part of the GPS, a radio wave transmission tower 13 which serves for a D-GPS (Differential GPS), and an information offer point (radio marker) 33 which determines the position of the portable terminal 11 by radio waves.

The portable terminal 11 includes the respective receivers of a GPS antenna 14, radio equipment 15 for a portable telephone, radio equipment 16 for a "PHS", and radio equipment 17 for receiving radio waves from the radio marker 33. The respective receivers receive radio waves from corresponding radio-wave transmission stations, and deliver them to a controller 22. (Incidentally, the initials "PHS" stand for "Personal Handy-phone System" which is a digital type of mobile terminal communications system standardized in Japan and some other countries. Hereinafter we refer mainly to PHS, but the present invention is not restricted to PHS, instead any type of digital type mobile terminal communications system can be applicable.)

The controller 22 acquires the current position of the portable terminal 11 by the use of the highest precision of position information among position information items obtained from the respective radio waves, and it lets the holder of the portable terminal

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11 know the acquired current position by supplying a display unit 18 with the current position and a map of the surrounding area. Numeral 19 indicates a speaker, which is used in the case of sounding an alarm to the holder of the portable terminal 11. In the portable terminal 11, the minimum map information, such as the map information of a district to which the holder often goes, is stored as map data 21. In a case where the portable terminal 11 lies within the limits of the map data 21, the controller 22 reads out the map data 21 and delivers it to the display unit 18. Further, the map data 21 stored in the portable terminal 11 should preferably be realized by mounting a detachable storage medium such as an IC card or miniature card. Thus, only the minimum map data of the zone where the holder wants to move need be installed, and an unnecessarily large storage capacity is not required. The embodiment therefore has the advantage that the portable terminal 11 can be reduced in size.

A direction detector 20 in the portable terminal 11 serves to independently detect the movement of the portable terminal 11 and specify the current position thereof in a case where no radio waves are detected by the portable terminal 11. The direction

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detector 20 includes a gyrocompass and an acceleration sensor. The controller 22 calculates the moving direction and moved distance of the portable terminal 11 by processing information from the direction detector 20, and it outputs the resultant current position to the display unit 18. Particularly-in a case where a three-dimensional gyro is employed and where acceleration sensors are arranged in three dimensions, the moving direction and moved distance of the portable terminal 11 in three dimensions can be calculated. In this case, therefore, the portable terminal 11 can effect navigation independently in the situation where no wireless positioning data is obtainable.

The central system 10 is connected to radio equipment (a portable-telephone base station) 23 through a portable-telephone exchange 25 and also to radio equipment (a PHS base station) 24 through a PHS exchange 26, and it provides the exchange of position information with the portable terminal 11, etc. An information providing unit 27 in the central system 10 retains map data 28 which contains the position data of the portable-telephone and PHS base stations 23 and 24. In a case where the map data 21 retained in the portable terminal 11 is insufficient to display

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the current position, the central system 10 sends the map data 28 to the portable terminal 11 so as to permit the display of the current position. The position data of the portable-telephone or PHS base stations 23 or 24 respectively is used when the portable terminal 11 has to find its position from the site of the nearest portable-telephone base station 23 or PHS base station 24 for the reason that the radio waves from the GPS 12 and the D-GPS 13 are not receivable.

In addition, the information providing unit 27 is connected with a home terminal 32 through a network or the like. Thus, it offers the position information of the portable terminal 11 in order to locate, for example, an old person or a child, who holds the portable terminal 11.

An information offer (providing) point (radio marker) 33 is used in order that the portable terminal 11 may acquire the current position in the case where signals from the GPS 12, D-GPS 13, portable-telephone base station 23 and PHS base station 24 are not available. The information offer point 33 includes radio equipment 29, a controller 30 and position data 31. The position data 31 is the stored data of a latitude and a longitude where the information offer point 33

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is disposed, and it is transmitted from the radio equipment 29 to the portable terminal 11 through the controller 30. On the side of the portable terminal 11, the current position thereof is acquired on the basis of the latitude and longitude information transmitted from the information offer point 33.

Fig. 2 is a flowchart showing a system changeover control process for the acquisition of the position information as performed by the controller 22 depicted in Fig. 1.

The portable terminal 11 can acquire the position information by using any of the GPS, portable telephone, PHS and radio marker systems. The precision of the position information decreases in the order of the position information from the GPS 12, those from the portable-telephone base station 23 and the PHS base station 24, and that from the radio marker 33. Therefore, the positioning systems or devices are automatically changed over successively toward those of lower precisions in such a manner that the GPS is used first for the acquisition of the current position, and then the second highest precision system is used if the GPS is unavailable.

At step S1 in Fig. 2, whether or not the signal from the GPS is being received is first determined.

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If the signal from the GPS is receivable, the position of the portable terminal (11 in Fig. 1) is determined using the GPS (step S5).

If the signal from the GPS is not receivable at the step S1, the flow of the control process advances to step S2, which serves to judge whether or not the position of the base station of the PHS or portable telephone system is available. The position of the base station of the PHS or portable telephone system can be obtained in such a way that a signal is transmitted from the portable terminal to the nearest base station, that the base station having received the signal transmits a signal to the central system 10, and that the central system at which the signal from the base station has arrived sends the position of the base station having received the transmitted signal from the portable terminal, back to the portable terminal. The position of the base station nearest to the portable terminal is regarded as the position of the holder of the portable terminal upon the determination that the person holding the portable terminal lies in the vicinity of the position of the base station.

Accordingly, in a case where the position of the base station of the PHS or portable telephone system

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is found at step S2, the position of the portable terminal or the holder thereof is acquired using the base station, as stated above, at step S6.

In a case where the position of the base station of the PHS or portable telephone system is not found at step S2, as in the case where telephonic communication is impossible outside the service areas of the PHS and portable telephone system, whether or not the signal from the radio marker 33 can be received is judged at step S3. Radio markers are disposed at each of the main or important spots of a town, and generate a radio signals indicative of the latitude and longitude of the corresponding spot.

If the portable terminal can receive the radio wave from the radio marker, the signal from the radio marker received by the radio equipment 17 is used at step S7. More specifically, the current position of the portable terminal or the holder thereof is regarded as being substantially identical to the latitude and longitude of the nearest radio marker, and is displayed on the display unit 18 as such.

However, if the radio wave from the radio marker is not receivable at step S3 either, the positioning is regarded as being impossible, and a display is presented to the holder to that effect (step S4).

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In the case where the positioning is determined to be impossible at step S4, the direction detector 20 in Fig. 1 is used for calculating the moving direction and moved distance from the site where the position of the portable terminal was measured last. The current position of the portable terminal is reckoned on the basis of the calculated moving direction and moved distance, and is displayed on the display unit.

Fig. 3 illustrates the relationship between the map data to be displayed on the portable terminal 11 (shown in Fig. 1) and the display screen of the display unit 18.

The left part of Fig. 3 illustrates the relationship between a screen display actually presented and the acquired map data. The map data includes data retained in the portable terminal and data downloaded from the central system 10. The map data items are divided into blocks in accordance with predetermined latitudinal and longitudinal limits and are managed by affixing Nos. to the respective blocks, as shown at the right part of this figure.

By way of example, in the case shown in Fig. 3, the map data in a range which is larger than the actual display screen is loaded for display, and the

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range defined by (x_1, y_1) and (x_2, y_2) in terms of latitudes and longitudes is displayed. As seen in the table at the right part of Fig. 3, the loaded map data corresponds to map No. 1. Herein, the latitudinal limits are from x_1 to x_2, while the longitudinal limits are from y_1 to y_2.

When the latitude and longitude of the portable terminal at the current time have been found, the table as shown at the right part of Fig. 3 is referred to, and the map data whose latitudinal and longitudinal limits embrace the current latitude and longitude of the portable terminal is loaded.

When the current position of the portable terminal has changed up to the end of the loaded map data, the next map is loaded. The map data items are set so that the peripheral edges of the maps overlap each other, and at least two map data items contain the latitude and longitude of a current position near the end of the map data. In a case where the current position is near the end of the map data and where either of the map data items to be loaded is not definite, the direction in which the holder of the portable terminal has proceeded or moved till then is computed, and a map ahead in the proceeding direction is loaded. Further, in a case where the position of

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the portable terminal is already at the end of the map data at the time of the turn-ON of the power source of the portable terminal, and where the proceeding direction of the holder till then is unknown, it is possible, by way of example, that a map of smaller number is once loaded so as to acquire the proceeding direction, whereupon the next map of an adjacent zone is loaded as may be needed.

Incidentally, the map data need not always be prepared so as to cover a range larger than the display screen as exemplified in Fig. 3, but the map of the zone which the display screen covers may well be displayed by managing in smaller divided regions beforehand and joining a plurality of map data items so as to output the joined map data items to the display screen. Also in this case, the map data with the plurality of map data items joined together is set to be somewhat larger than the display screen, and new map data is loaded on occasions as the position of the holder of the portable terminal changes.

Fig. 4 is a flowchart showing a processing flow in the case of acquiring the current position and displaying a map.

The map data display flow in the figure is performed by the controller 22 of the portable

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terminal 11. First, the user of the portable terminal 11 instructs the controller 22 to display the current position thereof at step S10. Then, the current position is obtained from the GPS at step S11. Here, as described with reference to Fig. 2, in the case where the current position cannot be obtained with the GPS, it is obtained on the basis of the position of a base station of the PHS or portable telephone systems. Further, in the case where the position of such a base station is unavailable, the radio marker is utilized. Still further, in the case where the radio marker cannot be utilized, the direction detector 20 of the portable terminal 11 is used for calculating the proceeding direction and moved distance of the holder and for estimating the current position from the last position information obtained. On this occasion, a display is presented to the effect that the current position cannot be acquired and is being estimated by the direction detector 20.

When the current position has been acquired at step S11, the next step S12 is executed to judge whether or not a map containing the current position is included in the map data 21 stored in the portable terminal 11. On condition that the map containing the current position is included in the map data 21 stored

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in the portable terminal 11, the flow advances to step S15, at which the map is displayed together with the current position.

In contrast, if the map containing the current position is not included in the map data 21 stored in the portable terminal 11, the controller 22 notifies the central system 10 of the current position at step S13. In the central system 10, the map data containing the received current position is searched for. The portable terminal 11 downloads the map data containing the current position from the central system 10 (step S14). At step S15, the map is displayed on the display unit 18 of the portable terminal 11, and the current position is simultaneously displayed in the map. The downloaded map data is stored in a memory as the map data 21 of the portable terminal 11. Thereafter, the flow returns to step S11, and the acquisition of the current position and the display of the map as well as the current position are continued.

The operation of displaying the current position may well be terminated by, for example, providing a display termination button in the portable terminal 11 beforehand and interrupting the flow of Fig. 4 subject to a depression of the button. Alternatively,

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the display operation may well be terminated by directly turning OFF the power source of the portable terminal 11.

Incidentally, in the case of acquiring the map data, it is not efficient to download the frequently used map data each time. Therefore, in addition to the map number and the latitude as well as the longitude, the number of times of display on the display screen and the date and time of the most recent access are recorded together in the map data 21 which is retained in the portable terminal 11. The map data is retained in the portable terminal 11 for a predetermined time period, and the map data for which a predetermined time period has expired since the date and time of the most recent access is erased on account of the limited storage capacity. Accordingly, the map data displayed in excess of a preset number of times during the predetermined time period is retained without being erased, by referring to the number of times of display on the display screen. In this way, frequent downloading of the same map data is avoided, and the storage capacity of the portable terminal 11 can be effectively used.

Fig. 5 is a flowchart showing the general process of an inquiry system for inquiring about the position

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of the holder of the portable terminal.

The inquiry system is realized by utilizing the system of the above embodiment. It can be applied to a person, such as an old person, whose destination is unknown and whose actions need to be supervised. Accordingly, it can be used for tracking the movements of any person or thing, e.g. a child, patient, vehicle etc.

First, the portable terminal 11 (as shown in Fig. 1) regularly acquires the current position at every fixed time period by the use of the GPS etc. in order to find its position at the current time. Accordingly, whether or not the fixed time period has lapsed is judged as indicated at step S20, and the portable terminal transmits the acquired current position to the central system 10 at step S21.

In the central system, each time the current position sent from the portable terminal is received, it is logged (step S22). Thus, the path which the holder of the portable terminal has followed is known at anytime.

Here, in the case where the holder is not acquiring the current position on the portable terminal side, the process of issuing a call from the central system side to the portable terminal 11 is executed, so as to acquire the current position

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(polling).

When the user of the home terminal 32 needs to know where the holder of the portable terminal 11 is now, he/she requests the central system to report the position of the holder of the portable terminal (step S23). Herein, the holder of the portable terminal is identified by an ID No., telephone No. or the like, of the portable terminal. Upon receiving the request for the acquisition of the current position from the home terminal, the central system judges whether or not the call can arrive at the portable terminal (step S24). Whether or not arrival is possible, is judged depending upon whether or not the portable terminal has sent a response signal in reply to a call signal transmitted from the central system.

In the case where the arrival has been judged impossible at step S24, the central system deduces the speed and direction of the portable terminal from the path thereof till now, and estimates the current position of the portable terminal, with reference to the log, at step S28, and it operates so as to display the estimated position on the home terminal (step S27). On this occasion, a display is also presented to the effect that the arrival of the call at the portable terminal is impossible. Thus, the user of

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the home terminal understands that the displayed position is an estimated one.

On the other hand, in the case where the arrival of the call has been judged possible at step S24, the central system commands the portable terminal to transmit a signal indicative of its current position. When the portable terminal receives the command (step S25), it transmits a signal of the current position to the home terminal through the central system (step S26). In the home terminal, the current position of the signal which has been sent from the portable terminal to this home terminal through the central system can be observed on a display unit (step S27).

Incidentally, a method of estimating the current position of the portable terminal in the central system may be as follows, by way of example:

In such a case where, during the movement of the holder of the portable terminal over a long distance by some means of transport, the moving direction and speed of the portable terminal can be estimated by extrapolation of GPS signals received infrequently near a window or GPS signals received on the occasion of transferring, and the current position can be estimated from the moving direction and speed in spite of the situation where GPS signals are not always able

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to be received.

Alternatively, in such a case where, during the movement of the holder in an automobile, the moving direction and speed of the portable terminal can be computed even with the intermittent reception of GPS signals similarly to the above case, and the current position can be predicted according to its trend or general area, analogous to predicting the course of a typhoon in a weather forecast, from the moving direction and speed, in spite of the situation where GPS signals are not always able to be received.

In this way, the supervisor who uses the home terminal can easily monitor the current position of the holder of the portable terminal merely by causing the person or thing to be monitored to carry the portable terminal. Therefore, the inquiry system can be used as a supervisory system very effectively.

Fig. 6 is a flowchart showing processes in the case where the system of the present invention is applied to the acquisition of position information between portable terminals.

The system shown in Fig. 5 corresponds to the case where the position information of the portable terminal is acquired by the home terminal. In contrast, in the example of the application shown in

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Fig. 6, the position information items are acquired between portable terminals 11 (as shown in Fig. 1), so that the holders of the portable terminals can mutually know where the other holders are.

In the flow of the processes illustrated in Fig. 6, it is assumed that a specific holder of a portable terminal 11 wants to know the current position of another holder who is set as a third party, and that he/she displays the position of the third party on the display unit 18 of his/her own portable terminal 11 through the central system 10.

First, the portable terminal carried by the third party is continually acquiring its current position by the use of the GPS, PHS, portable telephone system or radio marker. Further, in this portable terminal, whether or not a fixed time period has lapsed is judged (step S30), and the acquired current position is transmitted to the central system for each fixed time period (step S31). In the central system, the current position sent from the third party is logged (step S32), and the path of movement which the third party has followed is known anytime. Here in the flowchart of Fig. 6, the step of transmitting the current position to the central system is not mentioned on the side of the specific holder carrying

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a portable terminal 11 of the same construction. The reason therefor is that only the processes for knowing the current position of the third party by the specific holder are described. In practice, the portable terminal of the specific holder also transmits its current position to the central system every fixed time period, and the changes of its current position are also logged in the central system. Accordingly, the processes in Fig. 6 which are executed by a specific holder can be similarly executed toward the specific holder by the third party.

The specific holder who wants to know the current position of the third party, instructs his/her own portable terminal to display its position relative to the third party (step S33). Thus, the portable terminal of the specific holder requests the central system to acquire the position of the third party (step S34). On this occasion, the specific holder needs to identify the third party, and the ID No., telephone No. or the like of the third party portable terminal is utilized for the identification. Upon receiving the request for the acquisition of the current position of the third party from the specific holder, the central system checks whether or not a

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call can arrive at the portable terminal of the identified third party (step S35). As stated before, whether or not the arrival is possible is checked depending upon whether or not the portable terminal of the third party responds to a call signal transmitted from the central system.

If the arrival (communication) is impossible, the central system examines the speed and proceeding direction of the identified third party by the changes from the current position previously logged, and thereby estimates the current position of the third party (step S39), and it transmits a signal indicative of this estimated position to the portable terminal of the specific holder. The portable terminal of the specific holder receives the signal (step S40), and it subsequently acquires its own position by the use of the GPS, the base station of the PHS or portable telephone system, or the radio marker (step S41). The ensuing steps will be explained later.

On the other hand, in a case where communication with the third party is possible, the central system requests the portable terminal of the third party to transmit a signal indicative of its current position (step S36). The portable terminal of the third party acquires its current position by the use of any of the

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GPS, PHS, portable telephone system and radio marker (step S37), and it transmits the signal of its current position to the central system (step S38). The central system transmits the signal of the current position of the third party to the portable terminal of the specific holder. Thus, the portable terminal of the specific holder receives the signal of the current position of the third party (step S40), and it subsequently acquires its own current position (step S41).

In the case where the current position of the third party has been found by the transmission from the third party or by the estimation in the central system, and where the current position of the specific holder himself/herself has been found, the controller 22 judges whether or not a map capable of displaying both the positions of the third party and the specific holder is included in the map data 21 stored in the portable terminal of the specific holder (step S42). In the case where the map data capable of such display is stored, it is displayed, and the positions of the specific holder and the identified third party are displayed on the map (step S45).

After the termination of the display operation, the processing flow in the portable terminal of the

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specific holder is returned to step S34 so as to repeatedly acquire and display the current positions of the third party and the specific holder himself/herself, for the purpose of continually displaying the relative positions.

On the other hand, in the case where the map adapted to display the positions of the identified third party and the specific holder is not included in the map data stored in the portable terminal of the specific holder, this portable terminal transmits a signal indicative of the current positions of the third party and the specific holder to the central system (step S43). The central system searches for the map data capable of displaying both the positions of the third party and the specific holder simultaneously, on the basis of the signal of the current positions of the third party and the specific holder, and it transmits the map data capable of displaying both the positions simultaneously, to the portable terminal of the specific holder (step S44). In the portable terminal of the specific holder, the map data sent thereto from the central system is displayed, and the positions of the third party and the specific holder are displayed thereon (step S45).

In this manner, with the system of the present

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invention, the position of the third party who is to be sought out can be known, not only with the home terminal, but also with a portable terminal, and locating the person or the thing actually being searched for can be assured. Accordingly, a search e.g. for an old person or a child can be efficiently carried out.

Figs. 7A and 7B are diagrams for explaining processes which the central system executes in the processing flow of Fig. 6.

The flowchart of Fig. 7A illustrates the processes which the central system 10 (as shown in Fig. 1) executes in the case where the current positions of the third party and the specific holder have been transmitted thereto from the portable terminals 11.

Upon receiving the current positions of the two points locating the third party and specific holder (step S50), the central system calculates the distance in a straight line between the two points, from the positions of the two points (step S51). When the straight line distance between the two points has been evaluated, the suitable scale of a map is determined with reference to a table as shown in Fig. 7B (step S52). A map containing the two points is searched for

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from the determined scale of the map (step S53). Upon finding a map containing the two points, the central system transmits this map to the portable terminal having transmitted thereto the positions of the two points (step S54). In the portable terminal having transmitted the positions of the two points, a display is presented on the basis of the map data transmitted at step S54 by the central system.

Fig. 7B illustrates one example of a table which is used at the step S52 in Fig. 7A. In the illustration, the correspondence between the distance in a straight line and the sort of a map is not strictly appropriate, and Fig. 7B is presented just for explanation.

In the central system, a large number of scales of map data items are stored in order to cover various regions. In the example of Fig. 7B, maps in the four scale ranges of 1 to 10,000, 1 to 20,000, 1 to 50,000 and 1 to 100,000 are stored. The straight line distance signifies the distance between the two points for which the relative position is to be known, and it is indicated in units of kilometers.

In the example of Fig. 7B, when the straight line distance between the two points lies between 0km and 100km, the map of scale 1 to 10,000 is used. Upon

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reading from the table that a map of scale 1 to 10,000 is to be used in this manner, the central system searches for the map containing the transmitted current positions of the two points, from the map data of scale 1 to 10,000 in accordance with the latitudes and longitudes, and it transmits this map to the portable terminal, having already transmitted the straight line distance between the two points.

Whether or not both the two points are contained in an identical map is judged from latitudinal and longitudinal limits affixed to the map data. By way of example, as described with reference to Fig. 3, the map data consists of several individual map data items each of which covers predetermined limits, and each individual map data includes data which indicates the latitudinal and longitudinal limits covered by the map data itself. Accordingly, one of the individual map data items is first chosen, and it is judged whether or not the latitudes of the positions of the two points are contained in the latitudinal limits covered by the chosen map data item. If the latitudes of the positions of the two points are contained, it is subsequently judged whether or not the longitudes of the positions of the two points are contained in the longitudinal limits covered by the chosen map data

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item. In this way, whether or not the two points are contained in the single individual map data item can be judged.

The same applies to the maps of other scales. The table shown in Fig. 7B illustrates that, when the straight line distance between the two points is between 100km and 200km, the map data of scale 1 to 20,000 is searched for; that when the straight line distance is between 200km and 500km, the map data of scale 1 to 50,000 is searched for; and that when the straight line distance is 500km or over, the map data of scale 1 to 100,000 is searched for. It is of course allowed to prepare map data items in scales different from the scales mentioned in the above example, and to register them in a table for use.

Figs. 8A and 8B are flowcharts showing a process for supervising a third party who is carrying a portable terminal.

Fig. 8A illustrates a processing flow for starting the supervisory process.

The user of the portable terminal 11 (as shown in Fig. 1) sets a site which is to be supervised and a time period during which the third party does not move, in order to set the instructions for supervising the actions of the third party on the portable

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terminal of the user (step S60). The site to-be-supervised may be designated either by a regional name or by a latitude and a longitude. In the case the site to-be-supervised is designated with the regional name, a table for associating regional names with the latitudinal and longitudinal limits of correspondent regions is prepared in the portable terminal beforehand. When any regional name has been input, the latitudinal and longitudinal limits of the correspondent region are acquired, and correspondent map data is searched for from within the map data 21 stored in the portable terminal or is downloaded from the central system 10.

When the corresponding map data has been obtained for the designated site to-be-supervised, it is displayed on the display unit 18 (step S61). The user further designates a zone to-be-supervised on the map displayed for specifying the site to-be-supervised, by enclosing the zone with a rectangle, by way of example (step S62). A designating method in the case of enclosing the zone with a rectangle may be, for example, one in which the display unit of the portable terminal is furnished with a touch screen beforehand, and in which the positions of the diagonal lines of the rectangle are designated by touching these

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positions with a pen or the like.

When the zone to-be-supervised has been designated by the rectangle, the latitudes and longitudes of the designated zone are acquired and recorded (step S63). Since the zone is designated on the map displayed on the display unit, the latitudinal limits and longitudinal limits of the designated zone can be easily acquired in such a way that the sides of the rectangle are formed in parallel with the lines of latitudes and longitudes on the map when the rectangle is depicted on the display, on the side of the portable terminal.

When the latitudes and longitudes of the designated zone have been acquired, a time period for the supervision is set (step S64).

Fig. 8B illustrates the flow of the process for supervising the action of the third party.

When the supervisory process has been started, it is first judged whether or not a fixed time period which is a time interval for acquiring the current position of the third party has lapsed (step S65). In a case where the fixed time period has not lapsed, the lapse of the fixed time period is awaited. On the other hand, in a case where the fixed time period has lapsed, the current position of the third party to-be-

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supervised is acquired (step S66). When the current position has been acquired, it is compared with the last position so as to judge whether or not it is the same as the last position (step S67).

If the acquired current position is not the same as the last position, a counter for counting a time period during which, or the number of times which, the third party was at an identical position (as are counted every predetermined time period) is cleared (step S71). In contrast, if the acquired current position is the same as the last position, the content of the counter for counting the time period during which, or the number of times which, the third party was at the identical position is incremented (step S68). After incrementing, it is judged whether or not the total of the counter has exceeded - the predetermined value set initially (at the step S60 in Fig. 8A) (in step S69). In the case where the content of the counter is not greater than the predetermined value, the processing flow returns to the step S65 so as to continue the supervision.

On the other hand, in the case where the total of the counter is greater than the predetermined value, it is judged whether or not the third party to-be-supervised lies within the supervisory zone, and

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whether or not the current time falls within the supervisory time period (step S70). In the case where the third party does not lie within the supervisory zone or where the current time does not fall within the supervisory time period, the count value of the counter is cleared (step S71), and the processing is repeated from step S65. Besides, in the case where the third party lies within the supervisory zone and where the current time falls within the supervisory time period, it is decided that the third party to-be-supervised remains at the same site unnecessarily long, and that an abnormal situation may have occurred, and an alarm is raised (step S72).

The supervisory process thus far described is effective in the case where an administrator has to quickly know the fact that, for example, a skier in a skiing area is lying on the ground on account of an injury, and where he/she is to cope quickly with such matters. In such a process, however, the possibility of an erroneous warning will be high unless a high precision positioning system, such as GPS, is available. More specifically, in the case of utilizing the base station of the PHS or portable telephone systems, the position of a third party can only be specified as the location of the base station.

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Therefore, even when the third party has actually moved a little, he/she might be judged as standing at an identical position. This holds true also in the case of the positioning based on the radio marker. Accordingly, the supervision of an abnormal situation of a third party should ideally be done under the conditions in which the GPS can be utilized to the utmost.

Figs. 9A and 9B illustrate display examples which are presented on the display screen of the portable terminal 11 (as shown in Fig. 1) in the system of the present invention.

Fig. 9A exemplifies character displays.

The display 1 indicates the capture state of the satellites in the GPS. Mentioned as exemplary display items are "Satellite capture state", "Number of captured satellites" and "Number of capturable satellites". The "number of captured satellites" is the number of the satellites from which radio waves are actually being received, while the "number of capturable satellites" is the number of the satellites which ought to be theoretically capturable in view of the current latitude and longitude of the portable terminal. In addition, the "satellite capture state" denotes the reception state of the radio waves from

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the satellites. By way of example, the "satellite capture state" is so stipulated that a "Good" state is determined when the "number of captured satellites" reaches 80% of the "number of capturable satellites". Alternatively, the "satellite capture state" may well be determined by calculating the ratio of noise contained in each radio wave, to the principal signal of the radio wave.

The display 2 indicates the current position of the portable terminal. The current latitude and longitude are displayed on the basis of the GPS. Further, a three-point measurement is performed using at least three satellites, and the altitude of the current position can also be displayed.

The display 3 indicates the target position of the portable terminal. The "target position" is, for example, the position of a specified site to which the holder of the portable terminal wants to go. In such a case, when the holder designates a specified position on a map, the portable terminal obtains the latitude and longitude of the specified site from the map and calculates the azimuth of the specified site from the current position. The display 3 indicates these physical quantities. That is, the latitude and longitude of the target spot and the azimuth from the

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current position are given as exemplary display items.

The display 4 indicates navigation to a target spot. Given as exemplary display items are a distance and an azimuth to the target location and the moving speed of the portable terminal. Regarding the distance to the target location, when the current position and the specified target location are indicated, the terminal automatically calculates the distance from the differences of the latitudes and longitudes of the two points. Regarding the azimuth, a direction in which the portable terminal is currently proceeding, and a direction to the target position as calculated from the current position and the target position (numerals indicated in parentheses) are obtained with the direction detector 20 mounted in the terminal, and they are displayed. The moving speed of the portable terminal can also be calculated by the built-in acceleration sensor of the direction detector 20, and the calculated result is displayed.

Fig. 9B exemplifies simplified graphic displays.

The display 1 indicates the capture state of the satellites. Herein, the number of captured satellites and the number of capturable satellites are displayed by characters, and the captured satellites and

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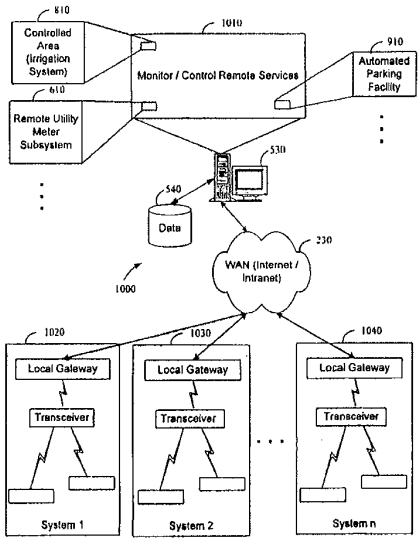
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(54) Title: SYSTEM AND METHOD FOR MONITORING AND CONTROLLING REMOTE DEVICES



(57) **Abstract:** The present invention is generally directed to a system for monitoring a variety of environmental and/or other conditions within a defined remotely located region. In accordance with one aspect of the invention, a system is configured to monitor utility meters in a defined area. The system is implemented by using a plurality of wireless transmitters, wherein each wireless transmitter is integrated into a sensor adapted to monitor a particular data input. The system also includes a plurality of transceivers that are dispersed throughout the region at defined locations. The system uses a local gateway to translate and transfer information from the transmitters to a dedicated computer on a network. The dedicated computer, collects, compiles, and stores the data for retrieval upon client demand across the network. The computer further includes means for evaluating the received information and identifying an appropriate control signal, the system further including means for applying the control signal at a designated actuator.

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SYSTEM AND METHOD FOR MONITORING AND CONTROLLING REMOTE DEVICES

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of U.S. patent applications Serial No. 09/271,517; filed March 18, 1999, and entitled, "System For Monitoring Conditions in a Residential Living Community;" Serial No. 09/102,178; filed June 22, 1998, entitled, "Multi-Function General Purpose Transceiver;" Serial No. 09/172,554; filed October 14, 1998, entitled, "System for Monitoring the Light Level Around an ATM;" Serial No. 09/412,895; filed October 5, 1999, entitled, "System and Method for Monitoring the Light Level Around an ATM and further claims the benefit of provisional patent application Serial No. 60/146,817; filed August 2, 1999 entitled, "System and Method for Monitoring and Controlling Residential Devices." Each of the above identified disclosures are incorporated herein by reference in their entireties.

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

The present invention generally relates to remotely operated systems, and more particularly to a computerized system for monitoring, reporting on, and controlling remote systems by transferring information signals through a wide area network (WAN) and using software applications hosted on a connected server to appropriately process the information.

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DISCUSSION OF THE RELATED ART

As is known, there are a variety of systems for monitoring and controlling manufacturing processes, inventory systems, emergency control systems, and the like. Most automatic systems use remote sensors and controllers to monitor and automatically respond to system parameters to reach desired results. A number of control systems utilize computers to process system inputs, model system responses, and control actuators to implement process corrections within the system. Both the electric power generation and metallurgical processing industries have had success controlling production processes by implementing computer controlled control systems in individual plants.

One way to classify control systems is by the timing involved between subsequent monitoring occurrences. Monitoring processes can be classified as aperiodic or random, periodic, and real-time. A number of remotely distributed service industries implement the monitoring and controlling process steps through manual inspection and intervention.

Aperiodic monitoring systems (those that do not operate on a predetermined cycle) are inherently inefficient as they require a service technician to physically traverse an area to record data, repair out of order equipment, add inventory to a vending machine, and the like. Such service trips are carried out in a number of industries with the associated costs being transferred to the consumers of the service.

Conversely, utility meter monitoring, recording, and client billing are representative of a periodic monitoring system. In the past, utility providers sent a technician from meter to meter on a periodic basis to verify meter operation and to record utility use. One method of cutting operating expenses in the utility industry involved

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increasing the period at which manual monitoring and meter data recording was performed. While this method decreased the monitoring and recording expense associated with more frequent meter observation and was convenient for consumers who favor the consistent billed amounts associated with "budget billing," the utility provider retained the costs associated with less frequent meter readings and the processing costs associated with reconciling consumer accounts.

Lastly, a number of environmental and safety systems require constant or real-time monitoring. Heating, ventilation, and air-conditioning systems, fire reporting and damage control systems, alarm systems, and access control systems are representative systems that utilize real-time monitoring and often require immediate feedback and control. These real-time systems have been the target of control systems theory and application thereof for some time.

A problem with expanding the use of control systems technology to distributed systems are the costs associated with the sensor - actuator infrastructure required to monitor and control functions within such systems. The typical approach to implementing control system technology is to install a local network of hard-wired sensors and actuators along with a local controller. Not only is there expense associated with developing and installing appropriate sensors and actuators but the added expense of connecting functional sensors and controllers with the local controller. Another prohibitive cost associated with applying control systems technology to distributed systems is the installation and operational expense associated with the local controller.

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Accordingly, an alternative solution to applying monitoring and control system solutions to distributed systems that overcomes the shortcomings of the prior art is desired.

SUMMARY OF THE INVENTION

Certain objects, advantages and novel features of the invention will be set forth in part in the description that follows and in part will become apparent to those skilled in the art upon examination of the following or may be learned with the practice of the invention. The objects and advantages of the invention may be realized and obtained by means of the instrumentalities and combinations particularly pointed out in the appended claims.

To achieve the advantages and novel features, the present invention is generally directed to a cost effective method of monitoring and controlling remote devices. More specifically, the present invention is directed to a computerized system for monitoring, reporting, and controlling remote systems and system information transfer by transmitting information signals to a WAN gateway interface and using applications on a connected server to process the information. Because the applications server is integrated on a WAN, Web browsers can be used by anyone with Internet access (and the appropriate access permissions) to view and download the recorded data.

In accordance with a broad aspect of the invention, a system is provided having one or more sensors to be read and/or actuators to be controlled remotely, ultimately through a computer on the Internet. The sensors and/or actuators are interfaced with wireless transceivers that transmit and/or receive data to and from the Internet. In this

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regard, additional wireless transceivers may relay information between the transceivers disposed in connection with the sensors and actuators and a gateway to the Internet. It should be appreciated that, a portion of the information communicated includes data that uniquely identifies the sensors and/or actuators.

In accordance with one aspect of the invention, a system is configured to monitor and report system parameters. The system is implemented by using a plurality of wireless transceivers. At least one wireless transceiver is interfaced with a sensor, transducer, actuator or some other device associated with the application parameter of interest. In this regard, the term "parameter" is broadly construed and may include, but is not limited to, a system alarm condition, a system process variable, an operational condition, *etc*. The system also includes a plurality of transceivers that act as signal repeaters that are dispersed throughout the nearby geographic region at defined locations. By defined locations, it is meant only that the location of each transceiver is known to a central computer. The central computer may be informed of transceiver physical locations after permanent installation, as the installation location of the transceivers is not limited. Each transceiver that serves to repeat a previously generated data signal may be further integrated with its own unique sensor or a sensor actuator combination as required. Additional transceivers may be configured as stand-alone devices that serve to simply receive, format, and further transmit system data signals. Further, the system includes a local data formatter that is configured to receive information communicated from the transceivers, format the data, and forward the data via the gateway to one or more servers interconnected with the WAN. The server further includes means for evaluating the received information and identifying the system parameter and the

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originating location of the parameter. The server also includes means for updating a database or further processing the reported parameters.

Consistent with the broader concepts of the invention, the "means" for evaluating the received information and the "means" for reporting system parameters are not limited to a particular embodiment or configuration. Preferably, these "means" will be implemented in software that is executed by a processor within a server integrated with the Internet. However, dedicated WANs or Intranets are suitable backbones for implementing defined system data transfer functions consistent with the invention.

In one embodiment, a client retrieves configured system data by accessing an Internet Web site. In such an embodiment, a system consistent with the present invention acts as a data collector and formatter with data being delivered upon client request, with availability twenty-four hours a day, seven days a week.

In more robust embodiments, a system can be configured to collect, format, and deliver client application specific information on a periodic basis to predetermined client nodes on the WAN. In these embodiments, client intervention would serve to close the feedback loop in the control system.

In yet another embodiment, a system can be configured to collect, format, and control client application specific processes by replacing a local control computer with a WAN interfaced server and integrating system specific actuators with the aforementioned system transceivers.

It should be further appreciated that the information transmitted and received by the wireless transceivers may be further integrated with other data transmission protocols for transmission across telecommunications and computer networks other than the

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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.

In yet a further embodiment, a system can be configured using the present invention to translate and transmit control signals from an existing local controller via the networked wireless transceivers. In this regard, the system of the present invention would require a data translator to tap into the data stream of an existing control system. Distinct control system signals may be mapped to function codes used by the present invention in order to provide customer access to control system data. In this way, the system of the present invention can be integrated with present data collection and system controllers inexpensively, as customers will only have to add a data translator and a wireless transmitter or transceiver as the application demands. By integrating the present invention with the data stream generated by present monitoring and control systems, potential customers enjoy the benefits of the present invention without the difficulties associated with integrating sensors and actuators to monitor individual system parameters.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings incorporated in and forming a part of the specification, illustrate several aspects of the present invention, and together with the description serve to explain the principles of the invention. In the drawings:

FIG. 1 is a block diagram of a prior art control system;

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FIG. 2 is a block diagram illustrating a monitoring / control system of the present invention;

FIG. 3A is a functional block diagram that illustrates a transmitter in accordance with the present invention integrated in a portable device with user operable buttons that trigger data transmissions as desired;

FIG. 3B is a functional block diagram that illustrates the integration of a sensor with a transmitter in accordance with the invention;

FIG. 3C is a block diagram illustrating a transceiver in accordance with the present invention integrated with a sensor and an actuator;

FIG. 3D is a functional block diagram further illustrating the transceiver of FIG. 3C as applied to a heating, ventilation, and air conditioning system controller;

FIG. 3E is a functional block diagram illustrating the combination of the transceiver of FIG. 3D with a global positioning system (GPS) receiver;

FIG. 4 is a functional block diagram that illustrates the functional components of a local WAN gateway constructed in accordance with the invention;

FIG. 5 is a diagram illustrating WAN connectivity in a system constructed in accordance with the invention;

FIG. 6 is a block diagram illustrating a client specific application in accordance with the invention (simple data collection or monitoring);

FIG. 7 is a block diagram illustrating another data monitoring and reporting application consistent with the present invention;

FIG. 8 is a block diagram illustrating a third client specific application in accordance with the invention (monitoring and controlling a process);

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FIG. 9 is a block diagram illustrating the present invention as deployed in a particular business application;

FIG. 10 is a block diagram further illustrating the present invention as deployed in a plurality of business applications;

FIG. 11 is a table illustrating the message protocol of the present invention;

FIG. 12 illustrates three sample messages using the message protocol of the present invention;

FIG. 13 is a block diagram illustrating the system of the present invention integrated with the local controller of FIG. 1; and

FIG. 14 is a block diagram illustrating the system of the present invention integrated with a mobile inventory unit.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Having summarized the invention above, reference is now made in detail to the description of the invention as illustrated in the drawings. While the invention will be described in connection with these drawings, there is no intent to limit it to the embodiment or embodiments disclosed therein. On the contrary, the intent is to cover all alternatives, modifications and equivalents included within the spirit and scope of the invention as defined by the appended claims.

Referring now to the drawings, reference is made to FIG. 1, which is a block diagram illustrating certain fundamental components of a prior art control system 100. More particularly, a prior art control system 100 includes a plurality of sensor actuators 111, 112, 113, 114, 115, 116, and 117 electrically coupled to a local controller 110. In a

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manner well known in the art of control systems, local controller 110 provides power, formats and applies data signals from each of the sensors to predetermined process control functions, and returns control signals as appropriate to the system actuators. Often, prior art control systems are further integrated via the public switched telephone network (PSTN) 120 to a central controller 130. Central controller 130 can be further configured to serve as a technician monitoring station or to forward alarm conditions via PSTN 120 to appropriate public safety officers.

Prior art control systems consistent with the design of FIG. 1 require the development and installation of an application-specific local system controller, as well as, the routing of electrical conductors to each sensor and actuator as the application requires. Such prior art control systems are typically augmented with a central controller 130 that may be networked to the local controller 110 via PSTN 120. As a result, prior art control systems often consist of a relatively heavy design and are subject to a single point of failure should local controller 110 go out of service. In addition, these systems require electrical coupling between the local controller and system sensors and actuators. As a result, appropriately wiring an existing industrial plant can be a dangerous and expensive proposition.

Having described a prior art control system and delineated some of its shortcomings, reference is now made to FIG. 2, which is a block diagram that illustrates a control system in accordance with the present invention. Control system 200 consists of one or more sensor / actuators 212, 214, 216, 222, and 224 each integrated with a transceiver. The transceivers are preferably RF (Radio Frequency) transceivers, that are relatively small in size and transmit a relatively low power RF signal. As a result, in

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some applications, the transmission range of a given transceiver may be relatively limited. As will be appreciated from the description that follows, this relatively limited transmission range of the transceivers is an advantageous and desirable characteristic of control system 200. Although the transceivers are depicted without a user interface such as a keypad, in certain embodiments of the invention the transceivers may be configured with user selectable buttons or an alphanumeric keypad. Often, the transceivers will be electrically interfaced with a sensor or actuator, such as a smoke detector, a thermostat, a security system, *etc.*, where external buttons are not needed.

Control system 200 also includes a plurality of stand-alone transceivers 211, 213, 215, and 221. Each stand-alone transceiver 211, 213, 215, and 221 and each of the integrated transceivers 212, 214, 216, 222, and 224 may be configured to receive an incoming RF transmission (transmitted by a remote transceiver) and to transmit an outgoing signal. This outgoing signal may be another low power RF transmission signal, a higher power RF transmission signal, or alternatively may be transmitted over a conductive wire, fiber optic cable, or other transmission media. The internal architecture of a transceiver integrated with a sensor / actuator 212 and a stand-alone transceiver 211 will be discussed in more detail in connection with FIGs. 3A through 3C. It will be appreciated by those skilled in the art that integrated transceivers 212, 214, 216, 222, and 224 can be replaced by RF transmitters (not shown) for client specific applications that require data collection only.

Local gateways 210 and 220 are configured and disposed to receive remote data transmissions from the various stand-alone transceivers 211, 213, 215, and 221 or integrated transceivers 212, 214, 216, 222, and 224 having an RF signal output level

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sufficient to adequately transmit a formatted data signal to the gateways. Local gateways 210 and 220 analyze the transmissions received, convert the transmissions into TCP/IP format and further communicate the remote data signal transmissions via WAN 230. In this regard, and as will be further described below, local gateways 210 and 220 may communicate information, service requests, control signals, *etc.* to remote sensor / actuator transceiver combinations 212, 214, 216, 222, and 224 from server 260, laptop computer 240, and workstation 250 across WAN 230. Server 260 can be further networked with database server 270 to record client specific data.

It will be appreciated by those skilled in the art that if an integrated transceiver (either of 212, 214, 216, 222, and 224) is located sufficiently close to local gateways 210 or 220 such that its RF output signal can be received by a gateway, the RF data signal need not be processed and repeated through stand-alone transceivers 211, 213, 215, or 221.

It will be further appreciated that a monitoring system constructed in accordance with the teachings of the present invention may be used in a variety of environments. In accordance with a preferred embodiment, a monitoring system such as that illustrated in FIG. 2 may be employed to monitor and record utility usage by residential and industrial customers as illustrated in FIG. 6. Another preferred monitoring system is illustrated in FIG. 7. FIG. 7 depicts the transfer of vehicle diagnostics from an automobile via a RF transceiver integrated with the vehicle diagnostics bus to a local transceiver that further transmits the vehicle information through a local gateway onto a WAN.

It will be further appreciated that a monitoring and control system consistent with the present invention may be used in a variety of environments. In accordance with a

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preferred embodiment, a control system such as that illustrated in FIG. 2 may be employed to monitor and control an irrigation system as illustrated in FIG. 8. Another preferred control system is illustrated in FIG. 9. FIG. 9 depicts a business application of a control system wherein the operation of a parking facility may be automated.

As will be further appreciated from the discussion herein, transceivers 212, 214, 216, 222, and 224 may have substantially identical construction (particularly with regard to their internal electronics), which provides a cost effective implementation at the system level. Furthermore, a plurality of stand-alone transceivers 211, 213, 215, and 221, which may be identical, are disposed in such a way that adequate coverage in an industrial plant or community is provided. Preferably, stand-alone transceivers 211, 213, 215, and 221 may be dispersed sufficient that only one stand-alone transceiver will pick up a transmission from a given integrated transceiver 212, 214, 216, 222, and 224 (due in part to the low power transmission nature of each transmitter). However, in certain instances two, or even more, stand-alone transceivers may pick up a single transmission. Thus, the local gateways 210 and 220 may receive multiple versions of the same data transmission signal from an integrated transceiver, but from different stand-alone transceivers. The local gateways 210 and 220 may utilize this information to triangulate, or otherwise more particularly assess the location from which the transmission is originating. Due to the transmitting device identification that is incorporated into the transmitted signal, duplicative transmissions (*e.g.*, transmissions duplicated to more than one gateway, or to the same gateway, more than once) may be ignored or otherwise appropriately handled.

In accordance with the preferred embodiment shown in FIG. 2, integrated transceivers 212, 214, 216, 222, and 224 may be disposed within automobiles (see FIG.

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7), a rainfall gauge (see FIG. 8), or a parking lot access gate (see FIG. 9) to monitor vehicle diagnostics, total rainfall and sprinkler supplied water, and access gate position, respectively. The advantage of integrating a transceiver, as opposed to a one-way transmitter, into a monitoring device relates to the ability of the transceiver to receive incoming control signals, as opposed to merely transmitting data signals. Significantly, local gateways 210 and 220 may communicate with all system transceivers. Since local gateways 210 and 220 are permanently integrated with WAN 230, server 260 can host application specific software which was typically hosted in an application specific local controller as shown in FIG. 1. Of further significance, the data monitoring and control devices of the present invention need not be disposed in a permanent location as long as they remain within signal range of a system compatible transceiver that subsequently is within signal range of a local gateway interconnected through one or more networks to server 260. In this regard, small application specific transmitters compatible with control system 200 can be worn or carried about one's person as will be further described below.

In one embodiment, server 260 collects, formats, and stores client specific data from each of the integrated transceivers 212, 214, 216, 222, and 224 for later retrieval or access from workstation 250 or laptop 240. In this regard, workstation 250 or laptop 240 can be used to access the stored information through a Web browser in a manner that is well known in the art. In another embodiment, server 260 may perform the additional functions of hosting application specific control system functions and replacing the local controller by generating required control signals for appropriate distribution via WAN 230 and local gateways 210 and 211 to the system actuators. In a third embodiment, clients may elect for proprietary reasons to host control applications on their own WAN

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control voltage *vfb* increases, the current through I_{fb} increases. If the collector current I_{c11} of the transistor Q_{11a} tends to be smaller than the current I_{12}, the collector voltage of Q_{11a}, which is also the control voltage *vfb*, tends to increase. This increased *vfb* increases the current through I_{fb}, which in turn draws a larger current through Q_{11a}. The opposite effect — *i.e.*, a decrease in *vfb* and the current through I_{fb} — occurs when the collector current I_{c11} tends to be larger than I_{12}. The circuit settles at a point where $I_{c11} = I_{12}$.

[0083] F_{11}, I_{11}, and Q_{11b} emulate I_{fb}. F_{11} and I_{11} form a source follower with near-unity gain that simply translates the collector voltage to a suitable level for driving Q_{11b}. The level-shifted voltage is converted into a current using the transistor Q_{11b}. The circuit settles to a point where $I_{C11}=I_{12}$.

[0084] Fig. 13 illustrates an example of an inverting current mirror which can be used to connect a dynamic bias control circuit (*e.g.*, an envelope detector) to a signal-processing circuit (*e.g.*, an amplifier, a transconductor, or a filter) which requires bias current to flow out of, not into, the signal processing circuit. For example, the current mirror of Fig. 13 can be used to connect the envelope detector of Fig. 12 to the transconductor circuit of Fig. 1.

[0085] The current mirror of Fig. 13 is powered by voltage sources V_{H13} and V_{L100}. Transistor Q_{127} (also illustrated in Fig. 12) is driven by output current αI_{124} of the envelope detector of Fig. 12. The base of PNP transistor Q_{128} (also illustrated in Fig. 12) is connected to the base of PNP transistor Q_{127}, and accordingly, the current $\beta_{13}I_{124}$ flowing through Q_{128} (where β_{13} is a constant) is proportional to the current αI_{124} flowing through Q_{127}. The current $\beta_{13}I_{124}$ from Q_{128} flows into the collector of a diode-connected

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(*i.e.*, base and collector of transistor connected together) NPN transistor Q_{1302}. The base and collector of Q_{1302} are connected to the respective bases of output transistors Q_{1304}. The output currents $\gamma_{13}I_{124}$ and $\delta_{13}I_{124}$ of the output transistors Q_{1304} mirror the current $\beta_{13}I_{124}$ flowing through Q_{1302}, which in turn mirrors the current αI_{124} flowing through Q_{127} — αI_{124} being the output of the envelope detector of Fig. 12. It can therefore be seen that the output currents $\gamma_{13}I_{124}$ and $\delta_{13}I_{124}$ of the current mirror of Fig. 13 ultimately mirror the output current αI_{124} of the envelope detector of Fig. 12. Furthermore, output currents $\gamma_{13}I_{124}$ and $\delta_{13}I_{124}$ flow in the proper direction — *i.e.*, with the current flowing in, not out — to provide the bias current I_B to a circuit such as the transconductor of Fig. 1. The constants γ_{13} and δ_{13} depend upon the device characteristics — *e.g.*, the relative cross-sectional areas — of transistors Q_{124}, Q_{124a}, Q_{127}, Q_{128}, Q_{1302}, and Q_{1304}.

[0086] In order to utilize the envelope detector of Fig. 12 to control the bias of a differential circuit such as the transconductor of Fig. 1, it can be desirable to feed only the positive side, or only the negative side, of differential voltage signal V_i into the non-differential input current signal I_{in} of the envelope detector. For example, one side of the voltage-mode signal V_i can be fed into the input of the detector through a resistor, in order to produce the current-mode signal I_{in}. Alternatively, V_i can be converted to a current-mode signal using a transconductor. For example, the conversion can be performed using a non-dynamically biased version of a circuit having a topology similar to the transconductor of Fig. 1, but in which I_B is kept constant, rather than being adjusted as described above. Such a circuit can be particularly useful, because it can convert a differential, voltage-mode signal into a non-differential, current-mode signal. The

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aforementioned non-dynamically biased circuit — which can send a signal into the input I_{in} of the envelope detector of Fig. 12 — is not to be confused with the dynamically biased version of the circuit of Fig. 1, in which the bias current I_E can be adjusted by an output current — *e.g.*, $\gamma_{13}I_{124}$ or $\delta_{13}I_{124}$ — of a current mirror receiving the output current αI_{124} of the envelope detector of Fig. 12.

[0087] The envelope detector of Fig. 12 can also be utilized to control the bias of a filter such as the low-pass filters of Figs. 8a and 8b. For example, the input signal i_{in} of the filter of Fig. 8a — or a signal proportional to i_{in} — can be used as the input signal I_{in} of the envelope detector of Fig. 12. The collector current of one of the output transistors Q_{128} (illustrated in Figs. 12 and 13) can then be used as the bias input I_{bias} of the filter of Fig. 8a. A matching collector current approximately equal to I_{bias} and produced by, *e.g.*, a different one of the output transistors Q_{128} can similarly be used to bias an auxiliary circuit such as the circuit of Fig. 8b.

[0088] An envelope detector such as the one illustrated in Fig. 12 can also be used, in conjunction with a current mirror, to provide a bias current $(I_{2p}/I_{3p})I_{bias}$ into the output transistor Q_{4p} of the filter of Fig. 8a. In addition, the envelope detector and current mirror can be used to provide a bias current $(I_{2n}/I_{3n})I_{bias}$ into the output transistor Q_{4n} of the filter of Fig. 8b.

[0089] An example of such a configuration is illustrated in Fig. 16, in which the envelope detector 1200 of Fig. 12 pulls current from a diode-connected PNP transistor Q_{m1}, the base and collector of which are connected to the respective bases of current-mirror

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transistors Q_{m2} and Q_{m3}. The emitters of Q_{m1}, Q_{m2}, and Q_{m3} are connected to a voltage source V_{H16}.

[0090] Transistor Q_{m1} has a cross-sectional area A_{x1}. Transistor Q_{m2} has an approximately equal cross-sectional area, and therefore produces approximately the same current, $I_{bias}=\alpha I_{124}$, as is pulled through Q_{m1}. However, transistor Q_{m3} is designed to have a cross-sectional area $(I_{2p}/I_{3p})A_{x1}$. Therefore, because the collector current of a bipolar transistor is generally proportional to the area of the transistor, Q_{m3} produces a current $(I_{2p}/I_{3p})I_{bias}$ which can be used to bias transistor Q_{4p} of the filter of Fig. 8a. In a preferred embodiment, an additional transistor Q_{m4} having an area $(I_{2n}/I_{3n})A_{x1}$ can be included in the current mirror of Fig. 16. The resulting current, $(I_{2n}/I_{3n})I_{bias}$, can be used to bias transistor Q_{4n} of the filter of Fig. 8b. Moreover, it is desirable to provide yet another transistor Q_{m2}' having an area of approximately A_{x1}, in order to provide bias current for Q_{1n} of the filter of Fig. 8b.

[0091] In accordance with an additional embodiment of the invention, the input (*i.e.*, compressing) stage of a companding filter can be eliminated, leaving only the frequency-dependent components and the expanding stage. An example of such a technique is illustrated by Figs. 20a and 20b. Fig. 20a is a block diagram of an exemplary log-domain circuit having an input circuit 2002 and an output circuit 2004. The input circuit receives an input current i_{in20} and performs a logarithmic operation on the input current i_{in20}, thus generating a logarithmically-compressed voltage V_{log20}. The output circuit 2004 filters and exponentiates the compressed voltage V_{log20}, thus generating an output current i_{out20}.

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[0092] In accordance with the invention, the input circuit 2002 can be eliminated, leaving only the output circuit 2004, as illustrated in Fig. 20b. The output circuit 2004 acts as a combination of an exponentiator and a low-pass filter. An input voltage V_{in20} can be applied directly to the input of the circuit 2004 which then generates a filtered, exponentiated output current i_{out20} based upon the input voltage V_{in20}. Such a circuit can be useful for applications requiring an exponential filter. For example, the filter-exponentiator 2004 of Fig. 20 can, optionally, be used to replace the filter 1104 and the exponentiator 1102 of the circuit of Fig. 11.

[0093] It has been demonstrated by the foregoing discussion that the design of syllabic companding log-domain filters can be greatly simplified by eliminating the compensation circuit in accordance with the invention. As discussed in detail above, the approach of the invention has numerous advantages over conventional methods involving syllabic companding and instantaneous companding log-domain filters.

[0094] Although the present invention has been described in connection with specific exemplary embodiments, it should be understood that various changes, substitutions and alterations can be made to the disclosed embodiments without departing from the spiit and scope of the invention as set forth in the appended claims.

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CLAIMS

WHAT IS CLAIMED IS:

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 configured 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 configured 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.

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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 configured 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 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 configured to

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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 operation 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 input; and

first and second biases, wherein the at least one input comprises first and second inputs, the first 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 and second input signals, the first bias signal being for controlling the first bias, the second input being adapted to receive a second input signal and a second bias signal, the second bias signal being for controlling the second bias, the second bias signal being approximately equal to the first bias signal,

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and the filter being configured to filter a difference of the first and second input signals, thereby generating a filter output signal.

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 configured 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 in accordance with 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 configured 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:

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a first transistor having a first signal-receiving 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 signal-receiving terminal and third and fourth current-carrying terminals, the second signal-receiving terminal being connected to the first current-carrying terminal, the third current-carrying terminal being connected to the first signal-receiving 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 signal-receiving terminal.

18. An apparatus as recited in claim 17, wherein the filter further comprises an expansion section, comprising:

a third transistor having a third signal-receiving terminal and fifth and sixth current-carrying terminals, the third signal-receiving terminal being for receiving the output signal of the compression operation; and

a high-frequency shunt connected between the third signal-receiving terminal and the fifth current-carrying terminal, wherein an output signal of the filter comprises a signal generated at the sixth current-carrying terminal.

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19. An apparatus as recited in claim 16, wherein the filter comprises an expansion section, comprising:

a transistor having a signal-receiving terminal and first and second current-carrying terminals, the signal-receiving terminal being for receiving an output signal of the compression operation; and

a high-frequency shunt connected between the signal-receiving 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 signal-receiving terminal and first and second current-carrying terminals, the first signal-receiving terminal being adapted to be connected to a first voltage source, the first current-carrying terminal being configured 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 signal-receiving terminal and third and fourth current-carrying terminals, the second signal-

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receiving 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.

22. An apparatus as recited in claim 16, wherein the filter comprises an expansion section, comprising a transistor having a signal-receiving terminal and first and second current-carrying terminals, the signal-receiving terminal being adapted to be connected to a voltage source, and the second current-carrying terminal being for receiving an output signal of the compression operation, wherein an output signal of the filter comprises a signal generated at the first current-carrying terminal.

23. An apparatus as recited in claim 16, wherein the third input signal further comprises at least one of the first and second bias signals.

24. A combined filter, comprising:

a first filter having:

a first filter configuration,

a first bias input for receiving a first bias,

a first input for receiving a first input signal, and

a first output for providing a first output signal;

a second filter having:

a second filter configuration,

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a second bias input for receiving a second bias,

a second input for receiving a second input signal, and

a second output for providing a second output signal, the second filter configuration matching the first filter configuration, the first bias and the second bias being adjusted in accordance with at least one amplitude of at least one of the first input signal and the second input signal, and the first bias and the second bias being adjusted to be approximately equal; and

a combined filter output configured to provide a combined output signal comprising a difference of the first output signal and the second output signal.

25. A combined filter as recited in claim 24, wherein the second input signal is approximately equal to an inverse of the first input signal.

26. A combined filter as recited in claim 24, wherein the first input signal comprises a third input signal and a first bias control signal for controlling the first bias, and wherein the second input signal comprises a second bias control signal for controlling the second bias, the second bias control signal being approximately equal to the first bias control signal.

27. A combined filter as recited in claim 26, wherein the second input signal further comprises a fourth input signal approximately equal to an inverse of the third input signal.

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28. A combined filter as recited in claim 24, further comprising a differencing block configured to perform the operations of:

receiving the first output signal;

receiving the second output signal; and

generating a single-ended output signal comprising a difference of the first and second output signals.

29. An apparatus for processing a signal, comprising:

a first transistor, comprising:

a first signal-receiving terminal,

a first current-carrying terminal adapted to be connected to a voltage source, and

a second current-carrying terminal connected to the first signal-receving terminal;

a second transistor, comprising:

a second signal-receiving terminal connected to the first signal-receiving terminal,

a third current-carrying terminal adapted to be connected to the voltage source, and

a fourth current-carrying terminal;

a first adjustable current source in communication with the second current-carrying terminal and allowing a first bias current to flow through the second current-carrying

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terminal;

a second adjustable current source in communication with the fourth current-carrying terminal and allowing a second bias current to flow through the fourth current-carrying terminal, the second bias current being approximately equal to the first bias current, and the first and second adjustable current sources being adjusted in accordance with an amplitude of a first input signal coupled into at least one of the second current-carrying terminal and the fourth current-carrying terminal; and

an output connected to the fourth current-carrying terminal.

30. An apparatus as recited in claim 29, further comprising:

a third transistor, comprising:

a fifth current-carrying terminal connected to the second current-carrying terminal,

a sixth current-carrying terminal connected to the first adjustable current source, and

a first input terminal for receiving a second input signal; and

a fourth transistor, comprising:

a seventh current-carrying terminal connected to the fourth current-carrying terminal,

an eighth current-carrying terminal connected to the second adjustable current source, and

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a second input terminal for receiving a third input signal, wherein the first input signal comprises a difference of the second and third input signals.

31. An apparatus as recited in claim 29, wherein the first adjustable current source comprises a third transistor, the first transistor comprising:

a fifth current-carrying terminal connected to a voltage source;

a sixth current-carrying terminal connected to the second current-carrying terminal; and

a first transistor input terminal, wherein the second adjustable current source comprises a fourth transistor, the second transistor comprising:

a seventh current-carrying terminal connected to the voltage source;

an eighth current-carrying terminal connected to the fourth current-carrying terminal; and

a second transistor input terminal connected to the first transistor input terminal, the first transistor input terminal and the second transistor input terminal being adapted to receive a bias control voltage which is adjusted in accordance with the amplitude of the first input signal.

32. An apparatus for processing a signal, comprising:

a dynamically biased signal-processing circuit having an input and an output; and

a feedback path providing a feedback signal from the output to the input.

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33. An apparatus as recited in claim 32, further comprising:

a differencing block configured to perform the operations of:

receiving the feedback signal,

receiving an input signal, and

generating a difference of the input signal and the feedback signal; and

a gain stage configured to perform the operations of:

receiving the difference,

amplifying the difference to thereby generate an amplified signal, and

providing the amplified signal to the input.

34. An apparatus as recited in claim 32, wherein the dynamically biased signal-processing circuit comprises a filter.

35. An apparatus as recited in claim 34, wherein the filter comprises a companding filter.

36. A signal-size detector, comprising:

a differencing block configured to perform the operations of:

receiving a first input signal,

receiving a second input signal, and

generating a difference signal comprising a difference of the first and second input signals;

an exponentiator configured to exponentiate a signal comprising the difference

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signal, thereby generating an exponentiated signal, wherein an output signal of the detector comprises the exponentiated signal; and

a filter configured to perform low-pass filtering of a signal comprising the difference signal, thereby generating a filtered signal, wherein the output signal further comprises the filtered signal, and wherein the second input signal comprises the output signal.

37. A signal-size detector as recited in claim 36, wherein the exponentiator and the low-pass filter are combined to form an exponentiator-filter, comprising:

a transistor having an input terminal and first and second current-carrying terminals, the first current-carrying terminal being adapted to be connected to at least one voltage source, the second current-carrying terminal being connected to an output of the exponentiator-filter, and the input terminal being connected to an input of the exponentiator-filter; and

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.

38. A signal-size detector, comprising:

first, second, third, fourth, and fifth nodes, wherein an input signal is received by the first node;

a first transistor, comprising:

a first signal-receiving terminal connected to the second node,

a first current-carrying terminal connected to the third node, and

a second current-carrying terminal adapted to receive a first bias current;

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a second transistor, comprising:

a second signal-receiving terminal connected to the fourth node,

a third current-carrying terminal connected to the third node, and

a fourth current-carrying terminal adapted to receive a second bias current, the fourth current-carrying terminal being connected to the fourth node;

a high-frequency shunt connected between the fourth node and a first voltage node, the first voltage node being adapted to be connected to a first voltage source;

a third transistor, comprising:

a third signal-receiving terminal connected to the fourth node,

a fifth current-carrying terminal connected to the fifth node, and

a sixth current-carrying terminal adapted to receive a third bias current; and

a fourth transistor, comprising:

a fourth 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.

39. A signal-size detector as recited in claim 38, further comprising:

a voltage limiter connected between the first node and the fourth signal-receiving terminal;

a fifth transistor, comprising:

a fifth signal-receiving terminal connected to the fourth node,

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a ninth current-carrying terminal connected to a sixth node, and

a tenth current-carrying terminal adapted to receive a fourth bias current;

a 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; and

a current mirror, comprising:

a controlling branch in communication with the twelfth current-carrying terminal, wherein the controlling branch is adapted to conduct a controlling current, and

a controlled branch adapted to conduct a controlled current, wherein the current mirror is configured to control the controlled current in accordance with the controlling current.

40. A method of processing a signal, comprising:

receiving at least one input signal into a selected one of a class-AB circuit and a class-B circuit, the selected one having at least one bias;

processing, by the selected one, 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;

receiving, into an amplitude detector, the at least one input signal;

detecting, by the amplitude detector, at least one amplitude of the at least one input

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signal; and

dynamically adjusting, by the amplitude detector, 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.

41. A method as recited in claim 40, wherein the selected one comprises an amplifier.

42. A method as recited in claim 40, wherein the selected one comprises a filter.

43. A method as recited in claim 42, wherein the filter is internally non-linear.

44. A method as recited in claim 42, wherein the filter comprises a companding filter.

45. A method as recited in claim 42, wherein the filter comprises a log-domain filter.

46. A method as recited in claim 40, wherein the amplitude detector comprises a filtered rectifier.

47. A method of as recited in claim 39, further comprising:

low-pass-filtering and exponentiating a detected signal comprising the at least one input signal, thereby generating a filtered-exponentiated signal; and

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generating a detector output signal comprising the filtered-exponentiated signal, wherein the detected signal comprises the detector output signal.

48. A method of processing a signal, comprising:

receiving a first input signal into a filter having at least one bias;

receiving a second input signal into the filter;

using the filter to apply 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;

using the filter to apply a second filtering operation to the second input signal, the second input signal controlling the at least one bias, the second filtering operation having a second frequency characteristic in which low frequencies are passed; and

adjusting the second input signal in accordance with an amplitude of the first input signal.

49. A method as recited in claim 48, 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.

50. A method of processing a signal, comprising:

receiving a first input signal into a filter having first and second biases;

receiving a second input signal into the filter;

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receiving, into the filter, a first bias signal related to an amplitude of at least one of the first and second input signals, the first bias signal being for controlling the first bias;

receiving, into the filter, a second bias signal, the second bias signal being for controlling the second bias, and the second bias signal being approximately equal to the first bias signal; and

filtering a difference of the first and second input signals, thereby generating a filter output signal.

51. A method as recited in claim 50, wherein the filter is internally non-linear.

52. A method as recited in claim 50, further comprising:

receiving the at least one of the first and second input signals into an amplitude detector;

detecting, by the amplitude detector, the amplitude; and

adjusting, by the amplitude detector, at least one of the first and second biases in accordance with the amplitude.

53. A method as recited in claim 50, wherein the filter comprises a companding filter.

54. A method as recited in claim 50, wherein the filter comprises a log-domain filter.

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55. A method as recited in claim 50, further comprising:

compressing, by the filter, a third input signal comprising the at least one of the first and second input signals;

filtering the third signal; and

expanding the third signal.

56. A method as recited in claim 55, wherein the compressing step is performed by a compression section, comprising:

a first transistor having a first signal-receiving 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 receive a first voltage; and

a second transistor having a second signal-receiving terminal and third and fourth current-carrying terminals, the second signal-receiving terminal being connected to the first current-carrying terminal, the third current-carrying terminal being connected to the first signal-receiving terminal, and the fourth current-carrying terminal being adapted to be connected to a second voltage source, wherein an output signal of the compressing step comprises a voltage at the second signal-receiving terminal.

57. A method as recited in claim 56, wherein the expanding step is performed by an expansion section, comprising:

a third transistor having a third signal-receiving terminal and fifth and sixth current-carrying terminals, the third signal-receiving terminal being for receiving the output signal

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of the compressing step; and

a high-frequency shunt connected between the third signal-receiving terminal and the fifth current-carrying terminal, wherein an output signal of the filter comprises a signal generated at the sixth current-carrying terminal.

58. A method as recited in claim 55, wherein the expanding step is performed by an expansion section, comprising:

a transistor having a signal-receiving terminal and first and second current-carrying terminals, the signal-receiving terminal being for receiving an output signal of the compressing step; and

a high-frequency shunt connected between the signal-receiving terminal and the first current-carrying terminal, wherein an output signal of the filter comprises a signal generated at the second current-carrying terminal.

59. A method as recited in claim 55, wherein the compression step is performed by a compression section, comprising a first transistor having a first signal-receiving terminal and first and second current-carrying terminals, the first signal-receiving terminal being adapted to be connected to a first voltage source, the first current-carrying terminal being configured 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 compressing step comprises a voltage at the second current-carrying terminal.

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60. A method as recited in claim 59, wherein the expanding step is performed by an expansion section, comprising:

a first node for receiving the output signal of the compressing step;

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

a second transistor having a second signal-receiving terminal and third and fourth current-carrying terminals, the second signal-receiving terminal being adapted to be connected to at least one of the first voltage source, the second voltage source, and a third voltage source, 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.

61. A method as recited in claim 55, wherein the expanding step is performed by an expansion section, comprising a transistor having a signal-receiving terminal and first and second current-carrying terminals, the signal-receiving terminal being adapted to be connected to a voltage source, and the second current-carrying terminal being for receiving an output signal of the compressing step, wherein an output signal of the filter comprises a signal generated at the first current-carrying terminal.

62. A method as recited in claim 55, wherein the third input signal further comprises at least one of the first and second bias signals.

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63. A method of processing a signal, comprising:

receiving a first input signal into a first filter having a first filter configuration and a first bias;

using the first filter to generate a first output signal;

receiving a second input signal into a second filter having a second filter configuration and a second bias, the second filter configuration matching the first filter configuration, the first bias and the second bias being adjusted in accordance with at least one amplitude of at least one of the first input signal and the second input signal, and the first bias and the second bias being adjusted to be approximately equal;

using the second filter to generate a second output signal; and

providing a combined output signal comprising a difference of the first output signal and the second output signal.

64. A method as recited in claim 63, wherein the second input signal is approximately equal to an inverse of the first input signal.

65. A method as recited in claim 63, wherein the first input signal comprises a third input signal and a first bias control signal for controlling the first bias, and wherein the second input signal comprises a second bias control signal for controlling the second bias, the second bias control signal being approximately equal to the first bias control signal.

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66. A method as recited in claim 65, wherein the second input signal further comprises a fourth input signal approximately equal to an inverse of the third input signal.

67. A method as recited in claim 63, further comprising:

receiving the first output signal;

receiving the second output signal; and

generating a single-ended output signal comprising a difference of the first and second output signals.

68. A method of processing a signal, comprising:

using a first transistor to control a current in a second transistor, wherein the first transistor comprises:

a first signal-receiving terminal,

a first current-carrying terminal adapted to be connected to a voltage source, and

a second current-carrying terminal connected to the first signal-receiving terminal, and wherein the second transistor comprises:

a second signal-receiving terminal connected to the first signal-receiving terminal,

a third current-carrying terminal adapted to be connected to the voltage source, and

a fourth current-carrying terminal;

using a first adjustable current source in communication with the second current-

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carrying terminal to allow a first bias current to flow through the second current-carrying terminal;

using a second adjustable current source in communication with the fourth current-carrying terminal to allow a second bias current to flow through the fourth current-carrying terminal, such that the second bias current is approximately equal to the first bias current;

adjusting the first and second adjustable current sources in accordance with an amplitude of a first input signal coupled into at least one of the second current-carrying terminal and the fourth current-carrying terminal; and

providing an output signal from an output connected to the fourth current-carrying terminal.

69. A method as recited in claim 68, further comprising controlling the output signal in accordance with the input signal, wherein the controlling step is performed using a circuit comprising:

a third transistor, comprising:

a fifth current-carrying terminal connected to the second current-carrying terminal,

a sixth current-carrying terminal connected to the first adjustable current source, and

a first input terminal for receiving a second input signal; and

a fourth transistor, comprising:

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a seventh current-carrying terminal connected to the fourth current-carrying terminal,

an eighth current-carrying terminal connected to the second adjustable current source, and

a second input terminal for receiving a third input signal, wherein the first input signal comprises a difference of the second and third input signals.

70. A method as recited in claim 68, wherein the first adjustable current source comprises a third transistor, the first transistor comprising:

a fifth current-carrying terminal connected to a voltage source;

a sixth current-carrying terminal connected to the second current-carrying terminal; and

a first transistor input terminal, wherein the second adjustable current source comprises a fourth transistor, the second transistor comprising:

a seventh current-carrying terminal connected to the voltage source;

an eighth current-carrying terminal connected to the fourth current-carrying terminal; and

a second transistor input terminal connected to the first transistor input terminal, the first transistor input terminal and the second transistor input terminal being adapted to receive a bias control voltage which is adjusted in accordance with the amplitude of the first input signal.

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71. A method of processing a signal, comprising:

dynamically biasing a signal-processing circuit having an input and an output; and

providing a feedback signal from the output to the input.

72. A method as recited in claim 71, further comprising:

receiving the communication;

receiving an input signal;

generating a difference of the input signal and the feedback signal;

amplifying the difference to thereby generate an amplified signal; and

providing the amplified signal to the input.

73. A method as recited in claim 71, wherein the signal-processing circuit comprises a filter.

74. A method as recited in claim 73, wherein the filter comprises a companding filter.

75. A method of detecting signal size, comprising:

receiving a first input signal;

receiving a second input signal;

generating a difference signal comprising a difference of the first and second input signals;

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Die folgenden Angaben sind den vom Anmelder eingereichten Unterlagen entnommen

Prüfungsantrag gem. § 44 PatG ist gestellt

(54) Zählerstands-Abfragesystem mit aktiver Regelmöglichkeit

(57) Um Zeit und Aufwand bei der Erfassung der verschiedensten Zählerstände im Bereich der öffentlichen Versorgung (Gas, Wasser, Strom...) zu sparen, wurde oben genanntes System entwickelt. Es bietet die Möglichkeit, auf einfache, zeitsparende und kostensparende Art die Zählerstände obiger Versorgungsunternehmen zentral zu erfassen und weiterzuverarbeiten. Als Übertragungsmedium wird der SMS-Dienst der vorhandenen GSM/PCN-Netze verwendet. Dadurch ergeben sich entscheidende Vorteile gegenüber herkömmlichen Methoden. Dadurch ergibt sich z. B. auf einfache Weise die Möglichkeit, Verbrauchsprofile zu erfassen.
Zusätzlich bietet das System die Möglichkeit, aktiv in vor Ort laufende Prozesse eingreifen zu können. Dazu werden Schaltausgänge zur Verfügung gestellt, die manuell von der Zentrale aus geschaltet werden können oder aber bei Überschreitung bzw. Erreichung bestimmter Grenzwerte automatisch aktiviert werden. Sämtliche Parameter sind von der Zentrale aus einstellbar und änderbar.
Durch die genormte Schnittstelle zu Zählern und durch die Verfügbarkeit solcher im Handel ist das System auf einfachste Weise einzusetzen, wenn an einer Stelle Bedarf besteht. Aber auch für die regelmäßige Erfassung der Verbrauchswerte in Privathaushalten kann dieses System in Zukunft zum Einsatz kommen.
Die Erfassungssoftware kann problemlos auf vorhandene Systeme angepasst werden, so dass eine Weiterverarbeitung der erfassten Größen in bisherigem Maße weiter erfolgen kann.

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Beschreibung

Zur Zeit werden sämtliche Zähler der verschiedensten Versorgungsunternehmen (Gas, Wasser, Strom) manuell abgelesen und weitergegeben um z. B. Abrechnungen zu erstellen oder auch Verbrauchsstatistiken zu ermitteln. Dadurch ergibt sich ein hoher Aufwand an Zeit und Personal. Je genauer ein Lastprofil erstellt werden soll, desto öfter muß eine Person vor Ort sein, um die benötigten Daten zu erfassen.

Das in den Patentansprüchen beschriebene System soll diese Arbeit erleichtern und effektiver gestalten. Außerdem gibt es immer mehr Anfragen von Kunden eine 'zeitnahe' Erfassung der Verbrauchswerte zur Verfügung gestellt zu bekommen.

Das in den Patentansprüchen beschriebene System nutzt den SMS-Nachrichtendienst der Netzbetreiber zur Übertragung der Zählerwerte oder Meßständen in eine zentrale Datenbank. Von hier aus können die Daten gezielt weiterverarbeitet werden. Das System bietet den Vorteil, daß die Erfassung der Werte je nach Bedarf erfogen kann. Hierzu bieten sich verschiedene Möglichkeiten:

Erfassung in festen Zeitintervallen. Hierbei wird der zu messende Wert zu vorher programmierten Zeiten in die Zentrale übertragen. In diesem Fall wird die vor Ort installierte GSM/PCN-Box selbst aktiv und startet die Übertragung an die Zentrale. Diese Methode eignet sich für die meisten Anwendungen z. B. die monatliche Abfrage des Stromzählerstandes oder des Wasserzählers

Erfassung auf Abruf. Hierbei wird von der Zentrale eine Aufforderung per SMS an die GSM/PCN-Box geschickt. Diese übermittelt daraufhin den aktuellen Zählerstand. Dadurch kann z. B. ein sehr detaliertes Verbrauchsprofil erstellt werden.

Erfassung bei bestimmten Ereignissen. Hierbei kann auf spezielle Kundenwünsche hin der Zählerstand übertragen werden (z. B. bei Überschreitung eines MAX-Wertes. Auch hierbei wird die GSM/PCN-Box selbständig aktiv und startet die Übertragung. Mittels der Schaltausgänge, die das System zur Verfügung stellt, kann daraufhin eine Reaktion im Prozess ausgelöst werden (z. B. Abschaltung).

Als Übertragungsmedium wurde der SMS-Dienst der vorhandenen GSM/PCN-Netze gewählt. Dieser bietet den Vorteil, daß die GSM/PCN-Box gezielt über ihre Rufnummer ansprechbar ist. Weiterhin bietet sich der Vorteil, daß die Nachricht asuch bei belegtem Netz ausgesendet werden kann. Eine zeitaufwendige Anwahlwiederholung im Besetztfall entfaällt somit. Der benötigte Zeitrahmen lässt sich dadurch besser einschätzen.

Der grösste Vorteil gegebüber herkömmlichen System, die eine aktive Punkt-zu-Punkt Verbindung aufbauen liegt in den wesentlich geringeren Kosten und in der wesentlich geringeren Zeit bis der Messwert in der Zentrale ankommt. Dadurch, daß keine Punkt-zu-Punkt Verbindung aufgebaut werden muß entfällt der komplette Rufaufbau, Verbindungsaufbau, Werteübermittlung und schließlich Verbindungsabbau. Die Übertragung läuft wesentlich effizienter als bei herkömmlichen Methoden, die mit Modems nach oben beschriebener Methode eine Verbindung aufbauen. Bei dem Einsatz mehrerer Tausend abzufragenden Aussenstellen ist eine tägliche Erfassung der Verbrauchswerte aus Zeitgründen schon nicht mehr möglich. Einzigste Möglichkeit zu Lösung wäre hier die Zentrale zu erweitern und mit mehreren Kanälen gleichzeitig Abzufragen, was aber die Kosten und den Aufwand sehr stark in die höhe treibt.

Weiterhin sind die Kosten für die Abfrage per SMS wesentlich geringer als beim Aufbau einer festen Verbindung mit der dazugehörenden Datenübermittlung. Speziell für solche Einsatzzwecke können bei den Netzbetreiber extra Parametrierkarten geschaltet werden, die den Kostenaufwand für eine Zählerabfrage nochmals reduzieren.

Abb. 1 zeigt den Aufbau und das Prinzip des Einsatzes der GSM/PCN-Box vor Ort. Die Box wird an den vor Ort vorhandenen Zähler angeschlossen über eine 20 mA-Schnittstelle. Entsprechende Zähler mit optischem und elektrischem Ausgang nach dieser Norm sind bereits im Handel erhältlich. Vorteil der genormten Schnittstelle ist, daß die Box ohne Aufwand der Parametrierung auch mit Zählern verschiedener Hersteller zusammenarbeitet. In der Zentrale wird ein GSM/PCN-Modem in Verbindung mit einem Rechner verwendet, um die GSM/PCN-Box anzusprechen bzw. die Werte zu empfangen und zu decodieren.

Abb. 2 zeigt den Aufbau im Inneren der GSM/PCN-Box, die an den Zähler vor Ort angeschlossen wird. Sie besteht im wesentlichen aus einem GSM/PCN-Modem, das die Verbindung zum Netz herstellt und die SMS absetzt und auch empfängt. Des weiteren befindet sich darin eine CPU, die die komplette Steuerung der Box übernimmt. Hierzu gehören die Bereitstellung der Schnittstellen nach aussen, aber auch die Steuerung der internen Uhr und des Datenspeichers, um Meßwerte über einen Zeitreum speichern zu können. In diesem Speicher werden auch die zu überwachenden Werte und eventuelle MAX/MIN-Werte festgehalten. Mit Hilfe der integrierten Uhr werden die Zeitintervalle zur Abfrage realisiert. Zum Anschluß an den Zähler wird die genormte 20 mA Schnittstelle herausgeführt.

Weitere Anschlüsse sind die Schaltausgänge, um in einen Prozeß eingreifen zu können, sowie ein Netzanschluß zur Spannungsversorgung und ein Antennenanschluß. Ein Akku übernimmt die Pufferung der Daten bei Spannungsausfall und ermöglicht auch dabei noch das Absetzen einer Meldung per SMS.

Der Empfang sowie die Weiterverarbeitung der Meßwerte bzw. Zählerstände wird in der Zentrale von einem Programm erfüllt, welches je nach Kunde auch speziellen Wünschen angepasst werden kann. Ebenso ist eine flexible Ausgabe der Daten in verschiedenen Formaten möglich, um eine Weiterverarbeitung mit vorhandener Softwaresystemen zu ermöglichen(z. B. zur automatischen Rechnungserstellung).

Die Parametrierung der kompletten GSM/PCN-Box erfolgt von der Zentrale aus über die Software. Sämtliche Werte der Meßwerterfassung (Zeitintervall de Abfrage) und der zu überwachenden Größen erfolgt ebenfalls von der Zentrale aus per SMS. Auch die interne Uhr wird aus der Ferne sysnchronisiert. Die Grenzwerte zur Aktivierung eines der Schaltausgänge sind ebenfalls in der GSM/PCN-Box hinterlegt. Somit kann auch bei Netzausfall auf vorher definierte Schaltzeitpunkte reagiert werden. Eine manuelle Schaltung von der Zentrale aus ist ebenfalls möglich.

Sämtliche Schaltbefehle und Datenübertragungen von und zu der Zentrale verwenden eine spezielle Codierung, die nur der Zentrale und der GSM/PCM-Box bekannt sind. Somit sind Fehlfunktionen bzw. irrtümliche Parametrierungen ausgeschlossen. Zur weiteren Sicherheit werden alle Parameteränderungen und Schalthandlungen gegenseitig quittiert.

Patentansprüche

1. System zur Übertragung von Zählerwerten über GSM/PCN-Netze in eine zentrale Erfassungsstelle. Die Übertragung der Meßwerte erfolgt auf Anforderung oder mittels programmiertem Zeitintervall in regelmäßigen Zeitabständen. Zur Übertragung der Werte wird der SMS-Dienst der vorhandenen GSM/PCN Netzbe-

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treiber verwendet. Die Übertragung erfolgt in codierter Form, wobei die Zentrale die Decodierung übernimmt und die Daten zur Verfügung stellt.

2. System wie in Patentanspruch 1 beschrieben zur Überwachung fester oder variabler Größen oder Ereignisse (Spannungsausfall, -schwankungen, MAX-Wert Überschreitung . . .), wobei das System in diesen Fällen selbständig eine Übertragung der Werte bzw. Meldung des Ereignisses übernimmt.

3. System wie in Patentanspruch 1 beschrieben, wobei das System Schaltausgänge zur Verfügung stellt, die mittels des SMS Dienstes der Netzbetreiber von der Zentrale aus aktiviert bzw. deaktiviert werden können. Hierdurch ergibt sich die Möglichkeit aktiv in die Regelung oder Steuerung der Prozesse vor Ort einzugreifen.

Hierzu 2 Seite(n) Zeichnungen

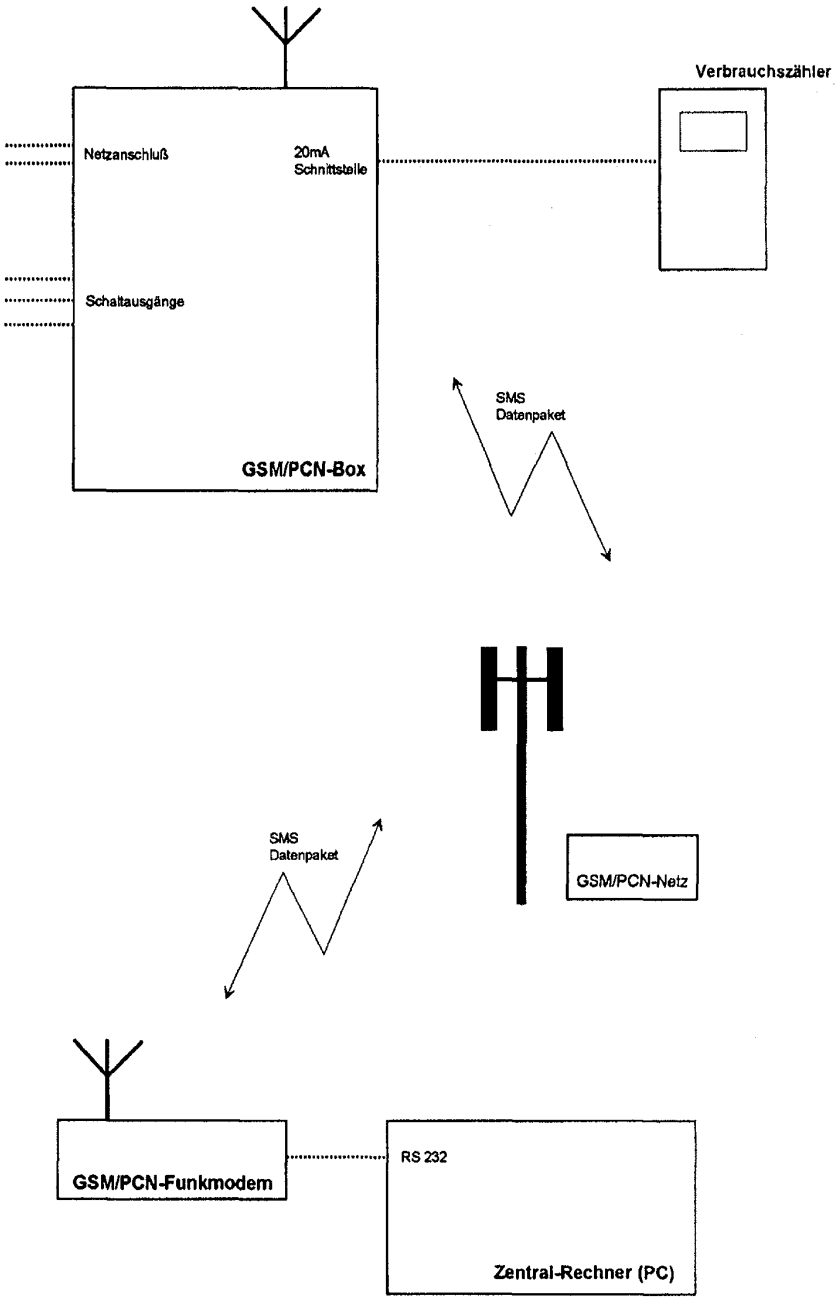
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- Leerseite -

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Offenlegungstag: 5. Juli 2001

Zeichnung 1

Gesamtübersicht



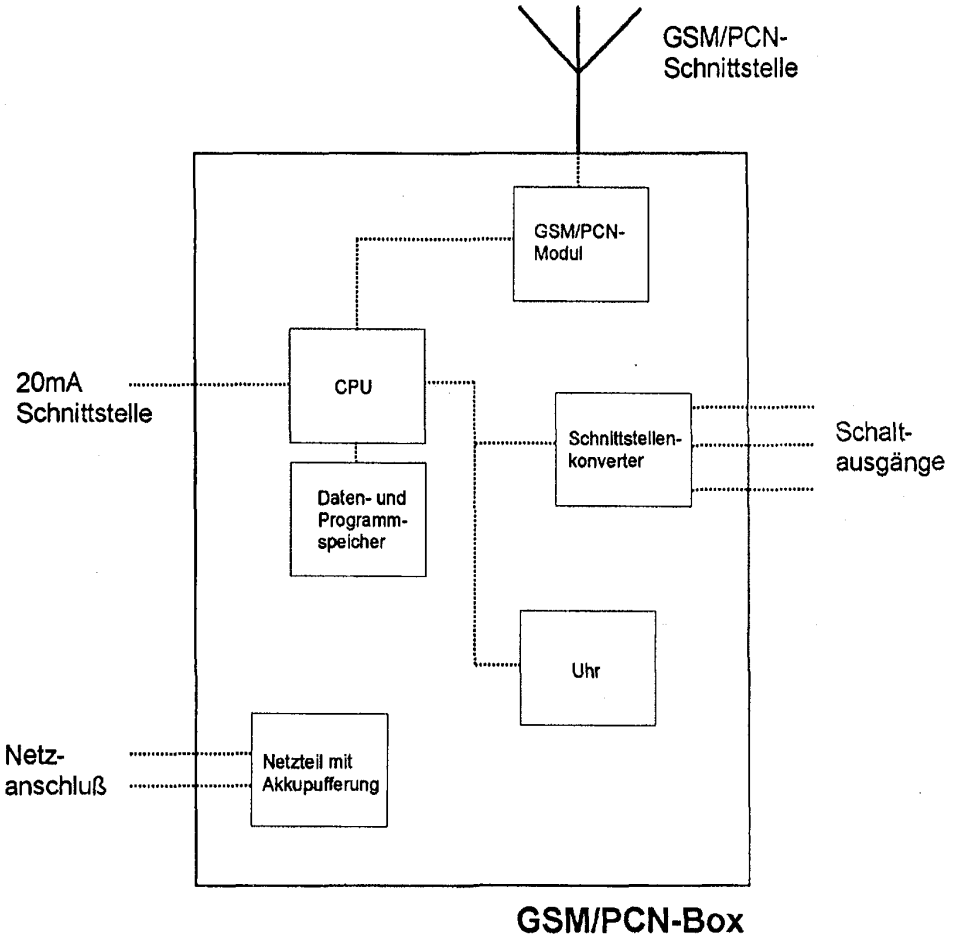
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Offenlegungstag: 5. Juli 2001

Zeichnung 2

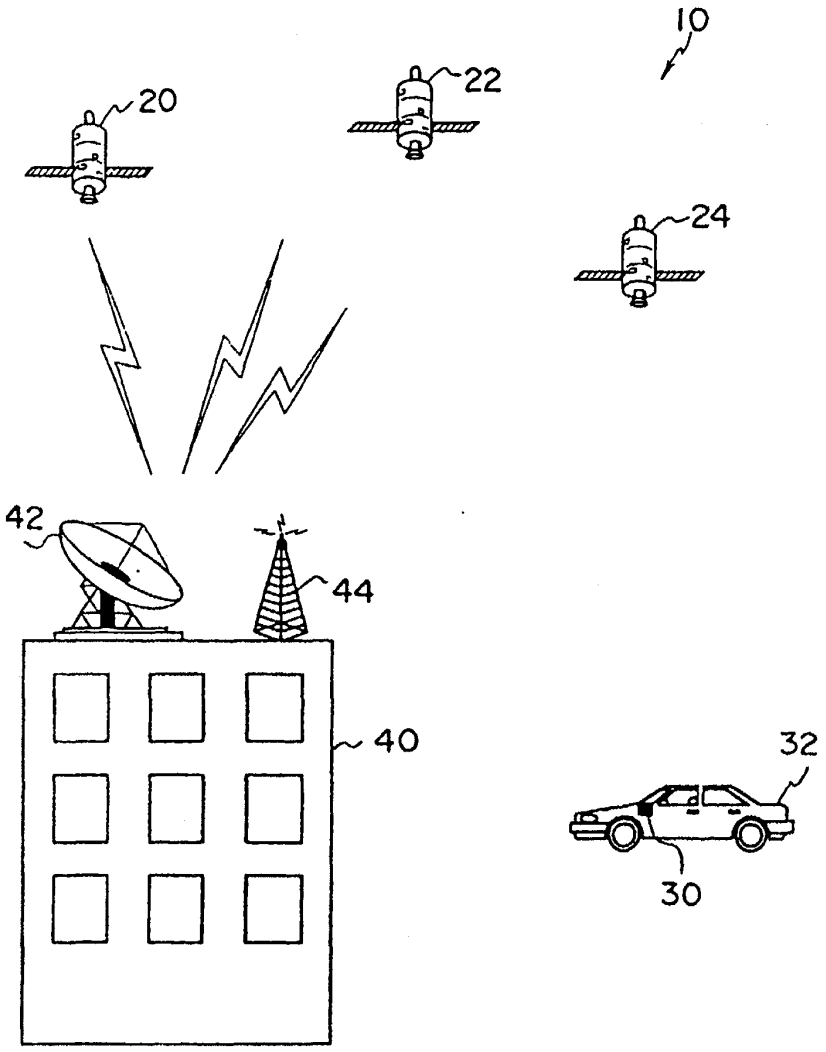
GSM/PCN-Box



102 027/374

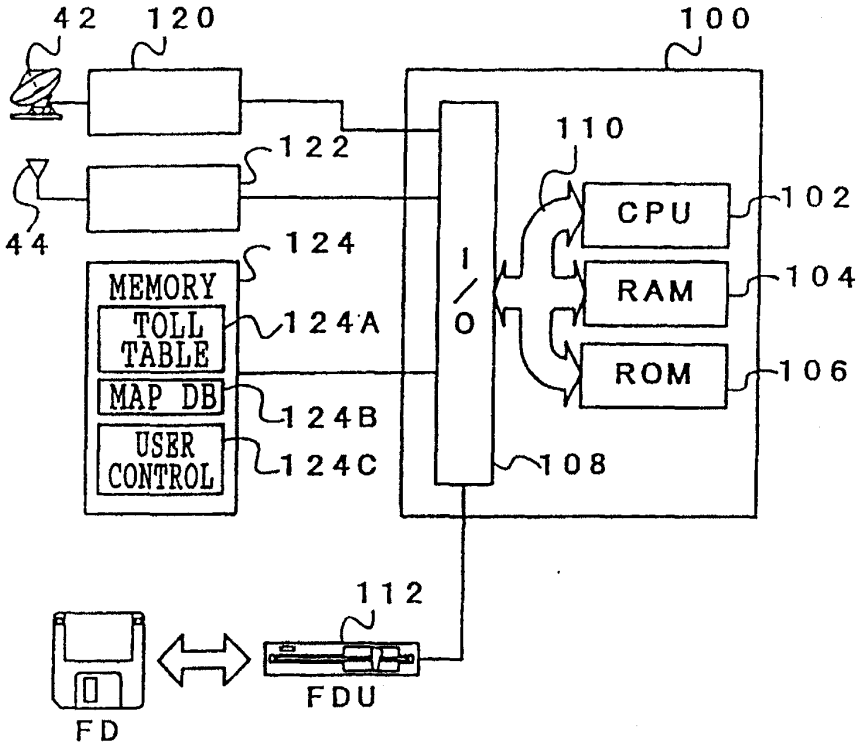
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FIG. 1



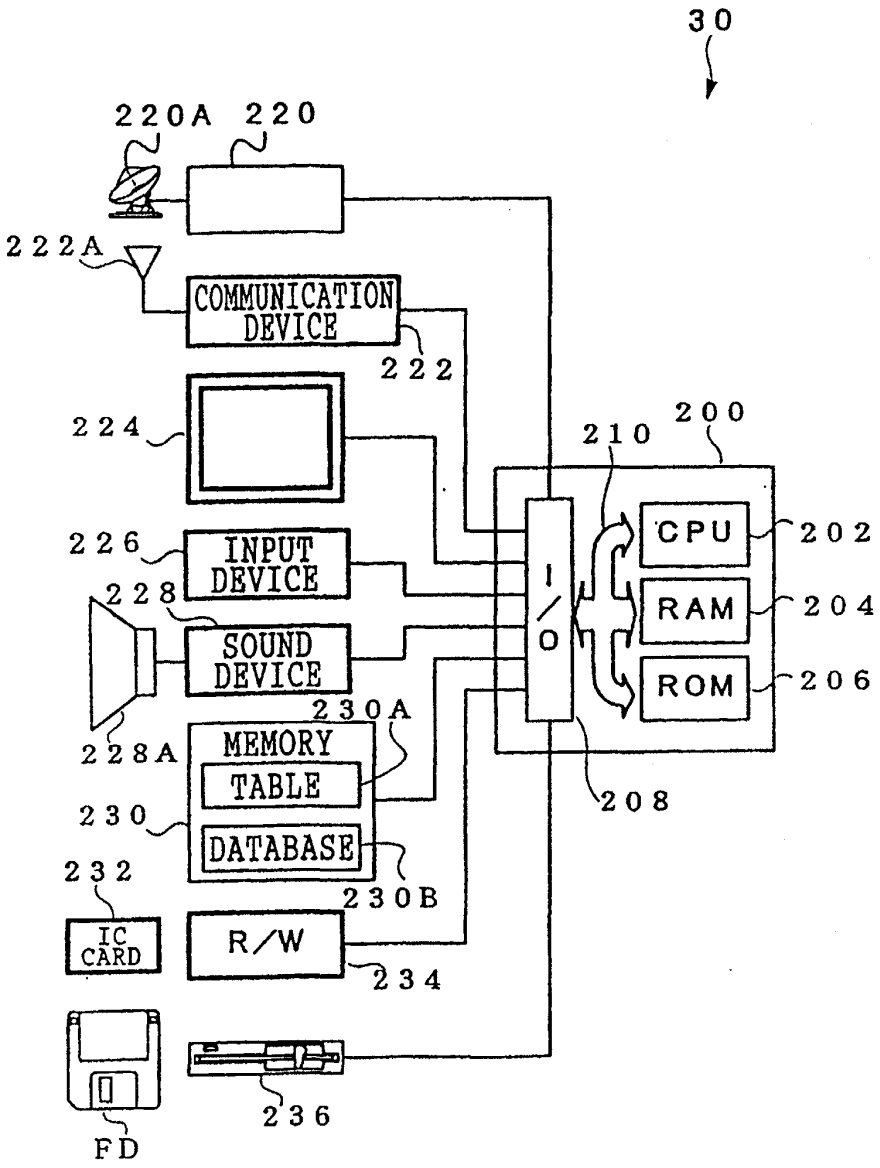
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FIG. 2



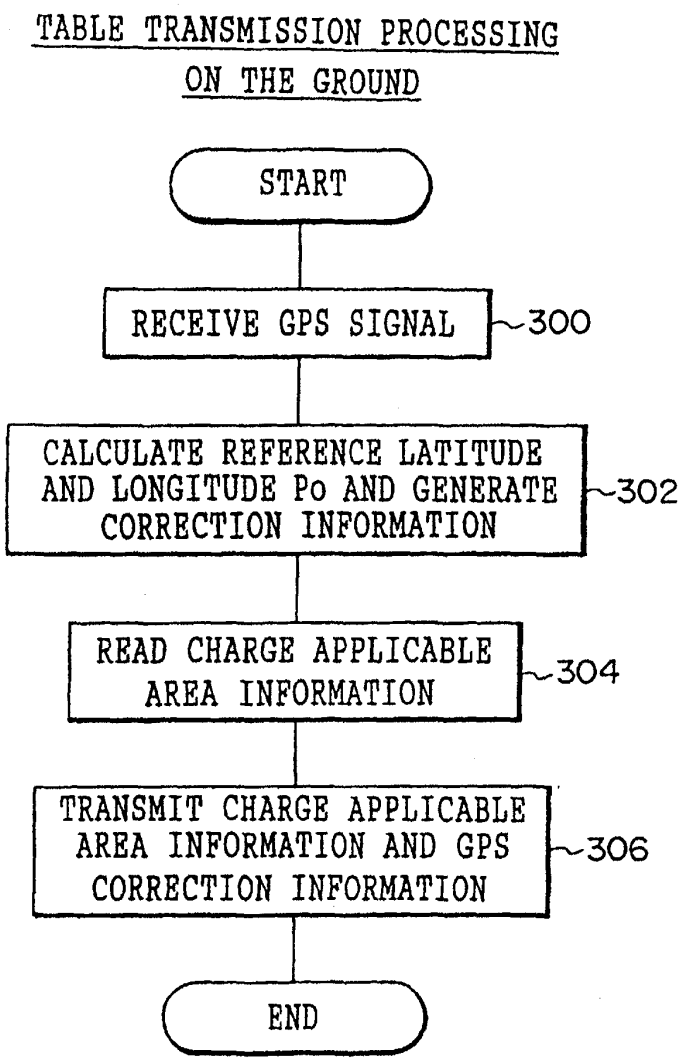
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FIG. 3



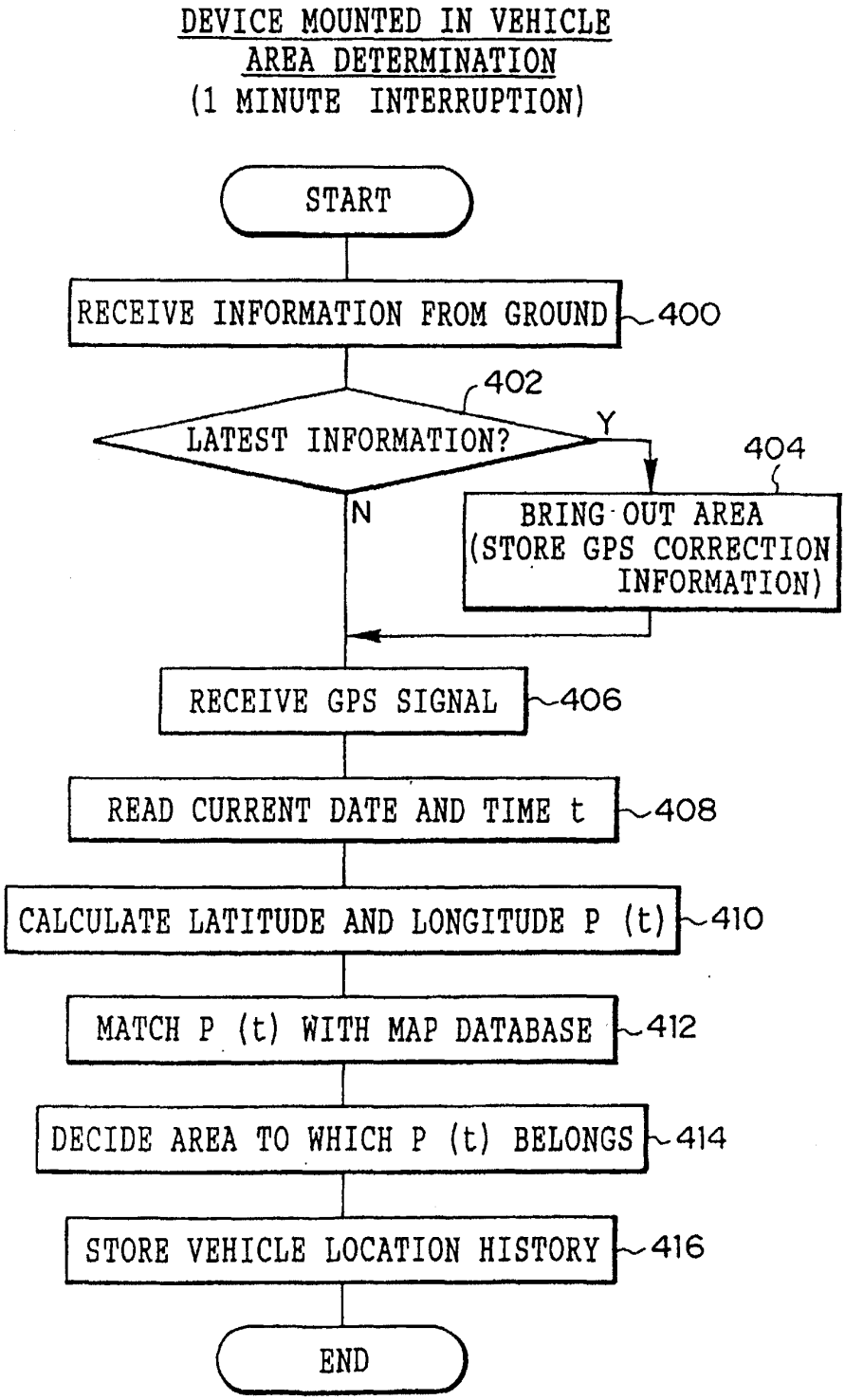
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FIG. 4



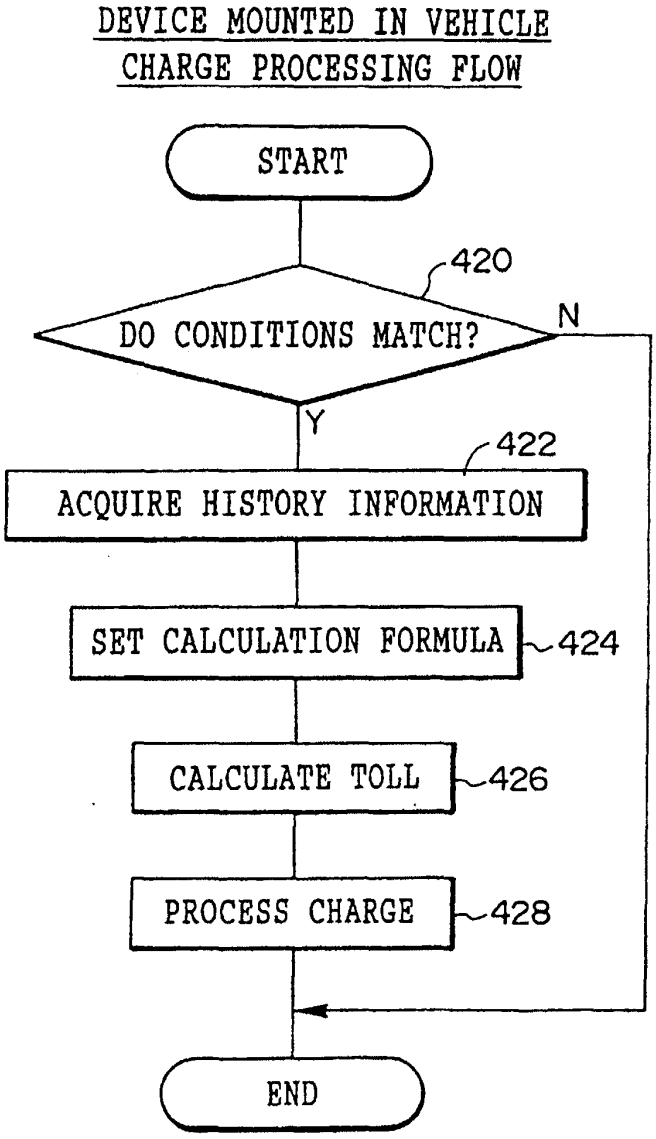
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FIG. 5



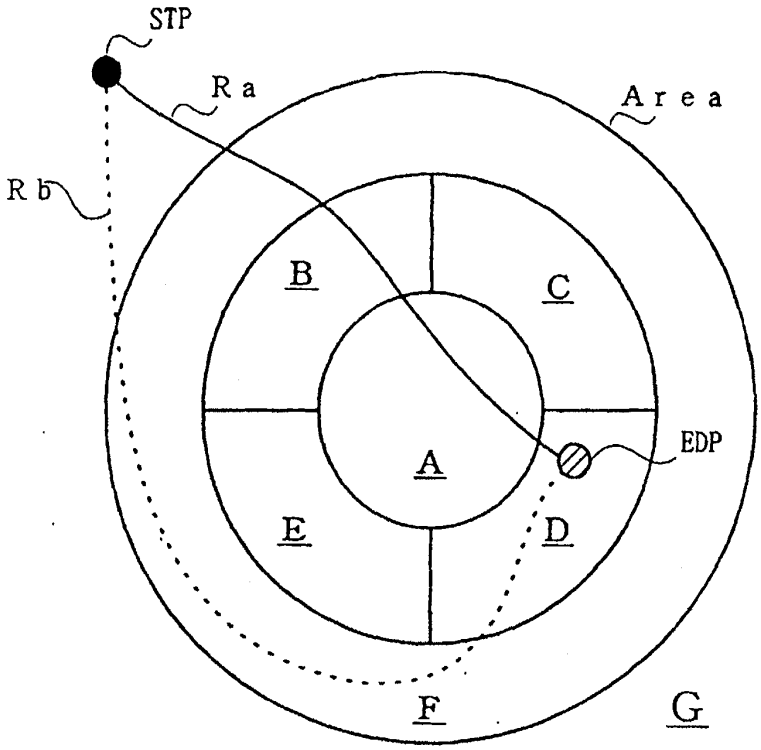
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FIG. 6



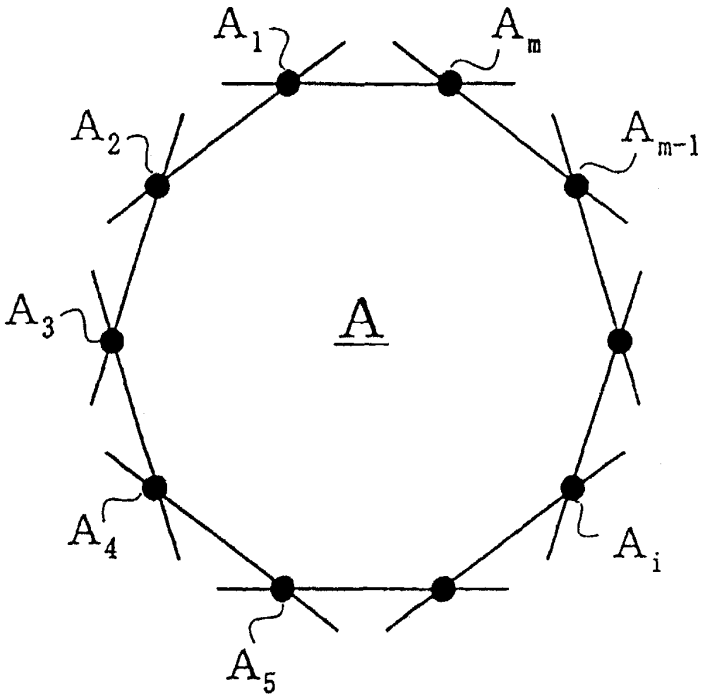
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FIG. 7



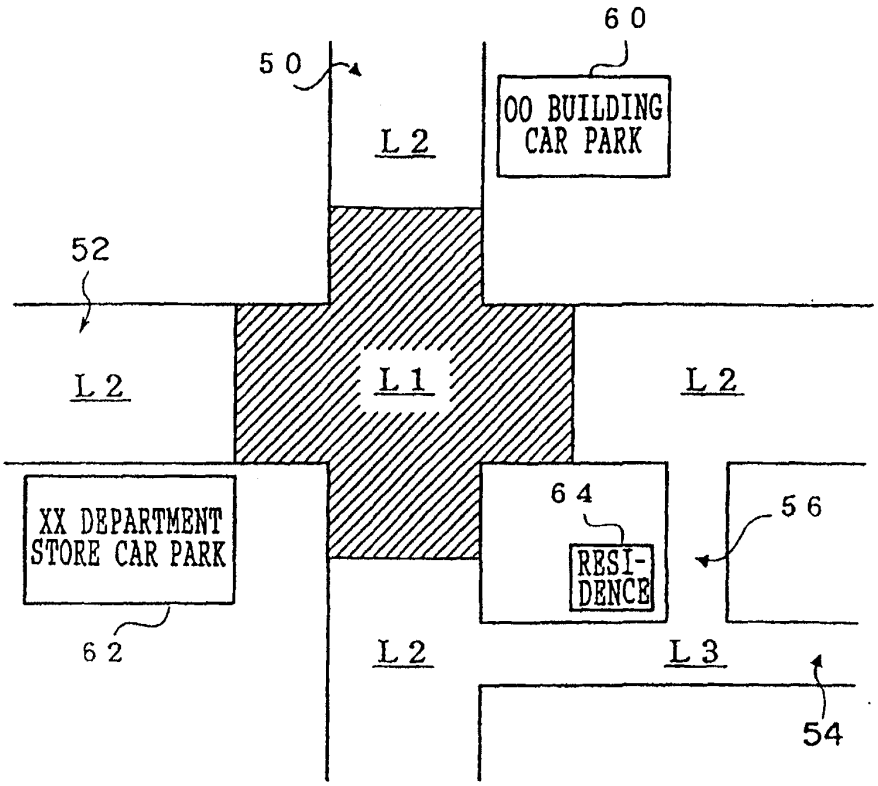
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FIG. 8



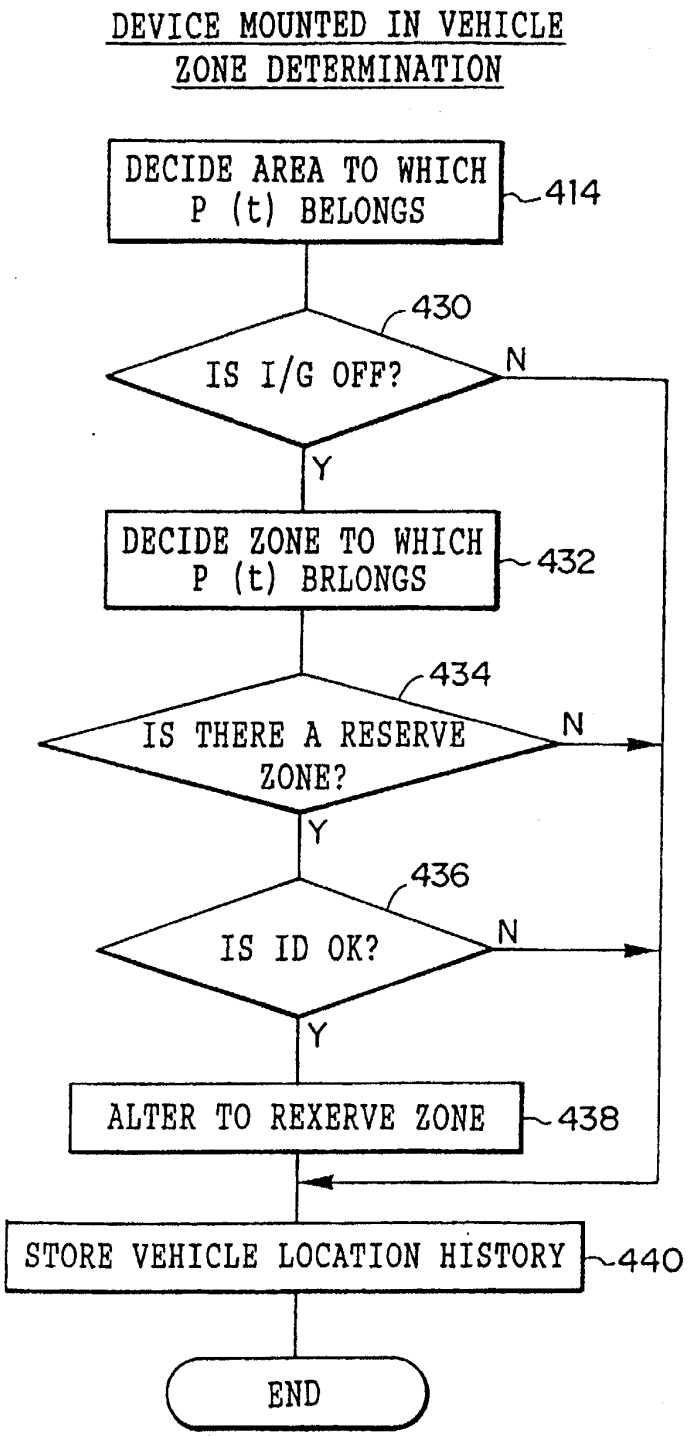
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FIG. 9



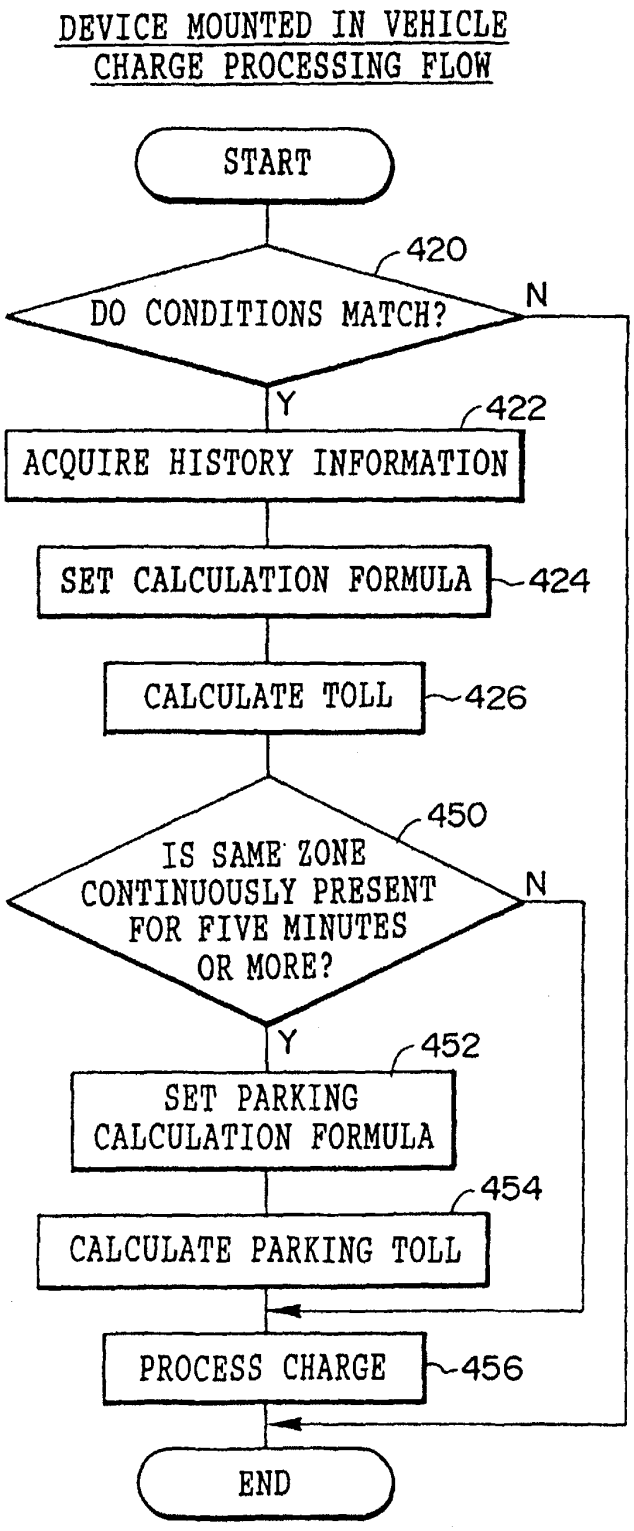
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FIG. 10



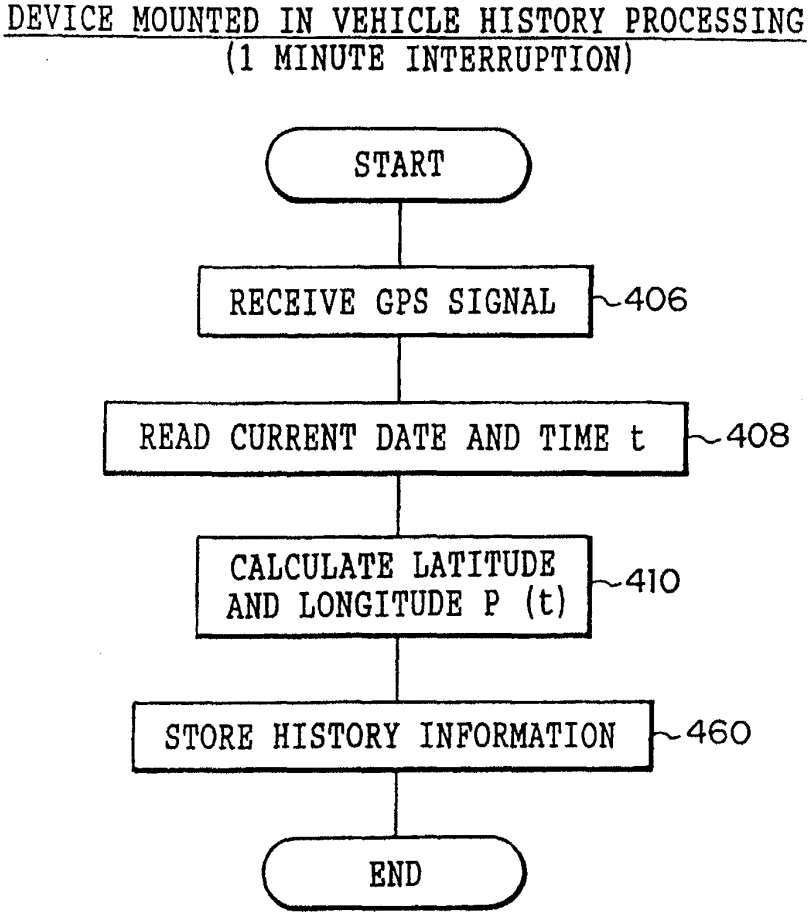
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FIG. 11



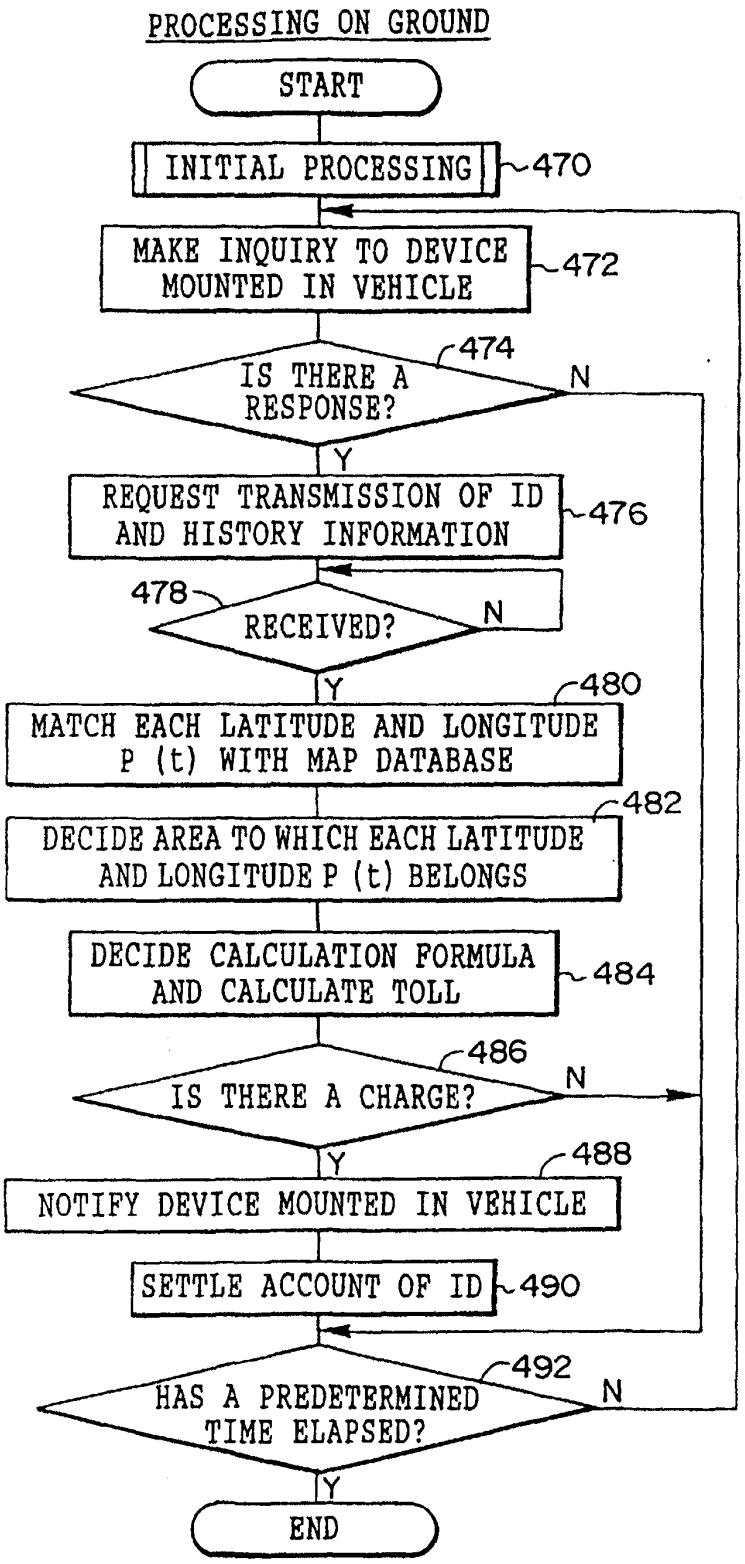
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FIG. 12



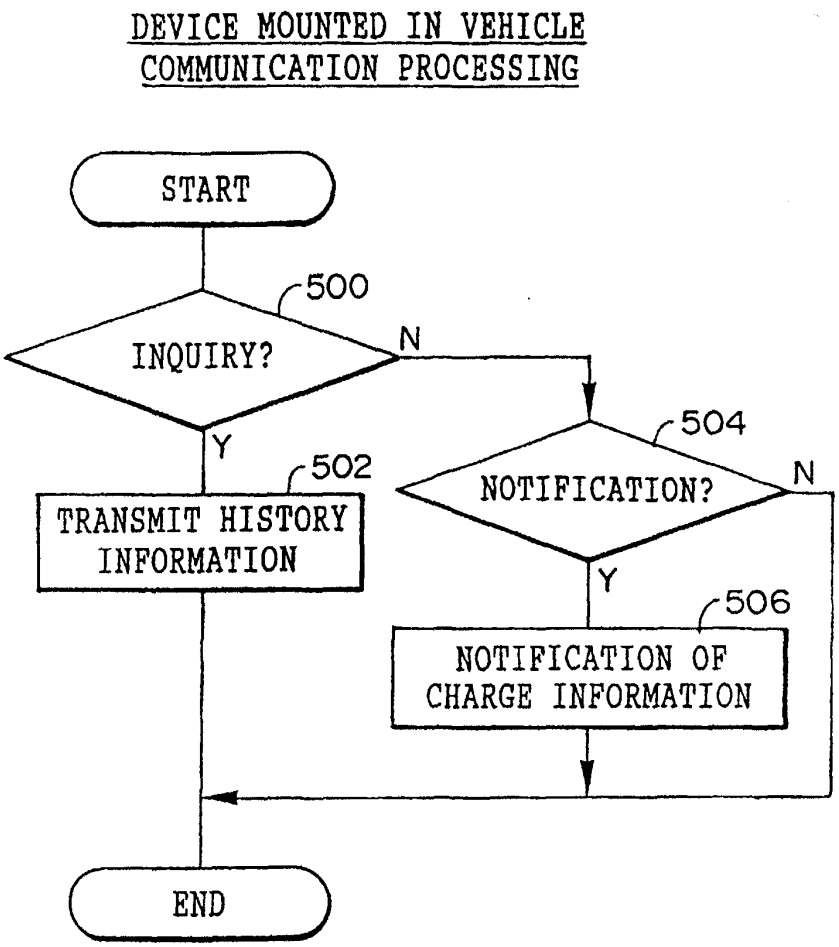
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FIG. 13



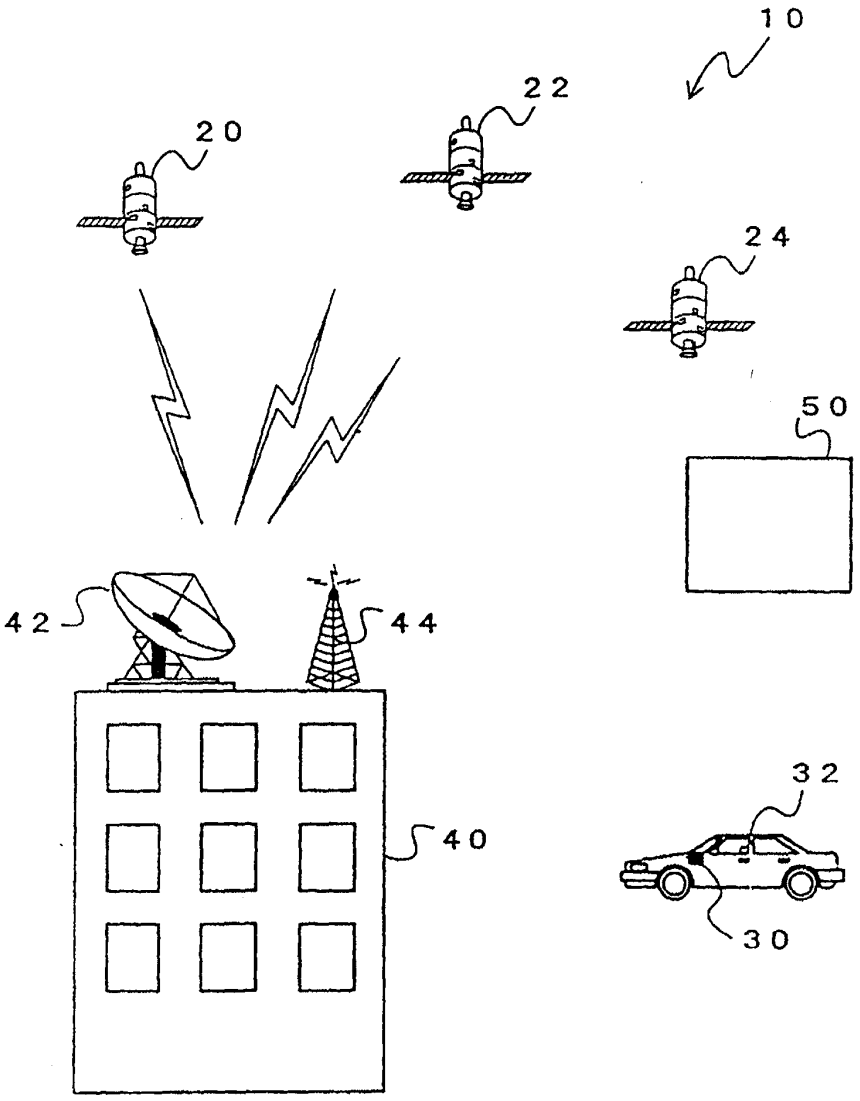
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FIG. 14



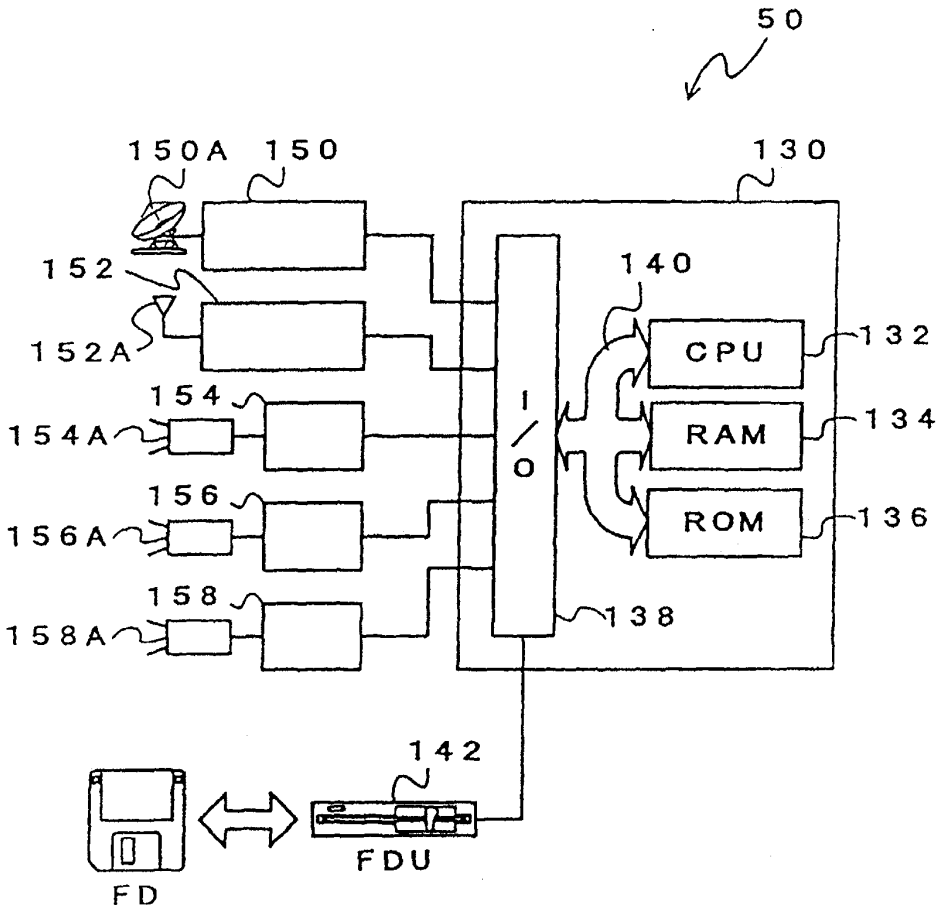
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FIG. 15



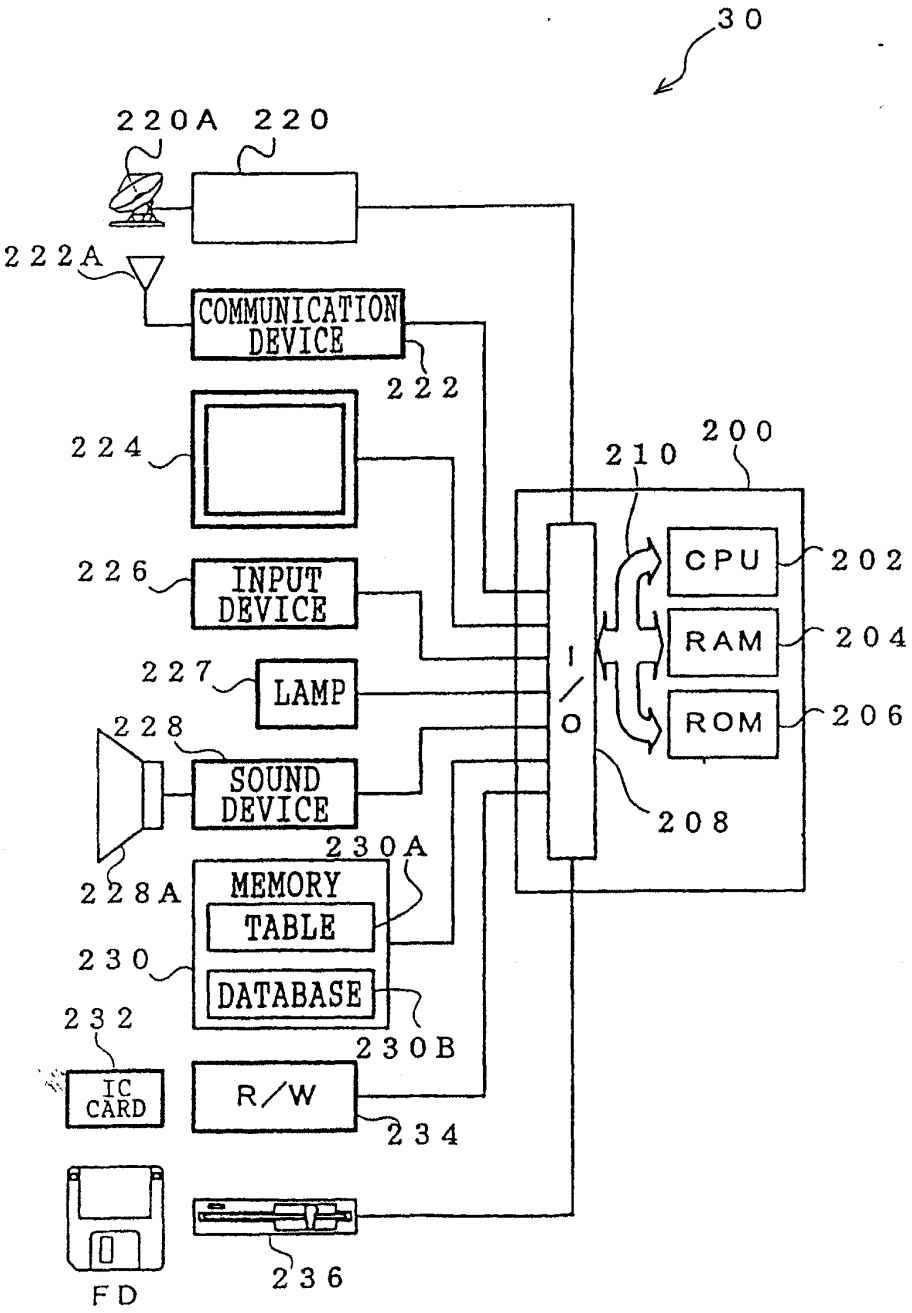
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FIG. 16



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FIG. 17



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FIG. 18A

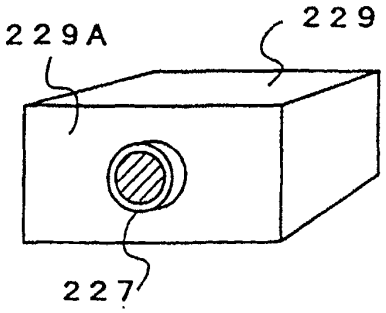
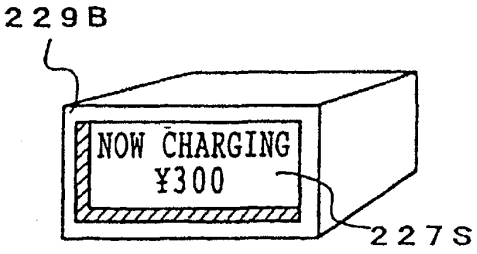
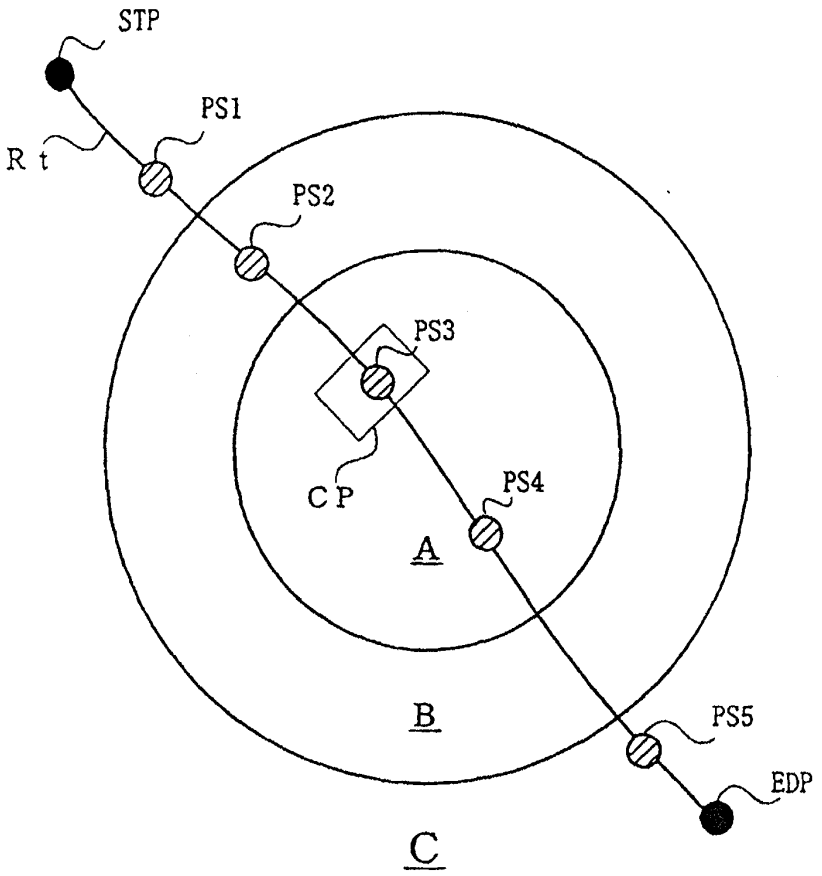


FIG. 18B



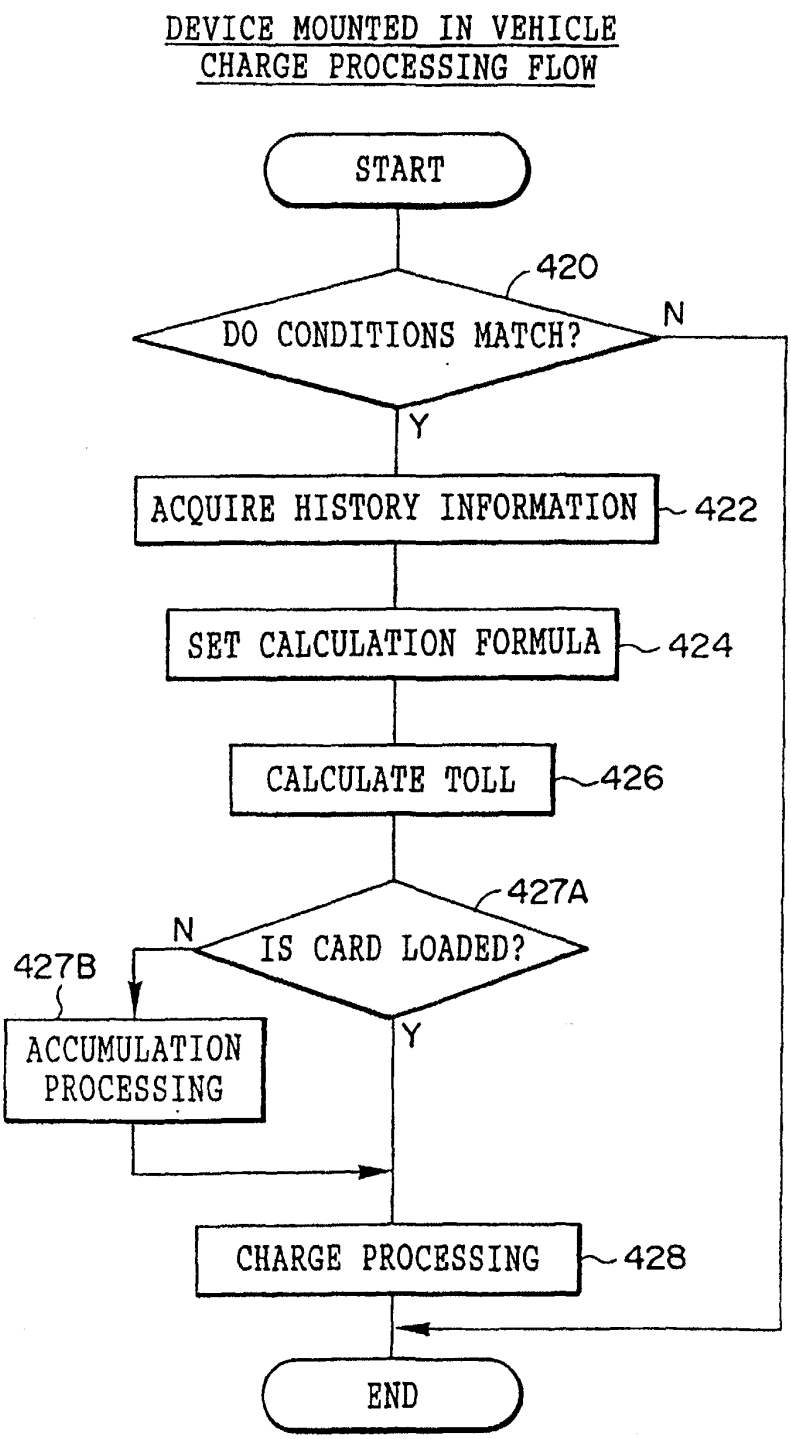
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FIG. 19



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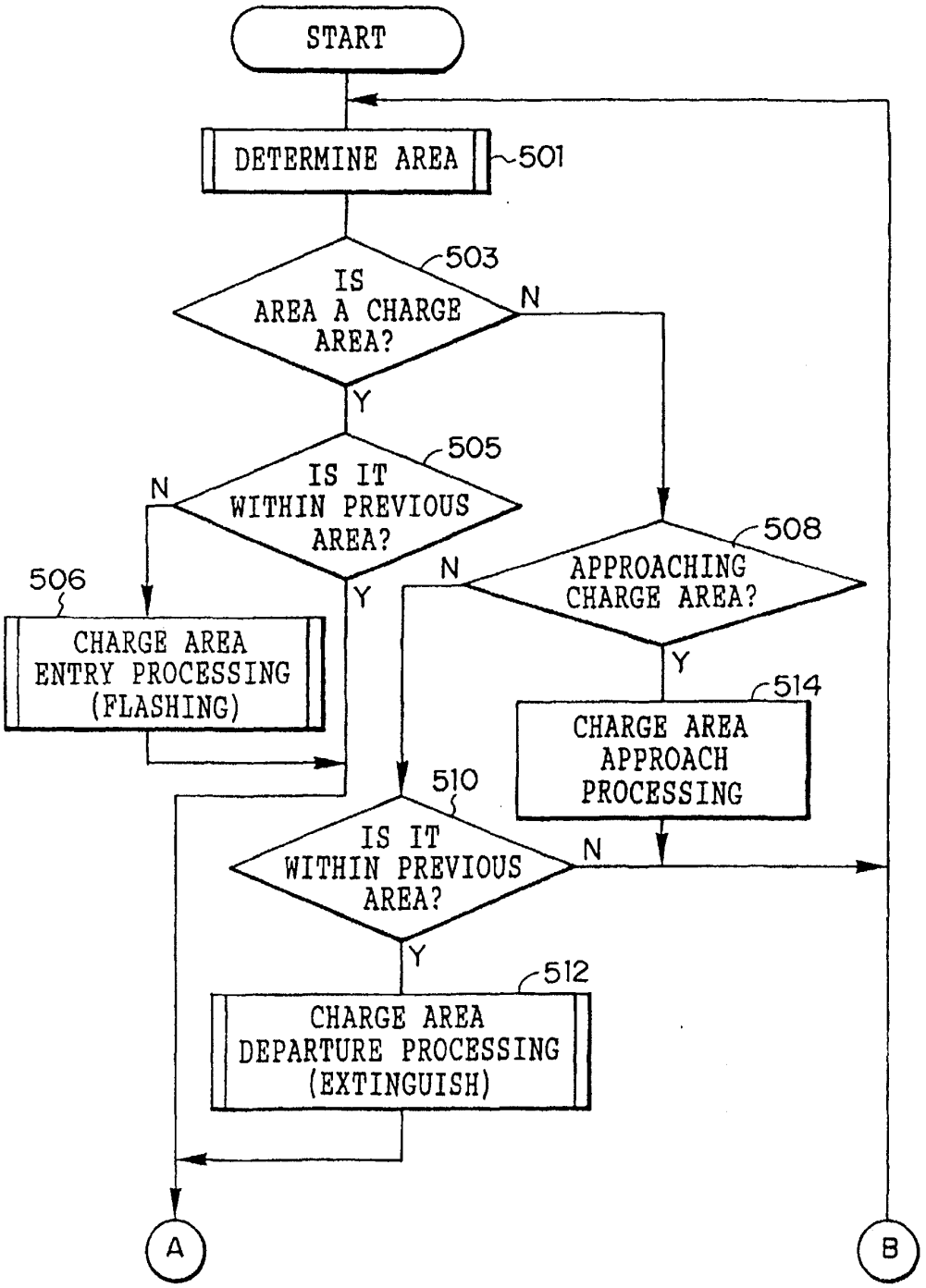
FIG. 20



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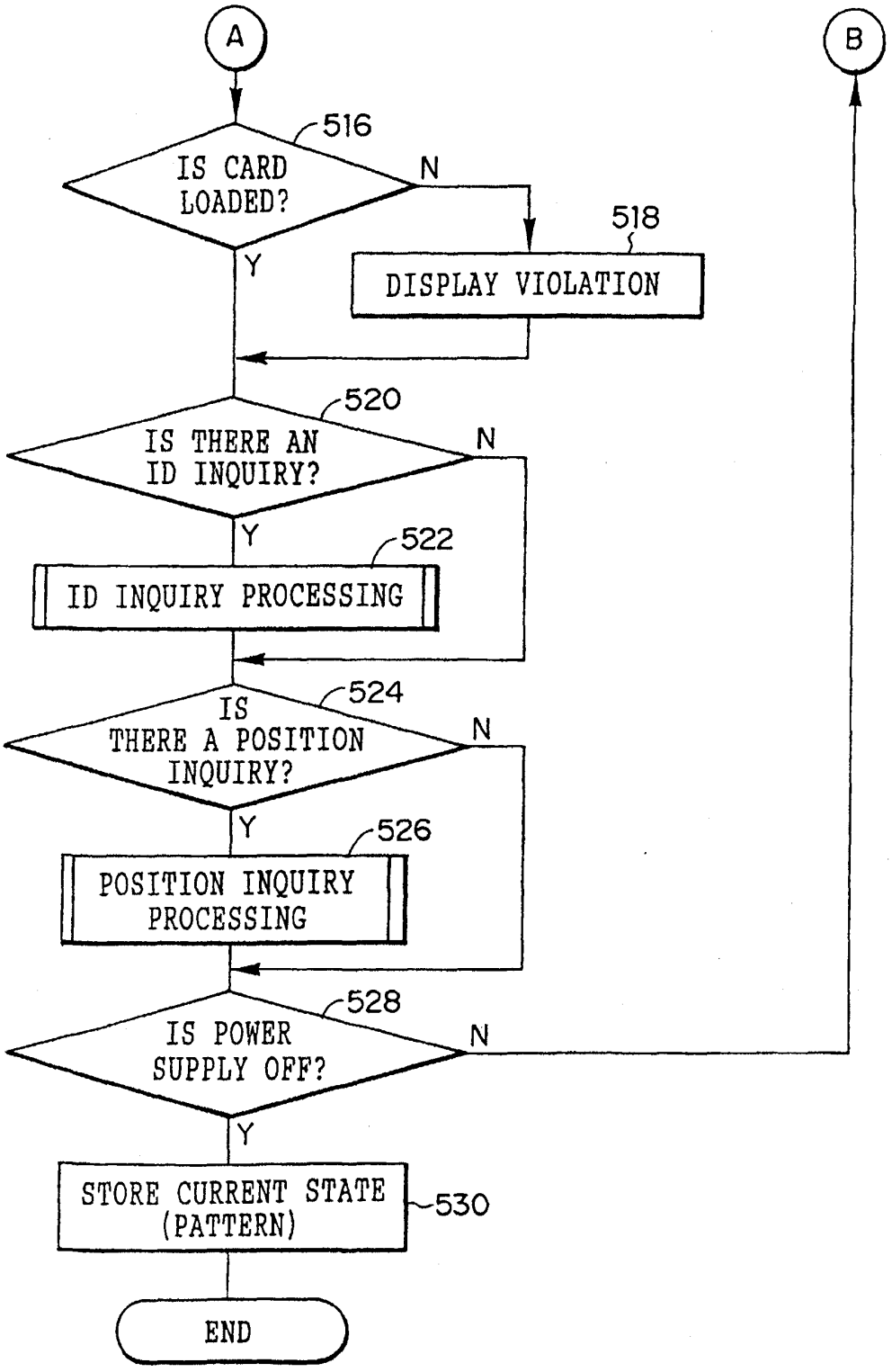
FIG. 21

DEVICE MOUNTED IN VEHICLE PROCESSING FLOW



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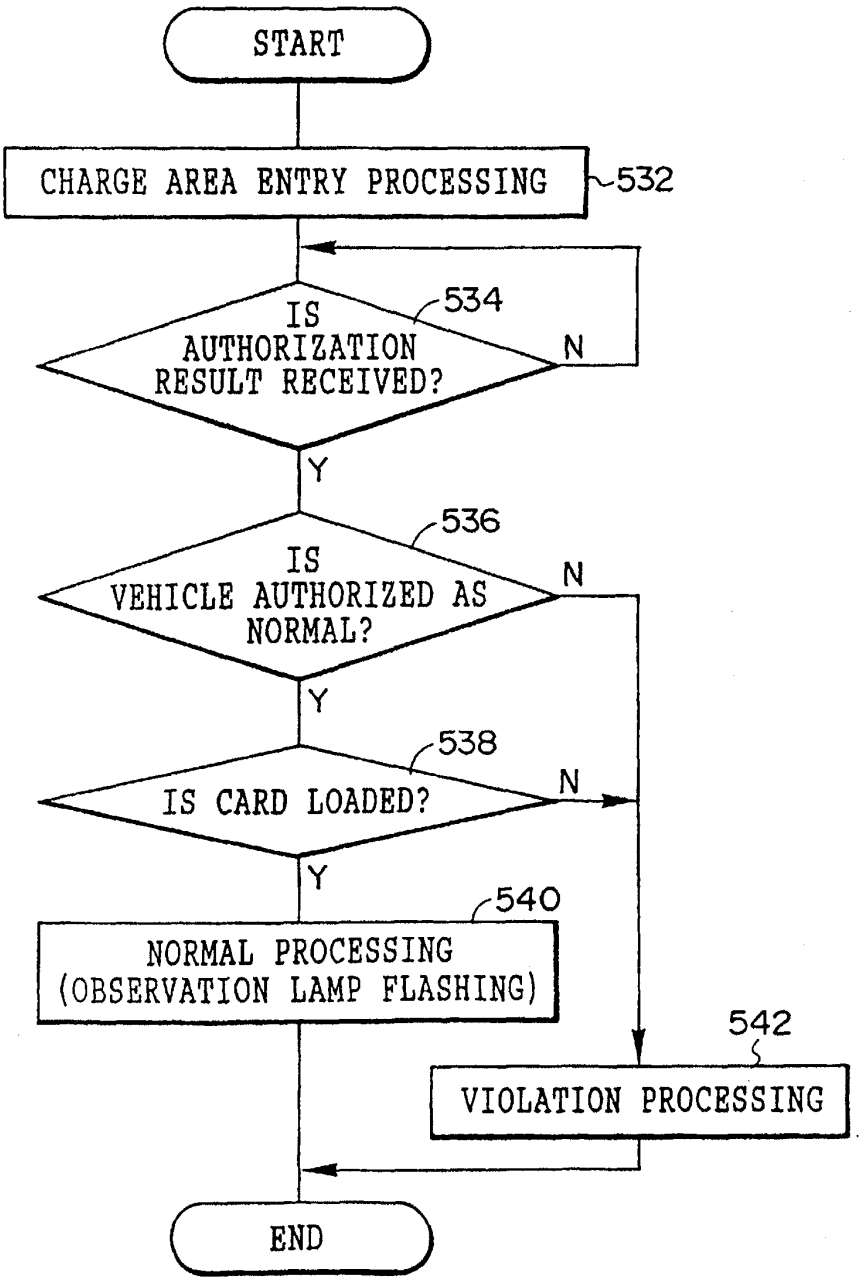
FIG. 21 (CONTINUED)



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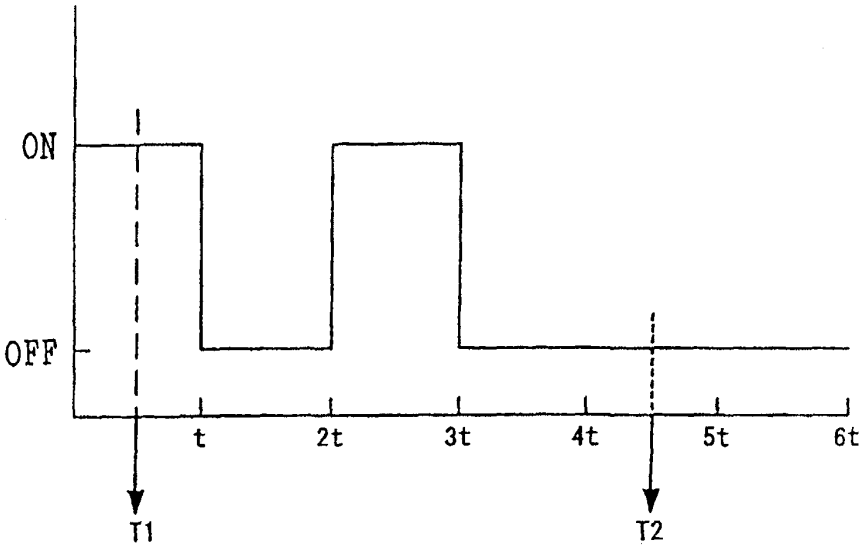
FIG. 22

DEVICE MOUNTED IN VEHICLE CHARGE AREA ENTRY PROCESSING



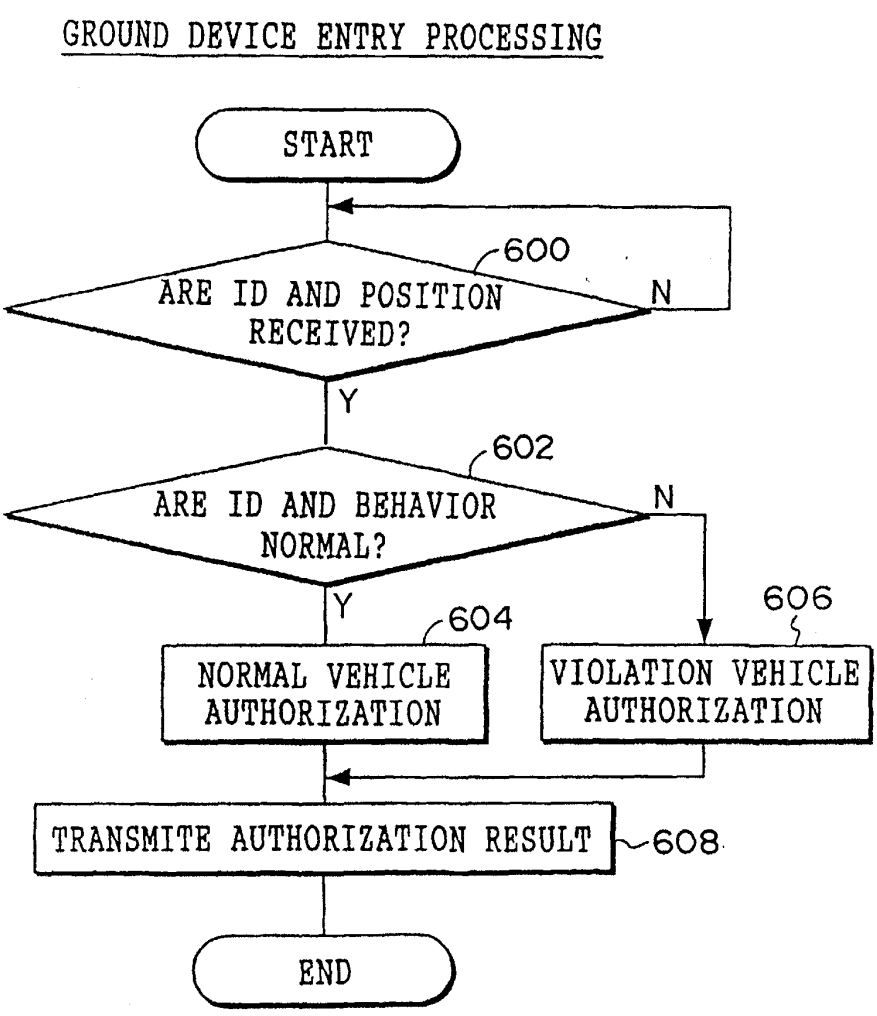
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FIG. 23



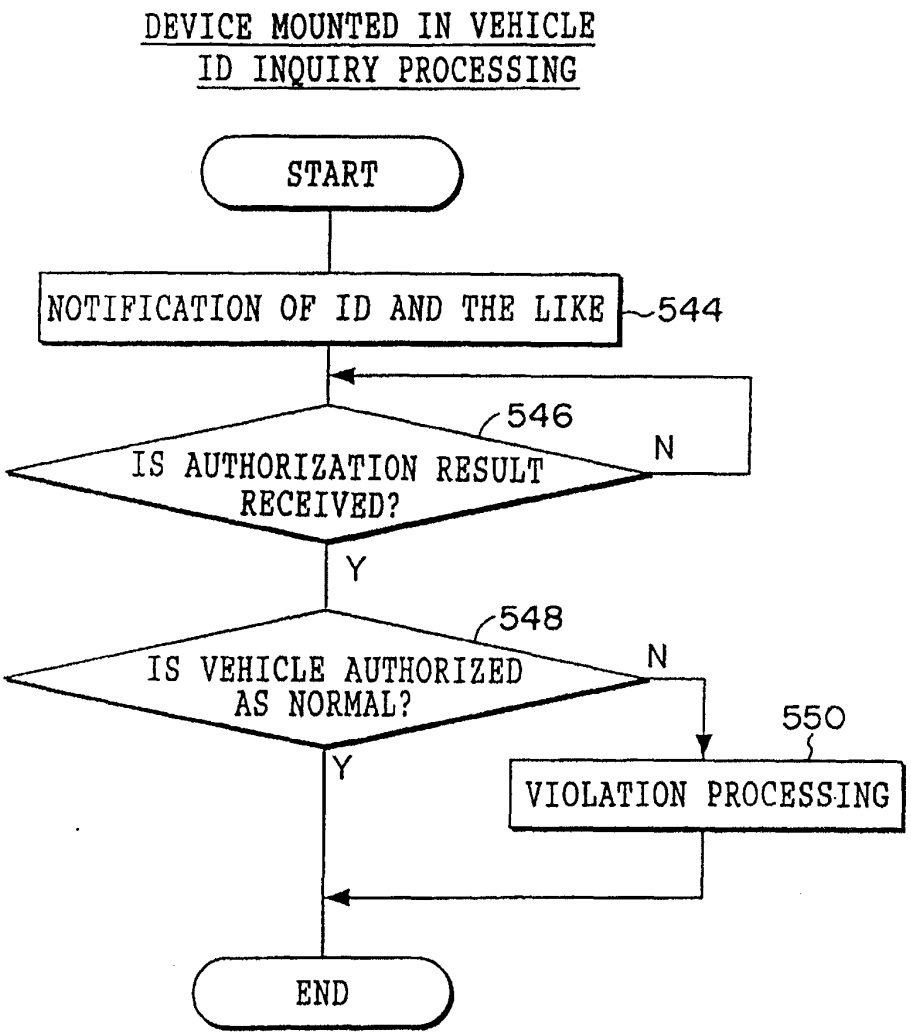
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FIG. 24



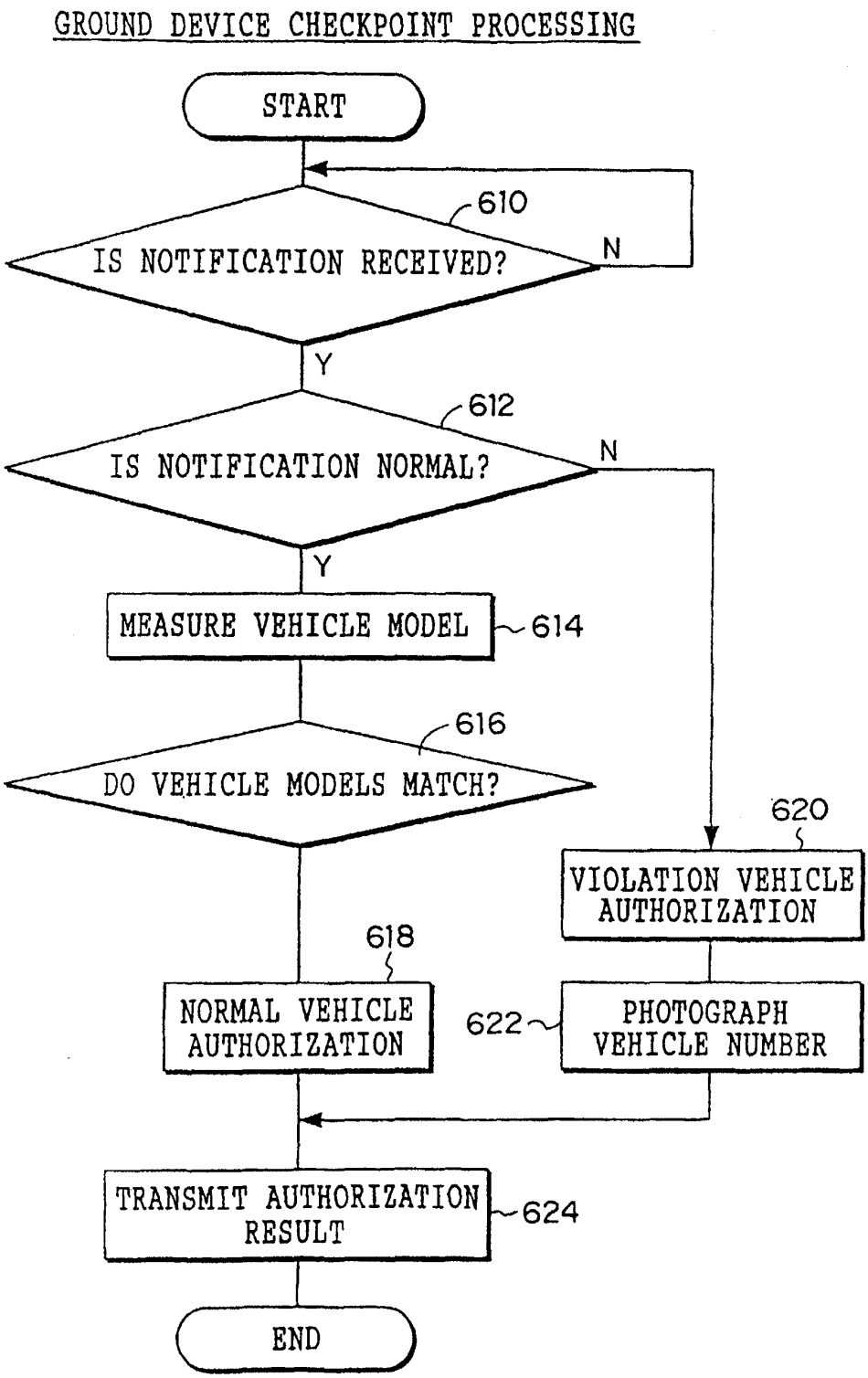
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FIG. 25



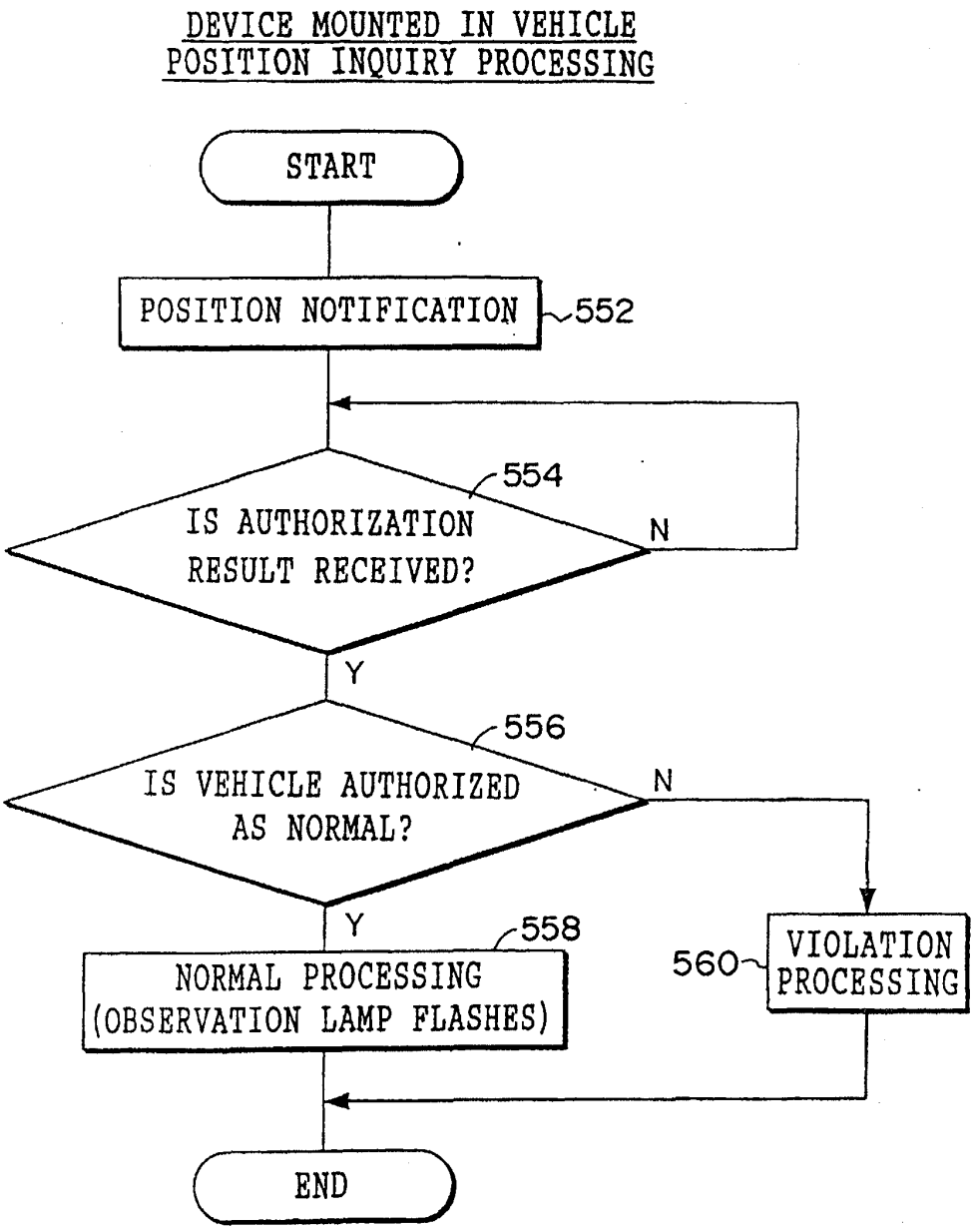
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FIG. 26



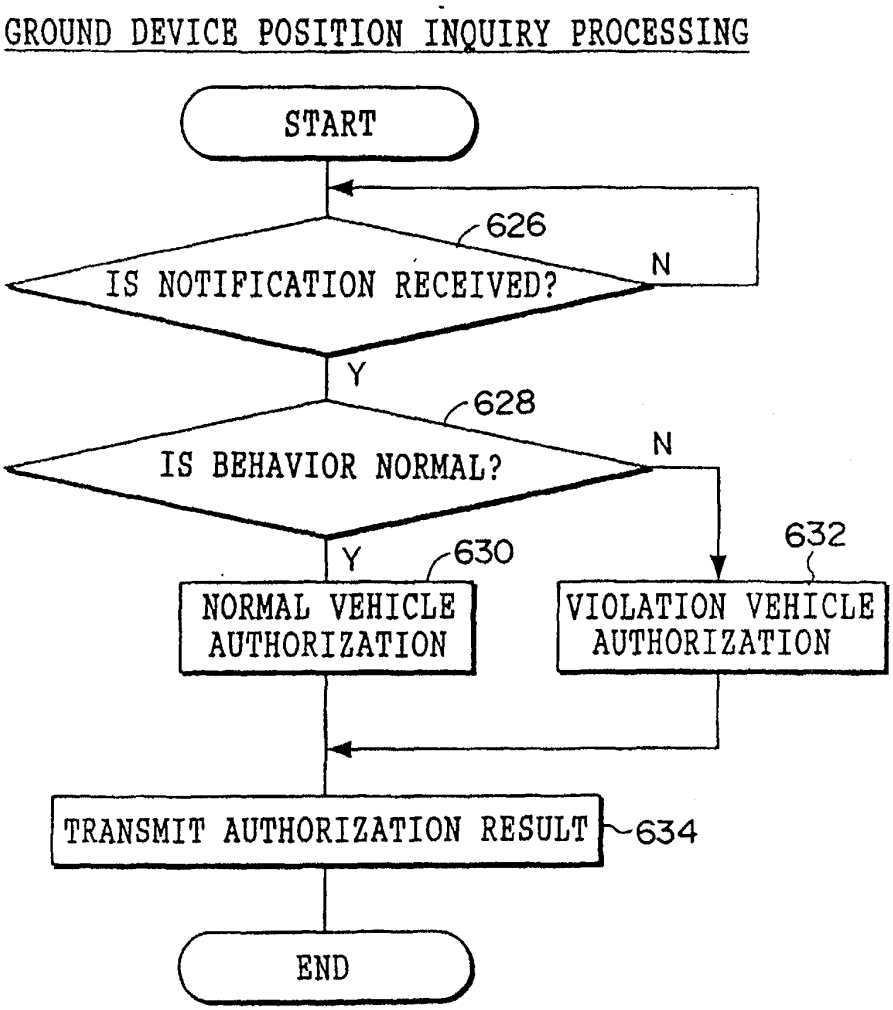
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FIG. 27



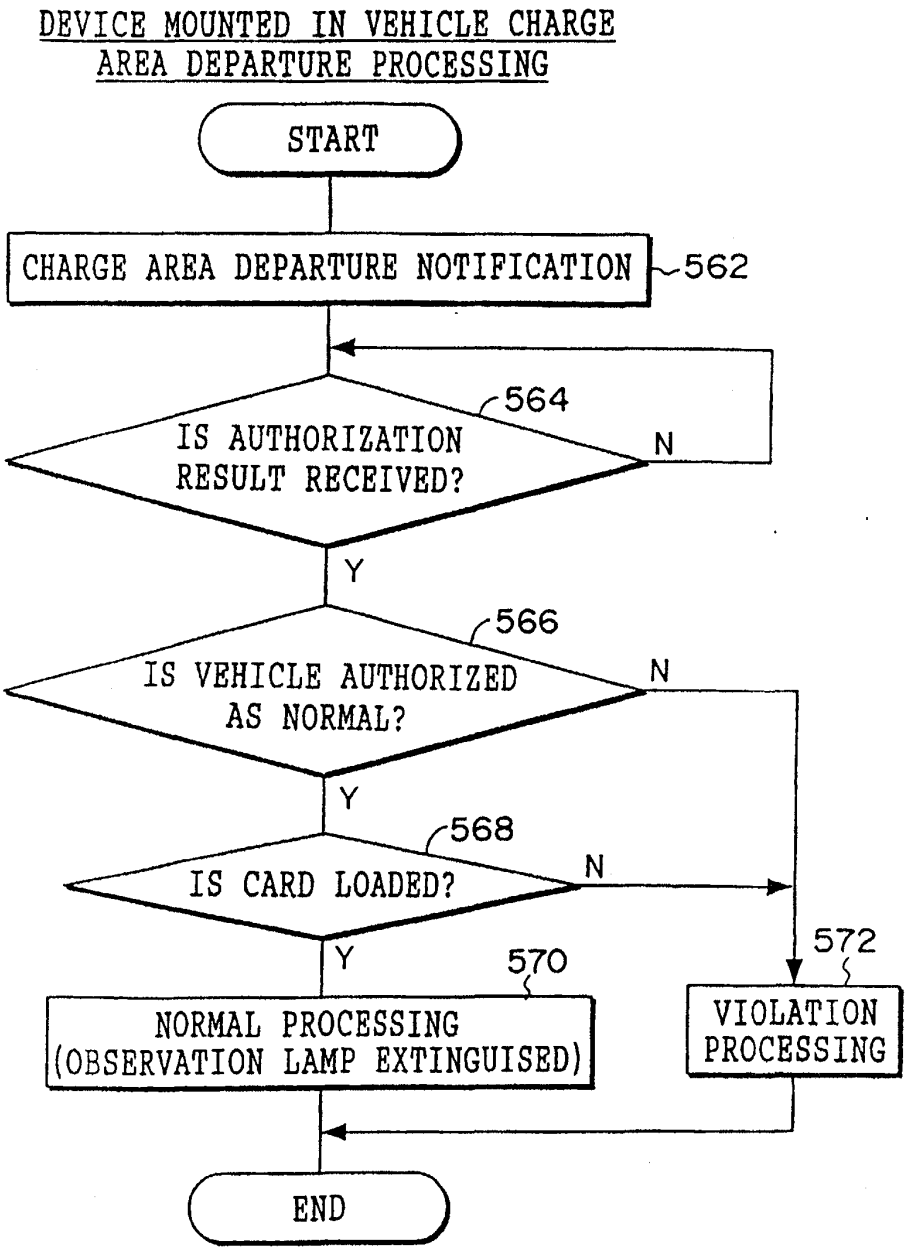
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FIG. 28



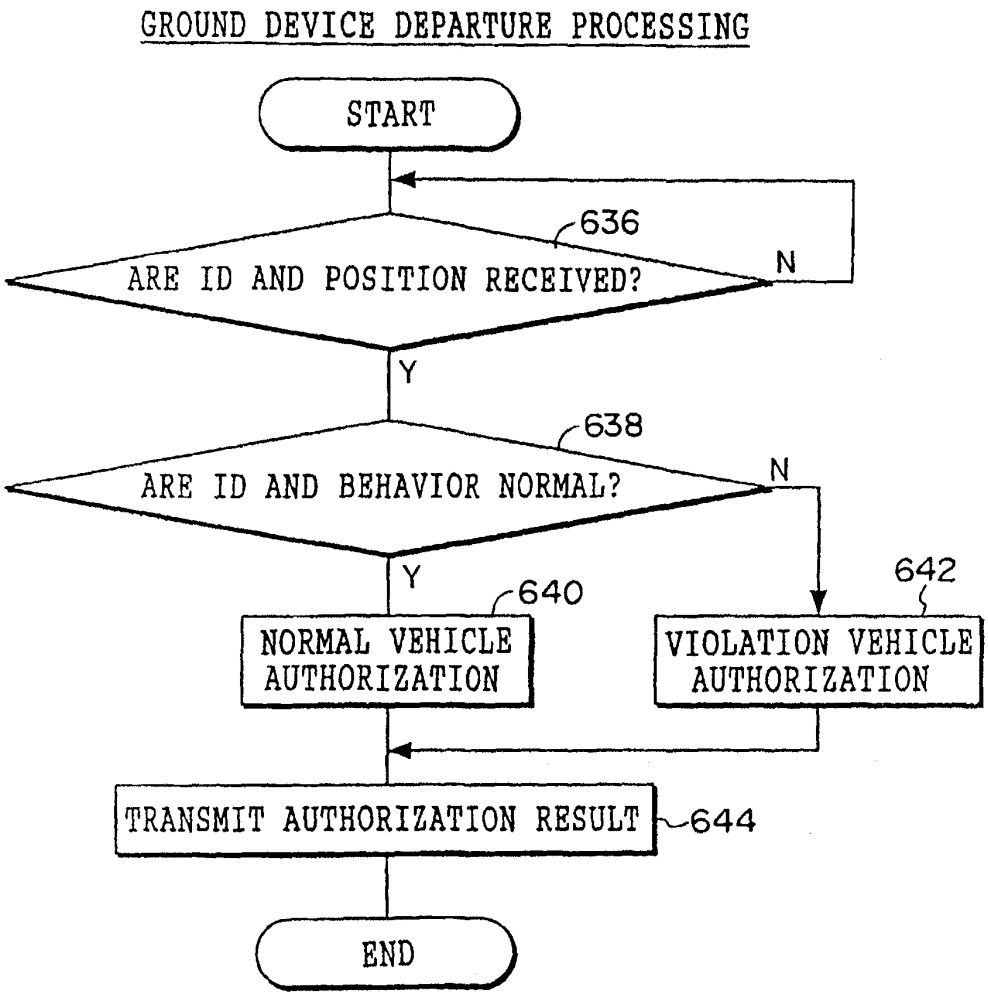
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FIG. 29



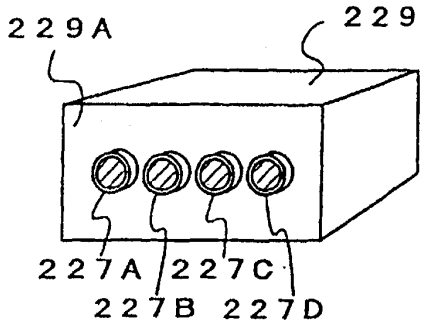
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FIG. 30



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FIG. 31



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FIG. 32

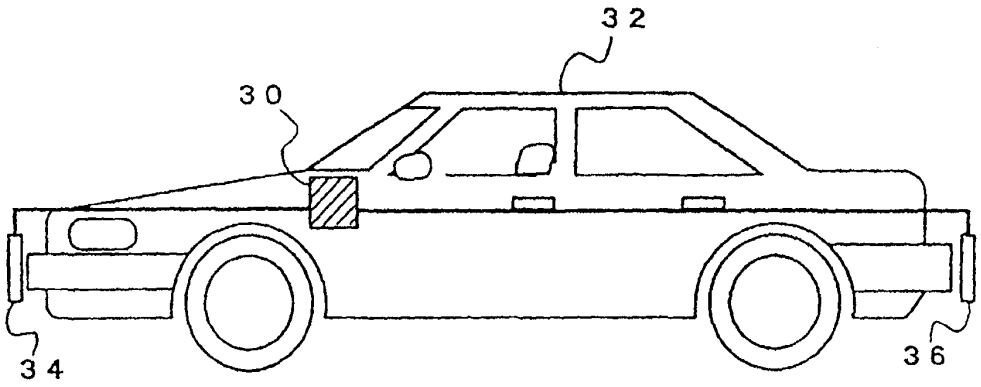
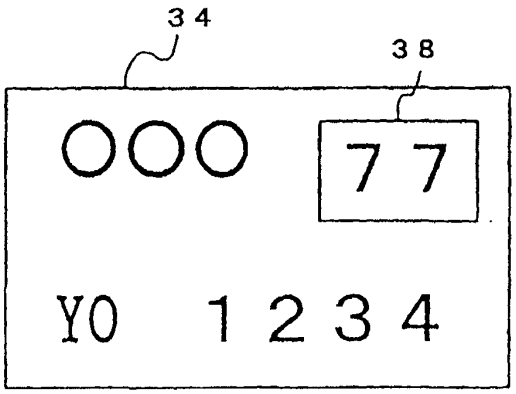
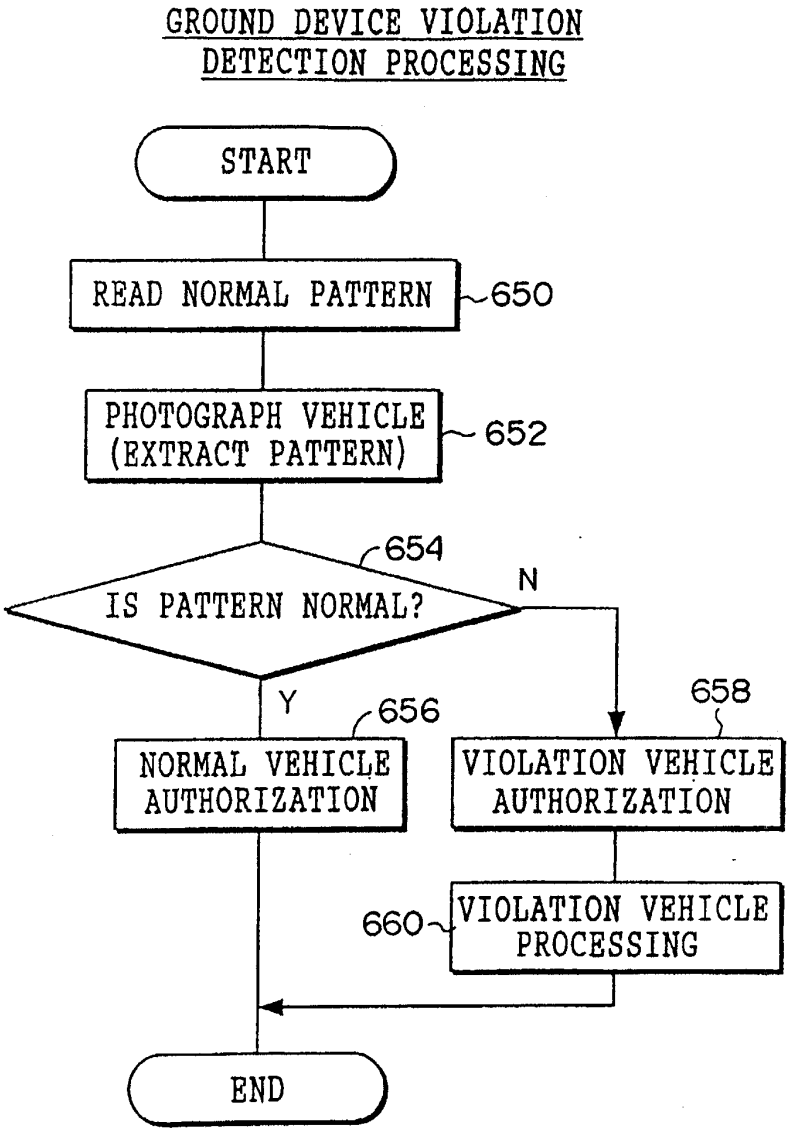


FIG. 33



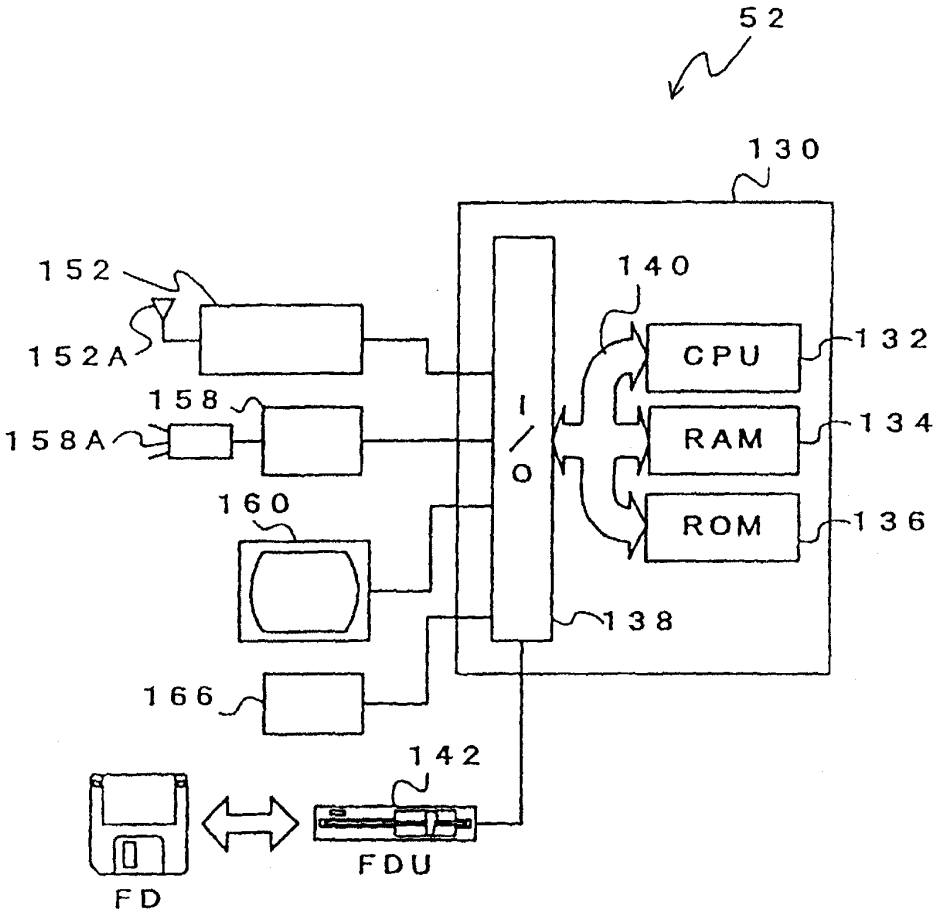
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FIG. 34



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FIG. 35



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FIG. 36A

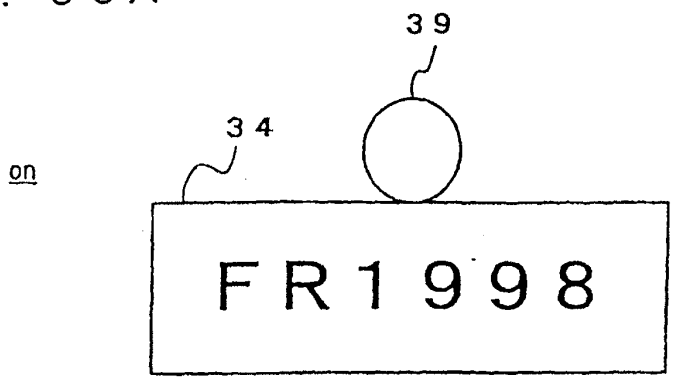
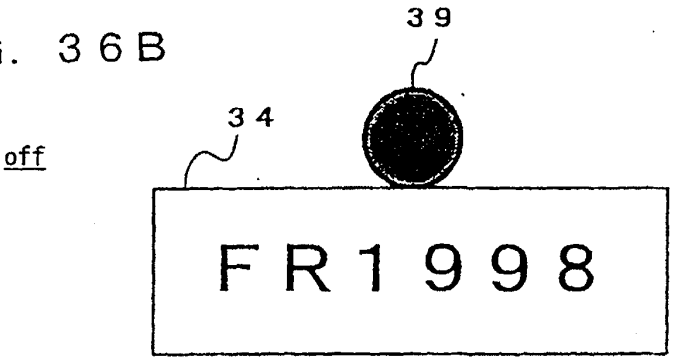
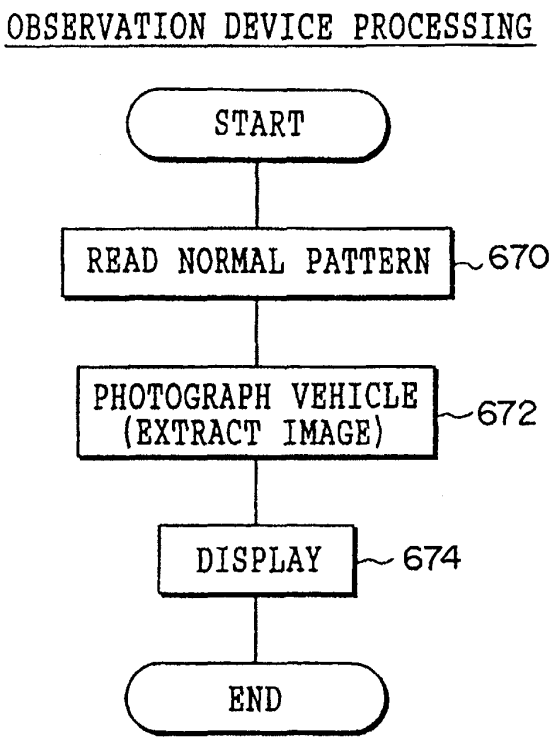


FIG. 36B



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FIG. 37



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FIG. 38A

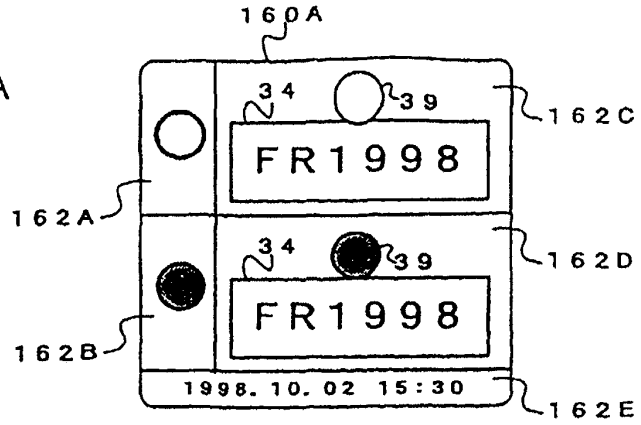


FIG. 38B

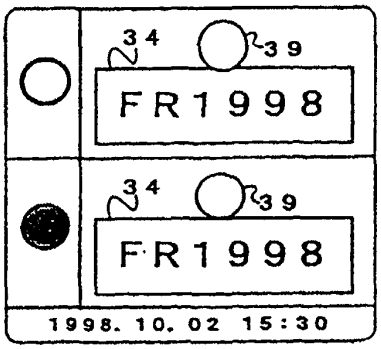


FIG. 38C

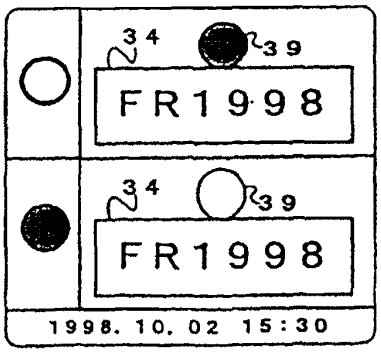
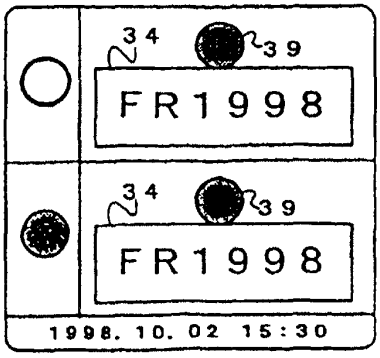
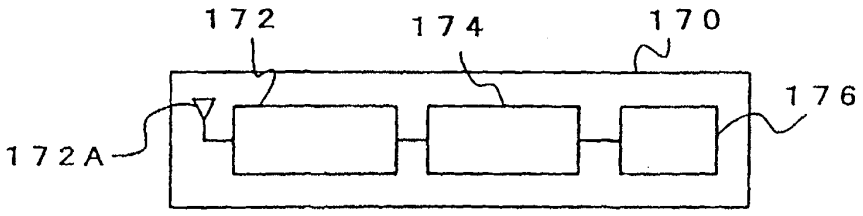


FIG. 38D



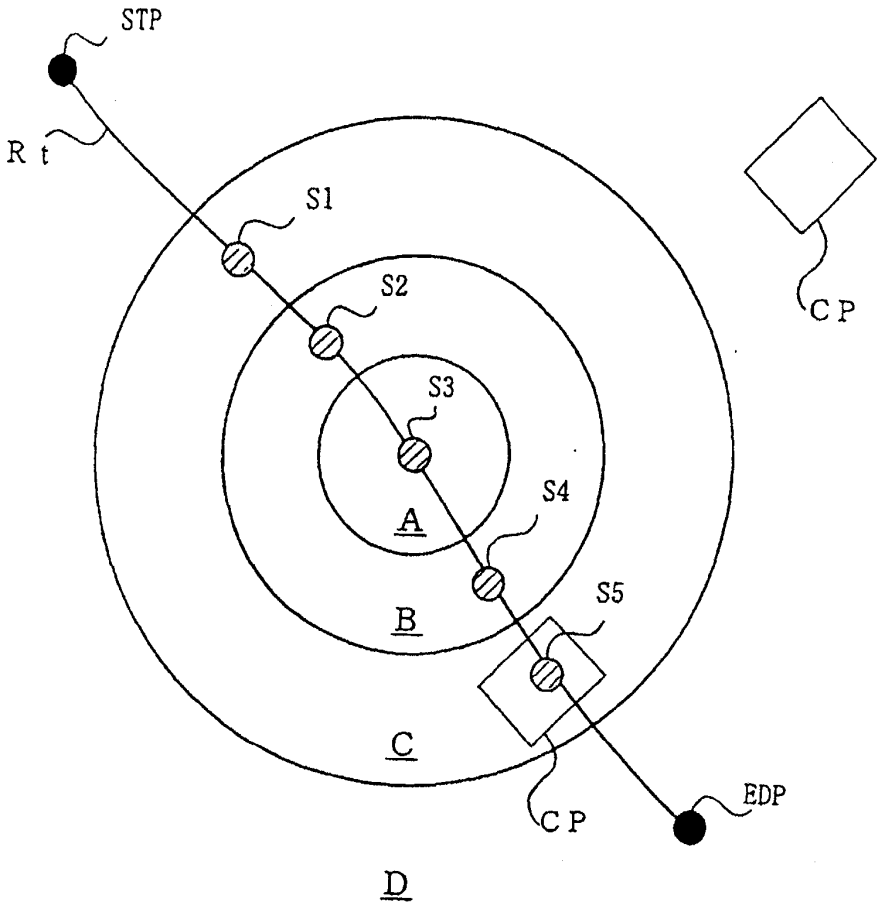
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FIG. 39



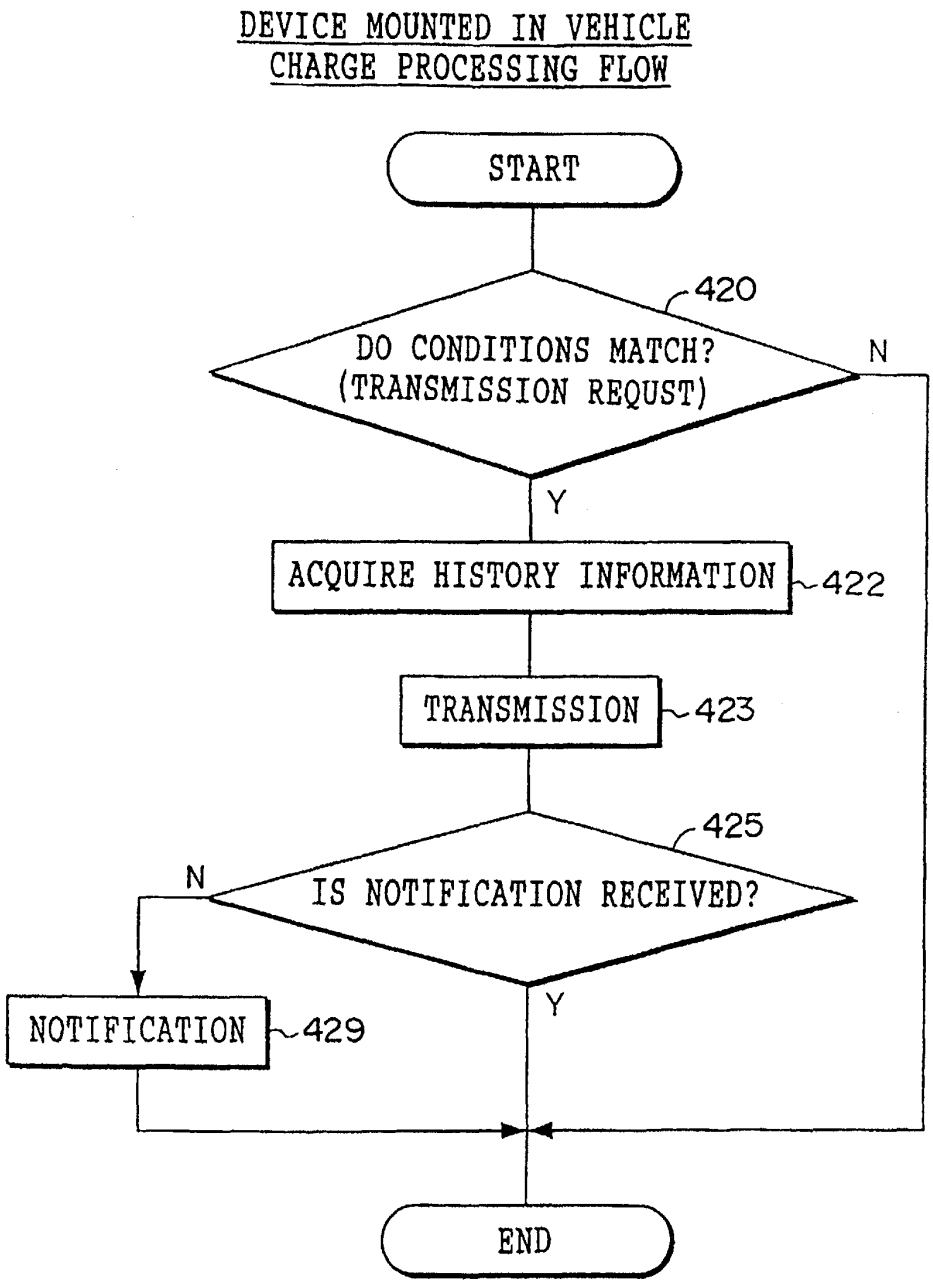
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FIG. 40



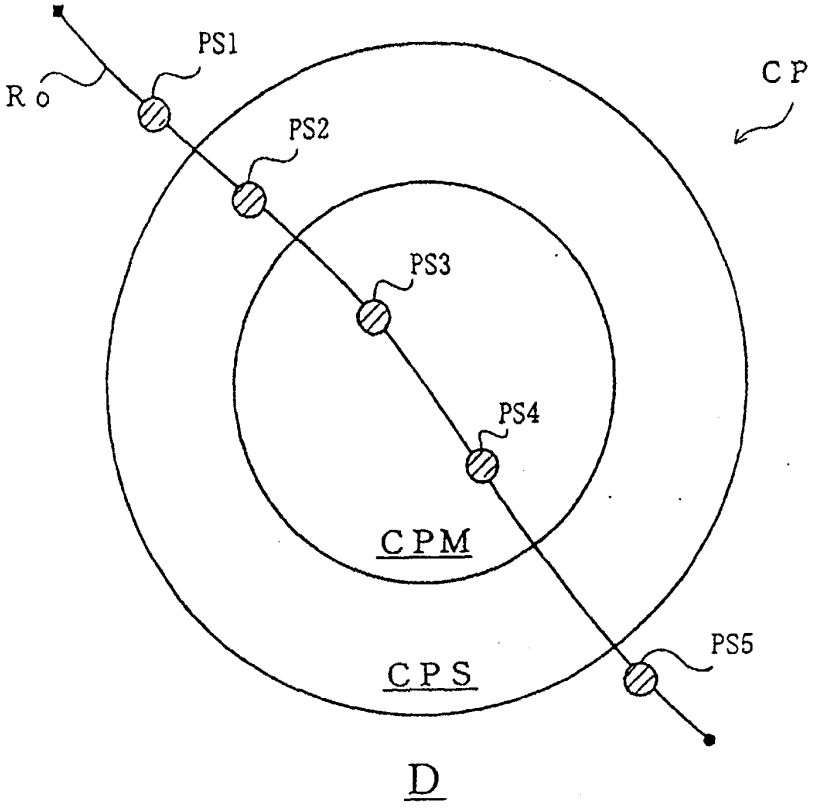
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FIG. 41



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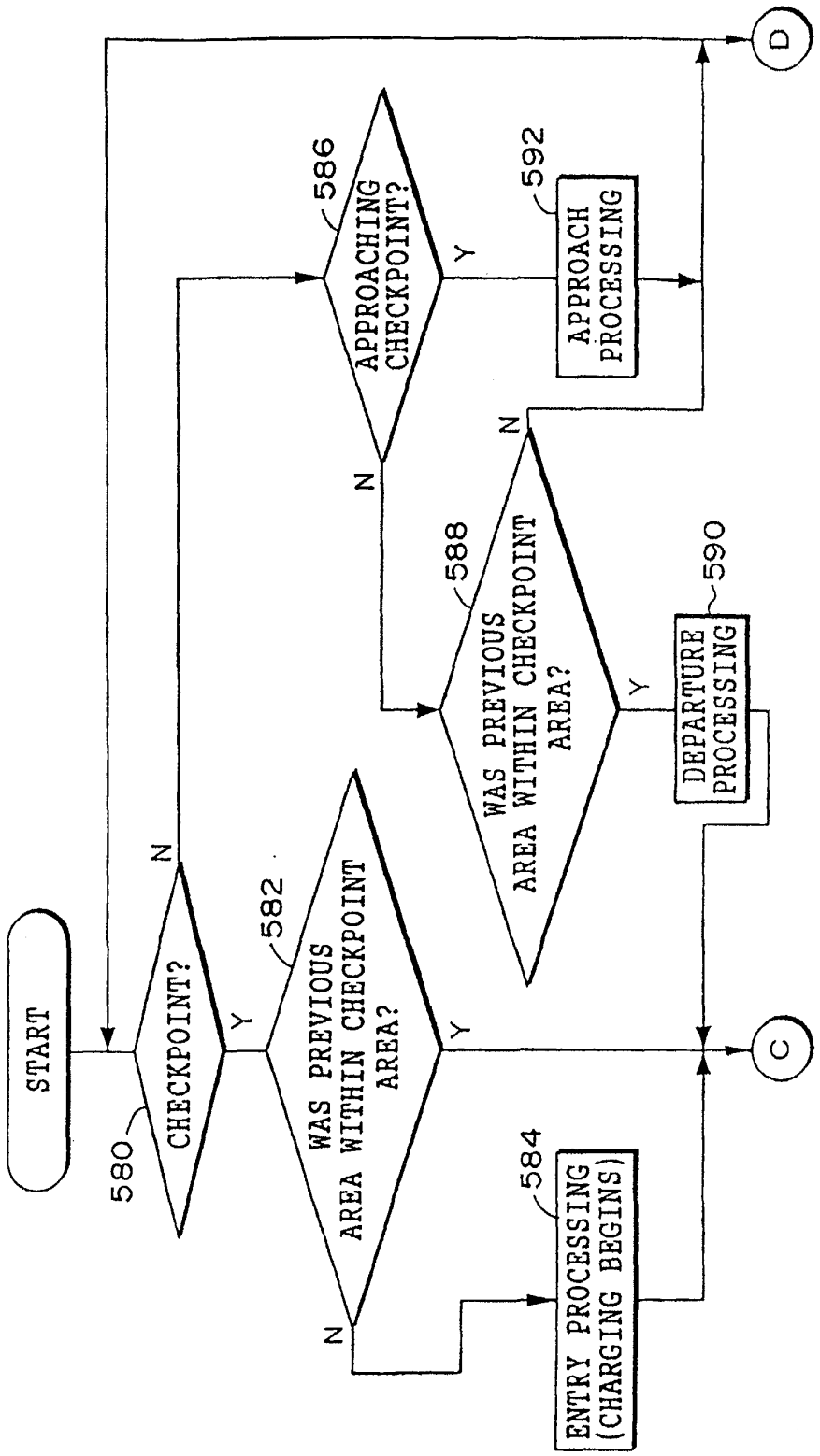
FIG. 42



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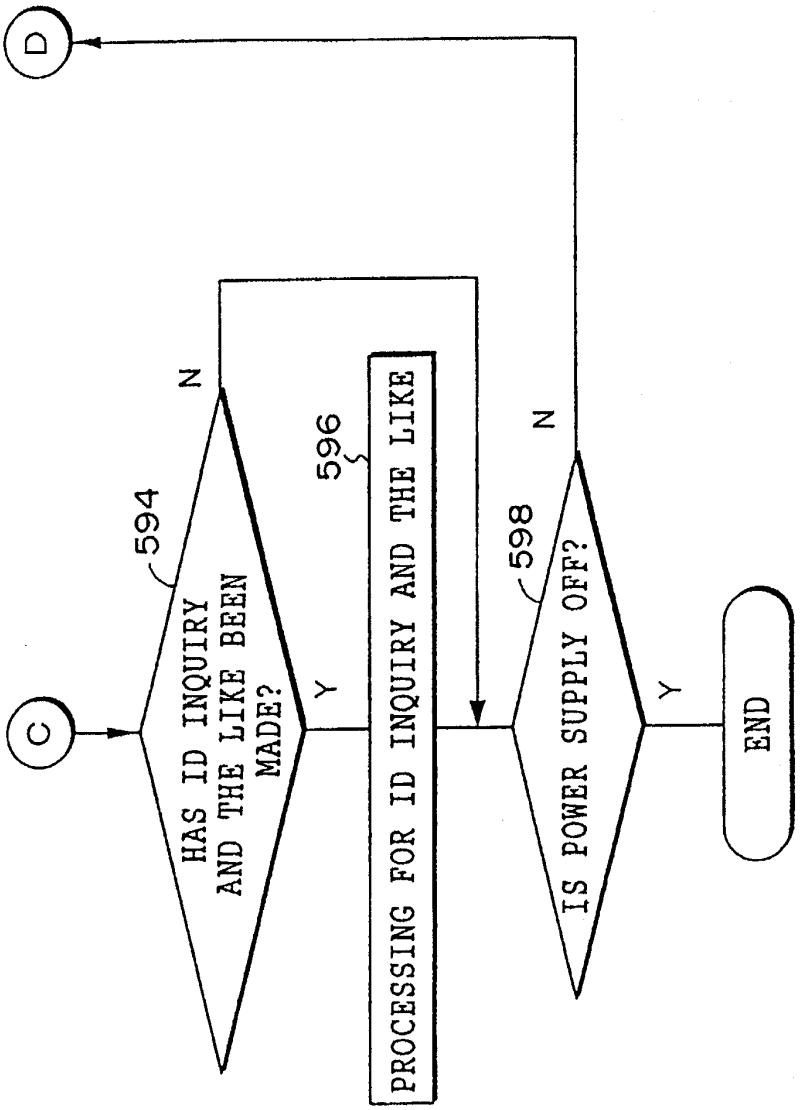
FIG. 43

DEVICE MOUNTED IN VEHICLE PROCESSING FLOW



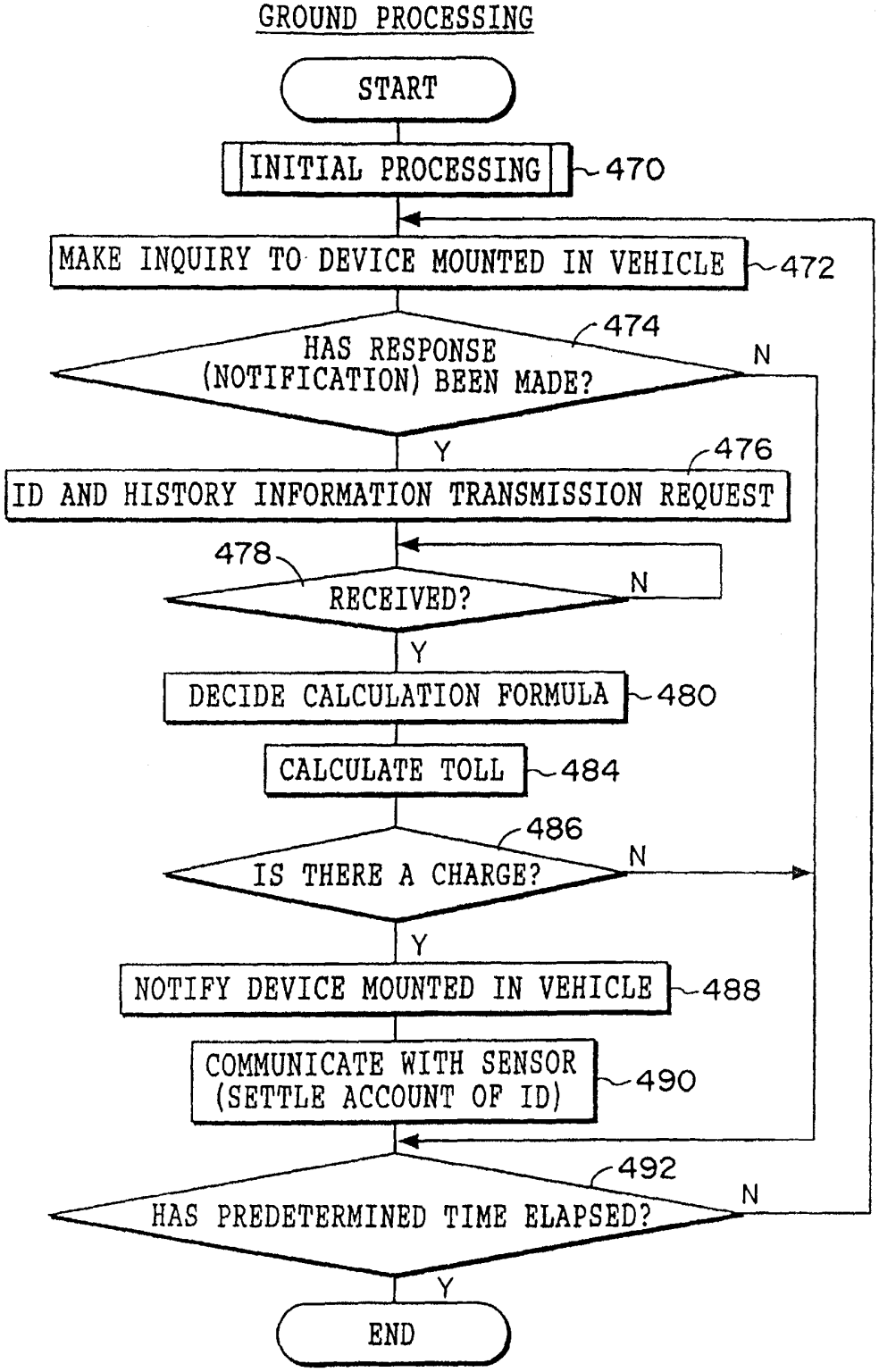
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FIG. 43 (CONTINUED)



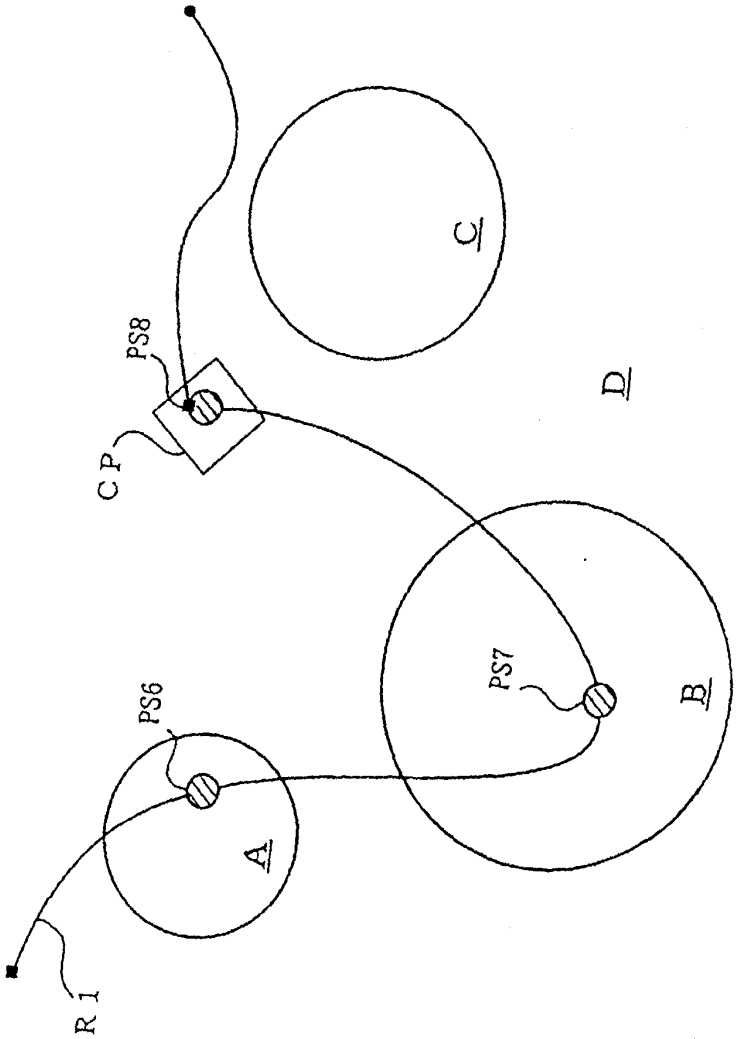
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FIG. 44



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FIG. 45



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FR Cite 2

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(75) Erfinder/Anmelder *(nur für US)*: OSTERHUBER, Ralf [DE/DE]; Gindlstr. 29a, 85055 Ingolstadt (DE).

(74) Anwälte: LE VRANG, Klaus usw.; Audi AG, Abteilung I/ET-3, 85045 Ingolstadt (DE).

(81) Bestimmungsstaat *(national)*: US.

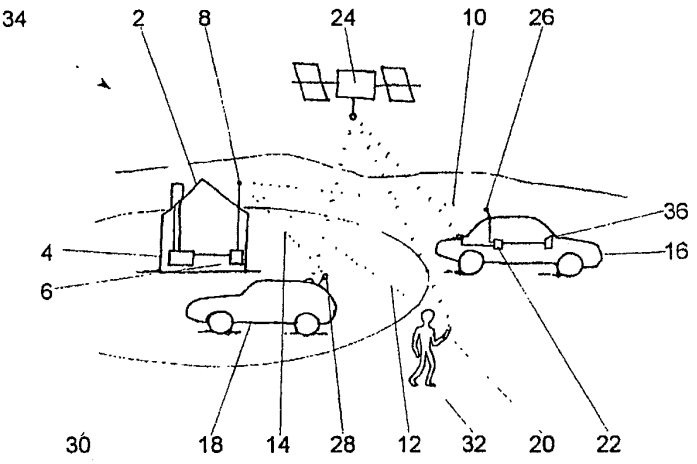
(84) Bestimmungsstaaten *(regional)*: europäisches Patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR).

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— *Mit internationalem Recherchenbericht.*
— *Vor Ablauf der für Änderungen der Ansprüche geltenden Frist; Veröffentlichung wird wiederholt, falls Änderungen eintreffen.*

[Fortsetzung auf der nächsten Seite]

(54) Title: REMOTE CONTROL SYSTEM WITH POSITION-DEPENDENT OPERATION

(54) Bezeichnung: FERNSTEUERUNGSANORDNUNG MIT POSITIONSABHÄNGIGEM BETRIEB



(57) Abstract: The invention relates to a control system for controlling an electrically controllable appliance (4) that is situated outside of a vehicle (16). Said controllable appliance (4) comprises a control device (6) with a receiver (8), and the vehicle comprises a device (22) for determining the position thereof and is equipped with a transmitter (26), which interacts with the receiver (8) of the controllable appliance (4). In addition, the control system comprises an electronic storage device (6) with geographic information including an item of information pertaining to the position of the controllable appliance (4), and is provided with an electronic data processing device (6). Said electronic data processing device correlates a position signal (10) from the position determination device (22), said position signal containing an item of information pertaining to the position of the vehicle (16), with the geographic information. The data processing device transmits a control signal to the control device (6) of the controllable appliance (4) when a correlation results in that a determined limiting value (30) of the distance between the position of the controllable appliance (4) and the position of the vehicle (16) is surpassed or fallen below of.

[Fortsetzung auf der nächsten Seite]

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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.

(57) Zusammenfassung: Bei dem erfindungsgemässen Steuerungssystem zum Steuern einer ausserhalb eines Fahrzeugs (16) angeordneten, elektrisch steuerbaren Einrichtung (4) weist die steuerbare Einrichtung (4) eine Steuerungsvorrichtung (6) mit einem Empfänger (8) auf und das Fahrzeug eine Vorrichtung (22) zur Bestimmung seiner Position und einen Sender (26), der mit dem Empfänger (8) der steuerbaren Einrichtung (4) zusammenwirkt. Das Steuerungssystem hat dabei ausserdem eine elektronische Speicherungsvorrichtung (6) mit geographischen Informationen einschliesslich einer Information über die Position der steuerbaren Einrichtung (4) und eine elektronische Datenverarbeitungsvorrichtung (6), die ein Positionssignal (10) aus der Positionsbestimmungsvorrichtung (22), welches eine Information über die Position des Fahrzeugs (16) enthält, mit den geographischen Informationen korreliert und ein Steuerungssignal an die Steuerungsvorrichtung (6) der steuerbaren Einrichtung (4) übermittelt, wenn die Korrelation ergibt, dass ein bestimmter Grenzwert (30) der Entfernung zwischen der Position der steuerbaren Einrichtung (4) und der Position des Fahrzeugs (16) über- oder unterschritten ist.

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FERNSTEUERUNGSANORDNUNG MIT POSITIONSABHÄNGIGEM BETRIEB

Die Erfindung betrifft ein Steuerungssystem nach Anspruch 1.

Im täglichen Berufs- und Privatleben wird eine kaum überschaubare Anzahl von elektrischen und elektronischen Einrichtungen als Hilfsmittel eingesetzt. Die meisten von ihnen sollen in Anwesenheit von Personen, die sich ihrer als Hilfsmittel bedienen, funktionieren und werden demgemäß von der Person zur Benutzung ein- und, wenn die Person das Hilfsmittel nicht mehr benötigt, von der Person auch wieder ausgeschaltet. Letzteres wird leicht einmal vergessen und kann in Abhängigkeit von der Einrichtung, insbesondere wenn die Person sich entfernt, schwerwiegende Folgen haben. Jedenfalls führt es zu unnötigem Verbrauch von Energie.

Einige solcher Einrichtungen oder Geräte benötigen vor ihrer Benutzung eine gewisse Vorlaufzeit. Bevor zum Beispiel Wärme in einem Gebäude spürbar wird, muß eine Heizung in dem Gebäude üblicherweise beträchtliche Zeit vorher eingeschaltet werden; bevor eine Kaffeemaschine Kaffee zubereitet hat, muß man sie einige Minuten zuvor anschalten und so weiter.

Der Erfindung liegt die Aufgabe zugrunde, ein Steuerungssystem für beliebige schaltbare, und daher elektrisch steuerbare Einrichtungen zu schaffen, welches die Bequemlichkeit und Sicherheit bei der Betätigung und dem Betrieb der Einrichtungen verbessert.

Diese Aufgabe wird erfindungsgemäß von einem Steuerungssystem mit den in Anspruch 1 formulierten Merkmalen gelöst. Vorteilhafte Ausgestaltungen der Erfindung sind in den Unteransprüchen angegeben.

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Im zivilen Transport- und Personenverkehr ist der Einsatz von Positionsbestimmungssystemen, insbesondere des GPS (Global Positioning System [Globales Positionsbestimmungssystem]), das zunächst für militärische Zwecke entwickelt wurde, bekannt und mittlerweile weit verbreitet. Ein derartiges Bestimmungssystem ermöglicht es zum Beispiel dem Fahrer eines Automobils - aber auch dem Steuermann eines Schiffs - seine geographische Position mittels Satellitenpeilung stets äußerst genau zu bestimmen und mit geographischen Informationen - üblicherweise in Form von "elektronischen Landkarten" - zu korrelieren. Die geographischen Informationen der elektronischen Landkarten sind in elektronischen Speicherungsvorrichtungen gespeichert. Eine elektronische Datenverarbeitungsvorrichtung führt die Korrelation aus. Die Position des Fahrzeugs kann dann üblicherweise auf einem Display im Fahrzeug sichtbar gemacht werden, wo neben der Position zum Beispiel Straßenverläufe der näheren Umgebung abgebildet werden, um die angezeigte Position der sichtbaren Umgebung zuordnen zu können.

Ebenfalls und nicht nur für Fahrzeuge bekannt und weit verbreitet sind Sender/Empfängersysteme insbesondere in Form von Mobiltelefonsystemen, die vorzugsweise mit dem bekannten GSM-Standard arbeiten (Global System for Mobile communication [Globales System für mobile Kommunikation]). Solche Sender/Empfängersysteme sind in der Lage, Informationen in Form von analogen oder digitalen Daten über Funk zu übermitteln.

Das erfindungsgemäße Steuerungssystem ermöglicht es, eine beliebige schaltbare, und daher elektrisch steuerbare Einrichtung aus einem Fahrzeug, in dem ein Benutzer sich der Einrichtung nähert oder sich von der Einrichtung entfernt, unter Verwendung einer Positionsbestimmungsvorrichtung der beschriebenen Art und unter Verwendung eines Sender/Empfängersystems der ebenfalls beschriebenen

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Art zu steuern. Dazu weist das erfindungsgemäße Steuerungssystem eine Positionsbestimmungsvorrichtung auf, welches die gegenwärtige Position des Fahrzeugs feststellt, sowie eine mit einer elektronischen Daten-Speicherungsvorrichtung in Signalverbindung stehende Datenverarbeitungsvorrichtung, die ein Informationssignal über die Position des Fahrzeugs aus der Positionsbestimmungsvorrichtung mit geographischen Informationen korreliert, welche in der Speicherungsvorrichtung gespeichert sind. Das erfindungsgemäße Steuerungssystem sendet ein Steuerungssignal aus der Datenverarbeitungsvorrichtung an die Steuerungsvorrichtung der steuerbaren Einrichtung, sobald die Datenverarbeitungsvorrichtung durch die Korrelation feststellt, daß ein bestimmter Grenzwert der Entfernung zwischen der Position des Fahrzeugs und der Position der steuerbaren Einrichtung über- oder unterschritten ist.

Diese entfernungsabhängige Betätigung der steuerbaren Einrichtung ermöglicht es, die vorzugsweise stationäre, vorzugsweise Haus-elektrische oder Haus-elektronische Einrichtung - Heizung, Garagentor, Kaffeemaschine, um nur einige Beispiele zu nennen - dann, wenn der Benutzer sich in dem Fahrzeug der steuerbaren Einrichtung nähert oder sich von ihr entfernt, genügend rechtzeitig und selbsttätig ein- oder auszuschalten.

Vorzugsweise sind die Speicherungsvorrichtung und die Datenverarbeitungsvorrichtung in dem Fahrzeug angeordnet. Somit können diejenigen entsprechenden Vorrichtungen erfindungsgemäß genutzt werden, welche bei bekannten Satellitennavigationssystemen in so ausgerüsteten Fahrzeugen ohnehin existieren. Ein erfindungsgemäßer Sender am Fahrzeug, der erfindungsgemäß mit einem Empfänger an der Steuerungsvorrichtung zusammenwirkt, übermittelt dann das Steuerungssignal von der Datenverarbeitungsvorrichtung im Fahrzeug an die Steuerungsvorrichtung der steuerbaren Einrichtung.

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Die meisten steuerbaren Einrichtungen, auf die sich die Erfindung richtet, werden im täglichen Leben nicht nur von einem Benutzer genutzt. Z.B. lebt in einer Wohnung oder einem Haus oft eine Familie, und zum Beispiel die Heizung soll nicht nur in Abhängigkeit vom Aufenthaltsort eines der Familienmitglieder gesteuert werden. Daher weist eine bevorzugte Ausführungsform des erfindungsgemäßen Steuerungssystems mindestens eine weitere Positionsbestimmungsvorrichtung mit einem weiteren Sender auf, der mit dem Empfänger an der Datenverarbeitungsanlage des Fahrzeugs zusammenwirkt und der ein Positionssignal aus der weiteren Positionsbestimmungsvorrichtung an den Empfänger des Fahrzeugs sendet. Die mindestens eine weitere Positionsbestimmungsvorrichtung kann entweder in einem weiteren Fahrzeug installiert sein oder - zum Beispiel für jüngere Familienmitglieder ohne Führerschein - auch als tragbare handheld-Vorrichtung, zum Beispiel in einem Handy, ausgestaltet sein.

Die Datenverarbeitungsvorrichtung korreliert nun auch das Positionssignal der weiteren Positionsbestimmungsvorrichtung mit den geographischen Informationen und schickt dann ein Steuerungssignal an die Steuerungsvorrichtung der steuerbaren Einrichtung, sobald die Korrelationen ergeben, daß bestimmte - wie beschrieben vorzugsweise programmierbare - Entfernungsgrenzwerte zwischen der Position der steuerbaren Einrichtung und den Positionen der Positionsbestimmungsvorrichtungen über- oder unterschritten sind.

Insbesondere bei den bevorzugten Steuerungssystem mit mehreren Positionsbestimmungssystemen, bei dem die Datenverarbeitungsvorrichtung mehrere Positionssignale zu korrelieren hat, bietet es sich erfindungsgemäß an, die Speicherungsvorrichtung und die Datenverarbeitungsvorrichtung, vorzugsweise stationär, bei der Steuerungsvorrichtung anzuordnen; (möglicherweise bei den mehreren Positionsbestimmungsvorrichtungen als Satellitennavigationssystem vorhandene Speicherungsvorrichtungen und

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Datenverarbeitungsvorrichtungen brauchen dann für das erfindungsgemäße Steuerungssystem nicht genutzt zu werden). Die erfindungsgemäßen Sender der Positionsbestimmungsvorrichtungen, die erfindungsgemäß mit dem Empfänger der Steuerungsvorrichtung zusammenwirken, senden dann die jeweiligen Positionssignale aus den Fahrzeugen und/oder tragbaren Positionsbestimmungsvorrichtungen zur Korrelation in die Datenverarbeitungsvorrichtung bei der steuerbaren Einrichtung.

Mittels des Steuerungssystems lassen sich erfindungsgemäß auch mehrere steuerbare Einrichtungen steuern, wobei jeder Einrichtung ein eigener Entfernungsgrenzwert zugeordnet sein kann, welcher vorzugsweise programmierbar ist, und zwar vorzugsweise entweder an der Datenverarbeitungsvorrichtung und/oder an der Steuerungsvorrichtung der steuerbaren Einrichtung.

Vorzugsweise weist auch die steuerbare Einrichtung einen Sender und die Datenverarbeitungsvorrichtung auch einen Empfänger auf. Auf diese Weise ist es erfindungsgemäß möglich, daß die steuerbare Einrichtung ein Informationssignal - zum Beispiel ein feedback-Signal - an das Fahrzeug sendet, wo eine entsprechende Information auf einem Display bewirkt wird.

Sender und Empfänger sind vorzugsweise und insbesondere in den Fahrzeugen Elemente von dort installierten Funktelefonanlagen.

Das erfindungsgemäße Steuerungssystem wird im folgenden mit Bezug auf die beigefügte Zeichnung beschrieben.

Die Figur zeigt schematisch eine räumliche Ansicht des erfindungsgemäßen Steuerungssystems.

In der Figur ist ein Haus 2 mit einer steuerbaren Heizungseinrichtung 4 erkennbar. Die Heizung 4 wird von einer Steuerungsvorrichtung 6 gesteuert.

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Die Steuerungsvorrichtung 6 weist einen Empfänger/Sender 8 zum Empfang von Positionssignalen 10, 12, 14 auf. Die Positionssignale 10, 12, 14 enthalten Informationen über die Positionen von zwei Fahrzeugen 16, 18 und von einer tragbaren Positionsbestimmungsvorrichtung 20, die in einem Handy integriert ist. Die Fahrzeuge 16, 18 sind mit einer fest installierten Positionsbestimmungsvorrichtung 22 (nur in Fahrzeug 16 dargestellt) in Form eines Satellitennavigationssystems ausgerüstet. Die Positionssignale 10, 12, 14 werden von den Positionsbestimmungsvorrichtungen 20, 22 mit Hilfe eines Satellitensystems 24 erzeugt und von Sendern/Empfängern 20, 26, 28 der Positionsbestimmungsvorrichtungen 20, 22 an den Empfänger/Sender 8 der Steuerungsvorrichtung 6 der Heizungsanlage 4 gesendet. Sender und Empfänger 8, 20, 26, 28 arbeiten mit dem bekannten GSM-Standard für Mobiltelefone, und sind im Falle des tragbaren Positionsbestimmungsvorrichtung 20 das Handy und bei den Fahrzeugen 16, 18 dort installierte Autotelefonanlagen.

Die Steuerungsvorrichtung 6 hat einen elektronischen Datenspeicher mit geographischen Informationen einschließlich einer Information über die Position der Heizungseinrichtung 4 sowie eine elektronische Datenverarbeitungsvorrichtung integriert. Die Datenverarbeitungsvorrichtung korreliert die empfangenen Positionssignale 10, 12, 14 mit den geographischen Informationen in der Speicherungsvorrichtung und erzeugt ein Steuerungssignal, wenn die Korrelation ergibt, daß ein bestimmter Grenzwert 30 der Entfernung zwischen dem Standort des Hauses 2 einerseits und andererseits den Positionen der Fahrzeuge 16, 18 und einer Person 32, die mit der tragbaren Positionsbestimmungsvorrichtung 20 zu Fuß unterwegs ist, über- oder unterschritten ist.

Im dargestellten Fall haben das Fahrzeug 16 und der Fußgänger 32 den Grenzwert 30 überschritten, während sich das Fahrzeug 18 innerhalb des Grenzwertes 30 - in der Nähe des Hauses 2, z.B. weil ein Bewohner des Hauses 2 nur kurz zu einem Einkauf in der Nähe des Hauses 2 gefahren war

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- befindet. Weil also nicht alle in das dargestellte Steuerungssystem 34 einbezogenen Teilnehmer 16, 18, 32 mit ihren zugeordneten Positionsbestimmungsvorrichtungen 20, 22 sich außerhalb des Grenzwertes 30, der hier auf ungefähr 100 km programmiert ist, befinden, steuert die Steuerungsvorrichtung 6 die Heizung 4, ihre Temperatur weiter zu halten und das Haus 2 weiter zu heizen. Sobald das Steuerungssystem 34 bei der Korrelation erkennt, daß auch das Fahrzeug 18 sich über den Entfernungsgrenzwert 30 hinaus bewegt hat, schaltet die Steuerungsvorrichtung 6 die Heizung 4 ab und erst dann wieder an, wenn einer der Teilnehmer 16, 18, 32 den Grenzwert 30 wieder unterschreitet.

Die Steuerungsvorrichtung 6 übermittelt außerdem Informationssignale 10, 12, 14 über ihren Zustand und den der Heizung 4 - zum Beispiel über die einwandfreie Funktion der Steuerungsvorrichtung 6 und die Temperatur der Heizung 4 - und bewirkt so eine Anzeige der Informationen auf einer Anzeige 36, die in dem Fahrzeug 16 ein Element des dort installierten Satellitennavigationssystems ist, sowie auf einem Display des Handy 20.

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Patentansprüche

1. Steuerungssystem zum Steuern einer außerhalb eines Fahrzeugs (16) angeordneten, elektrisch steuerbaren Einrichtung (4), wobei
   - die steuerbare Einrichtung (4) eine Steuerungsvorrichtung (6) mit einem Empfänger (8) aufweist und wobei
   - das Fahrzeug eine Vorrichtung (22) zur Bestimmung seiner Position und einen Sender (26) aufweist, der mit dem Empfänger (8) der steuerbaren Einrichtung (4) zusammenwirkt, und wobei
   - das Steuerungssystem (34) eine elektronische Speicherungsvorrichtung (6) mit geographischen Informationen einschließlich einer Information über die Position der steuerbaren Einrichtung (4) und eine elektronische Datenverarbeitungsvorrichtung (6) aufweist, die ein Positionssignal (10) aus der Positionsbestimmungsvorrichtung (22), welches eine Information über die Position des Fahrzeugs (16) enthält, mit den geographischen Informationen korreliert und ein Steuerungssignal an die Steuerungsvorrichtung (6) der steuerbaren Einrichtung (4) übermittelt, wenn die Korrelation ergibt, daß ein bestimmter Grenzwert (30) der Entfernung zwischen der Position der steuerbaren Einrichtung (4) und der Position des Fahrzeugs (16) über- oder unterschritten ist.

2. Steuerungssystem nach Anspruch 1, wobei die Speicherungsvorrichtung (22) und die Datenverarbeitungsvorrichtung (22) in dem Fahrzeug angeordnet sind und der Sender (26) des Fahrzeugs (16) das Steuerungssignal (10) an den Empfänger (8) der steuerbaren Einrichtung (4) sendet.

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3. Steuerungssystem nach Anspruch 1, wobei die Speicherungsvorrichtung (6) und die Datenverarbeitungsvorrichtung (6) bei der Steuerungsvorrichtung (6) der steuerbaren Einrichtung (4) angeordnet sind und der Sender (26) des Fahrzeugs (16) das Positionssignal (10) an den Empfänger (8) der steuerbaren Einrichtung (4) sendet.

4. Steuerungssystem nach einem der vorhergehenden Ansprüche mit mindestens einer weiteren Positionsbestimmungsvorrichtung (20) mit einem weiteren Sender (20), der mit dem Empfänger (8) der steuerbaren Einrichtung (4) zusammenwirkt, wobei die elektronische Datenverarbeitungsvorrichtung (6) auch ein Positionssignal (12) aus der weiteren Positionsbestimmungsvorrichtung (20), welches eine Information über die Position der weiteren Positionsbestimmungsvorrichtung (20) enthält, mit den geographischen Informationen korreliert und ein Steuerungssignal an die Steuerungsvorrichtung (6) sendet, wenn die Korrelation ergibt, daß auch ein weiterer bestimmter Grenzwert (30) der Entfernung zwischen der Position der steuerbaren Einrichtung (4) und der Position der weiteren Positionsbestimmungsvorrichtung (20) über- oder unterschritten ist.

5. Steuerungssystem nach Anspruch 4, wobei die weitere Positionsbestimmungsvorrichtung (20) in einem weiteren Fahrzeug (18) installiert oder von einer Person (32) tragbar ausgestaltet ist.

6. Steuerungssystem nach einem der vorhergehenden Ansprüche, wobei die steuerbare Einrichtung (4) stationär ist.

7. Steuerungssystem nach Anspruch 6, wobei die steuerbare Einrichtung (4) eine Haus-elektrische oder Haus-elektronische Einrichtung ist.

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8. Steuerungssystem nach einem der vorhergehenden Ansprüche, wobei die Positionsbestimmungsvorrichtungen (20, 22) GPS-Vorrichtungen sind.

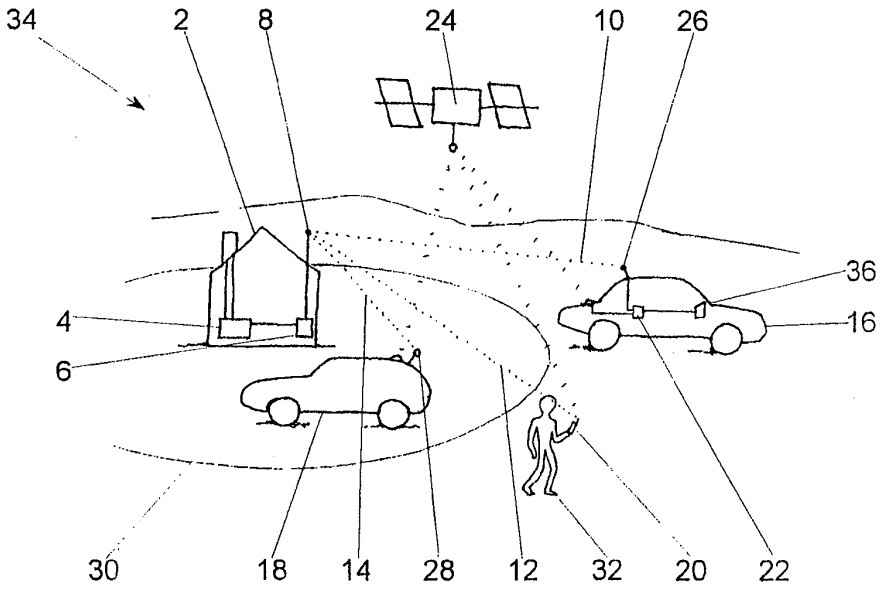
9. Steuerungssystem nach einem der vorhergehenden Ansprüche, wobei die Sender (8, 20, 26, 28) und die Empfänger (8, 20, 26, 28) GSM-Vorrichtungen sind.

10. Steuerungssystem nach einem der vorhergehenden Ansprüche, wobei die Sender (26, 28) und die Empfänger (26, 28) in den Fahrzeugen (16, 18) Elemente von in dem Fahrzeugen (16, 18) installierten Telefonanlagen sind.

11. Steuerungssystem nach einem der vorhergehenden Ansprüche, wobei die Grenzwerte (30) an der Datenverarbeitungsanlage (6, 22) und/oder an der Steuerungsvorrichtung (6) einstellbar sind.

12. Steuerungssystem nach einem der vorhergehenden Ansprüche, wobei die Steuerungsvorrichtung (6) der steuerbaren Einrichtung (4) auch einen Sender (8) aufweist und im Bereich der Positionsbestimmungsvorrichtung (20, 22) auch einen Empfänger (20, 26, 28) angeordnet ist, wobei der Sender (8) der steuerbaren Einrichtung (4) ein Informationssignal (10, 12, 14) mit Information über die steuerbare Einrichtung (4) und/oder ihre Steuerungsvorrichtung (6) an den Empfänger (20, 26, 28) der Positionsbestimmungsvorrichtung (20, 22) sendet, wobei das Informationssignal eine Information auf einer Anzeige (20, 36) im Bereich der Positionsbestimmungsvorrichtung (20, 22) bewirkt.

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Figur

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INTERNATIONAL SEARCH REPORT

Intern .ial Application No
PCT/EP 00/12106

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G08C17/02 G01C21/26

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 G08C G01C H04B

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, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	WO 00 17737 A (KONINKL PHILIPS ELECTRONICS NV) 30 March 2000 (2000-03-30) page 3, line 18 - line 34 page 6, line 29 -page 7, line 26 page 12, line 30 -page 14, line 4	1-12
P,X	WO 00 54007 A (KUNIMATSU YOSHIMASA ;TOKAI RIKA CO LTD (JP); NAGASAKA CHIKAO (JP);) 14 September 2000 (2000-09-14) abstract	1-12

☐ Further documents are listed in the continuation of box C.

☒ 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)

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"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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Date of the actual completion of the international search	Date of mailing of the international search report
23 May 2001	31/05/2001

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	Lõpez-Pérez, M-C

1

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

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Intern. nal Application No
PCT/EP 00/12106

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0017737 A	30-03-2000	BR 9906952 A	03-10-2000
		CN 1288539 T	21-03-2001
		CN 1288540 T	21-03-2001
		WO 0017738 A	30-03-2000
		WO 0018070 A	30-03-2000
		WO 0017789 A	30-03-2000
		EP 1044400 A	18-10-2000
		EP 1046261 A	25-10-2000
		EP 1046097 A	25-10-2000
		EP 1044422 A	18-10-2000
WO 0054007 A	14-09-2000	JP 2000258169 A	22-09-2000

Form PCT/ISA/210 (patent family annex) (July 1992)

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INTERNATIONALER RECHERCHENBERICHT

Intern. ıales Aktenzeichen
PCT/EP 00/12106

A. KLASSIFIZIERUNG DES ANMELDUNGSGEGENSTANDES
IPK 7 G08C17/02 G01C21/26

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

B. RECHERCHIERTE GEBIETE

Recherchierter Mindestprüfstoff (Klassifikationssystem und Klassifikationssymbole)
IPK 7 G08C G01C H04B

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, PAJ, INSPEC

C. ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie°	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
P,X	WO 00 17737 A (KONINKL PHILIPS ELECTRONICS NV) 30. März 2000 (2000-03-30) Seite 3, Zeile 18 - Zeile 34 Seite 6, Zeile 29 -Seite 7, Zeile 26 Seite 12, Zeile 30 -Seite 14, Zeile 4	1-12
P,X	WO 00 54007 A (KUNIMATSU YOSHIMASA ;TOKAI RIKA CO LTD (JP); NAGASAKA CHIKAO (JP);) 14. September 2000 (2000-09-14) Zusammenfassung	1-12

☐ Weitere Veröffentlichungen sind der Fortsetzung von Feld C zu entnehmen

☒ Siehe Anhang Patentfamilie

° Besondere Kategorien von angegebenen Veröffentlichungen :
"A" Veröffentlichung, die den allgemeinen Stand der Technik definiert, aber nicht als besonders bedeutsam anzusehen ist
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Europäisches Patentamt, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Lõpez-Pérez, M-C

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INTERNATIONALER RECHERCHENBERICHT

Angaben zu Veröffentlichungen, die zur selben Patentfamilie gehören

Interna ales Aktenzeichen
PCT/EP 00/12106

Im Recherchenbericht angeführtes Patentdokument	Datum der Veröffentlichung	Mitglied(er) der Patentfamilie	Datum der Veröffentlichung
WO 0017737 A	30-03-2000	BR 9906952 A	03-10-2000
		CN 1288539 T	21-03-2001
		CN 1288540 T	21-03-2001
		WO 0017738 A	30-03-2000
		WO 0018070 A	30-03-2000
		WO 0017789 A	30-03-2000
		EP 1044400 A	18-10-2000
		EP 1046261 A	25-10-2000
		EP 1046097 A	25-10-2000
		EP 1044422 A	18-10-2000
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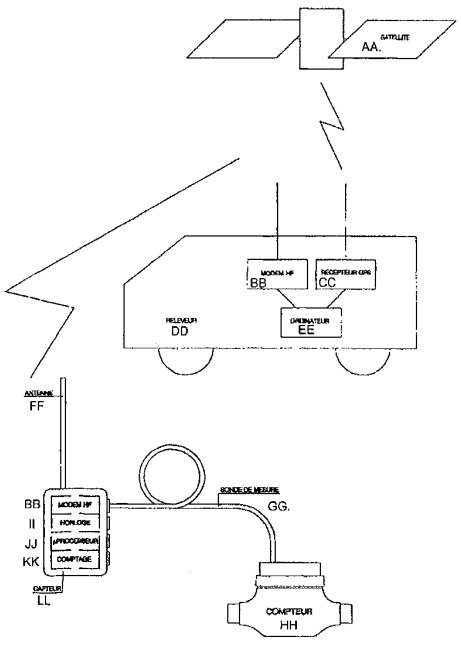
Déclaration en vertu de la règle 4.17 :
— *relative à l'identité de l'inventeur (règle 4.17.i)) pour toutes les désignations*

Publiée :
— *sans rapport de recherche internationale, sera republiée dès réception de ce rapport*

En ce qui concerne les codes à deux lettres et autres abréviations, se référer aux "Notes explicatives relatives aux codes et abréviations" figurant au début de chaque numéro ordinaire de la Gazette du PCT.

(54) **Title:** STAND-ALONE REMOTE READING SYSTEM IN THE FIELD OF METER READING

(54) **Titre :** SYSTEME AUTONOME DE RELEVE A DISTANCE DANS LE DOMAINE DU COMPTAGE



(57) Abstract: The invention concerns a system for remote meter reading based on a stand-alone sensor enabling transmission by microwave links of data concerning the meter associated therewith. Said system uses GPS positioning, with accurate management of the available electric power and with a fractal communication protocol.

(57) Abrégé : Ce système de lecture de compteurs à distance est basé sur un capteur autonome permettant de transmettre par liaisons hertziennes les informations relatives au compteur qui lui est associé. Ce système fait appel au positionnement GPS, à une gestion précise de l'énergie électrique disponible et à un protocole de communication fractale.

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DESCRIPTION DE L'INVENTION

a) Titre de l'invention

"Système autonome de relevé à distance dans le domaine du comptage".

b) Domaine technique visé

Le domaine technique auquel se rapporte l'invention est celui de la lecture de compteur. Actuellement l'accessibilité au compteur en vue d'en effectuer la lecture est malaisée.

Les compteurs les plus utilisés sont des compteurs domestiques : eau, gaz et électricité.

c) Etat actuel de la technique

L'état actuel de la technique oblige les compagnies d'eau, gaz et électricité à pratiquer un relevé qui nécessite la présence d'un agent près du compteur.

Les applications actuelles du relevé à distance ont, quant à elles, un ou plusieurs inconvénients, à savoir :

- Présence d'un câble d'alimentation,
- Présence d'un fil de communication,
- Dans le cas d'une alimentation par pile, la durée de vie de celle-ci est insuffisante,
- Dans le cas d'une transmission radio à basse puissance, celle-ci est très erratique et difficilement localisable,
- Dans le cas d'une transmission radio haute puissance, l'Institut Belge de la Protection Technique (IBPT) exige une licence d'utilisation. Cette exigence est valable également pour l' Europe.

d) Exposé de l'invention

L'invention comprend 2 ensembles : le capteur installé près du compteur et le releveur installé dans un véhicule.

1°) Le capteur

Le capteur se présente sous la forme d'un petit boîtier étanche (1) qui extérieurement reçoit les informations de 4 compteurs au moyen de 4 sondes (2) et d'une antenne (3). Ce capteur est installé à proximité immédiate du ou des compteurs à relever.

Intrinsèquement, ce capteur est constitué d'un émetteur de 10mW maximum (4) – conformément aux normes fixées par l' IBPT -, d'un récepteur (5), d'un système de gestion composé d'un microprocesseur (6) – auquel sont traditionnellement attachées deux mémoires, la première contenant le logiciel de traitement des données et l'autre dans laquelle il stocke et gère les données -, une horloge d'éveil (7), ayant pour fonction de cadencer les ordres et d'opérer le réveil du microprocesseur, ainsi que 3 piles alcalines (8).

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Le microprocesseur est classiquement relié aux sondes par un interface ou adaptateur (9).

Le choix de la gestion des piles est en relation étroite avec leur fréquence de renouvellement et doit se faire au même rythme que le changement du compteur afin de minimiser les interventions chez l'abonné.

La durée de vie maximale d'un compteur est imposée par le service de métrologie du pays concerné (12 ans pour la Belgique).

Afin de minimiser la consommation du capteur, celui-ci n'est pas alimenté la plupart du temps (environ 99.98 % du temps). Seule l'horloge interne reste alimentée en permanence par les piles.

Sur le plan fonctionnel, le capteur se met régulièrement, soit toutes les 10 secondes, à l'écoute (à l'aide du récepteur) pendant un laps de temps extrêmement court, soit 2 millisecondes c'est-à-dire le temps nécessaire au microprocesseur afin d'analyser le passage de trois caractères. Si pendant ce laps de temps, le récepteur capte une bribe d'information plausible, appelé "mot de synchronisation" ou "caractère de pré-alerte", en provenance du véhicule ou d'un capteur voisin, le microprocesseur prolongera son temps d'écoute jusqu'à ce qu'il ne capte plus aucune information plausible circulant sur les ondes (bruit hertzien).

Si pendant le temps prolongé d'écoute, le capteur reçoit un message le concernant, il émet automatiquement les différents index (max.4) du compteur auquel il est attaché. Ces index sont totalisés et mémorisés dans le capteur; ils sont en parfait synchronisme avec les totalisateurs mécaniques des compteurs ce qui permet une éventuelle vérification.

2°) Le releveur

La base principale du releveur est un ordinateur portable auquel est adjoint un émetteur/récepteur (Modem haute fréquence ou modem HF) et un récepteur GPS (système de positionnement global).

Le modem HF permet d'établir une communication avec le capteur sur une distance inférieure à 300 mètres compte tenu de la faible puissance de l'émetteur (conformément aux normes imposées par l'IBPT).

Le tout est embarqué dans un véhicule sillonnant la zone dans laquelle le relevé des index doit être effectué.

La réception GPS permet de localiser le véhicule en temps réel (en fonction du positionnement en longitude et latitude).

e) Fonctionnement

Dans la mémoire de l'ordinateur est installé un fichier comprenant par client deux paramètres importants à savoir : les coordonnées GPS du capteur et son numéro d'identification.

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Compte tenu de la faible puissance des émetteurs utilisés (ndlr : portée inférieure à 300 m), il est nécessaire pour le releveur de déterminer la localisation des capteurs dans un rayon de 300 m, cette détermination est effectuée via le fichier de base et le récepteur GPS.

Grâce à ce système, il n'existe plus aucune relation entre le véhicule sillonnant la voirie et le releveur embarqué.

Les avantages apportés par cette invention peuvent être énumérés comme suit :

- Pas de câble d'alimentation du capteur,
- Pas de fil pour la télécommunication avec le capteur,
- Installation du capteur très aisée (corollaire des deux points précédents),
- Le matériel haute fréquence utilisé nécessite uniquement une agréation mais pas de licence d'utilisation,
- Le véhicule embarquant le releveur peut avoir une fonction différente (ex : camion pour la récolte des immondices),
- Les rendez-vous auprès des abonnés pour le relevé des index ne sont plus nécessaires,
- Le problème du changement de locataire ne se pose plus.

f) Description de la mise en œuvre du système pour un professionnel

La description de la fabrication du système pour un professionnel dans le domaine des télécommunications est la suivante (cfr : fig.1).

1°) Le capteur

Le cœur du système est une horloge dont la consommation d'énergie est minime qui met en éveil le microprocesseur ainsi que le récepteur pendant un laps de temps très court par rapport à la période de sommeil. Les impulsions en provenance des sondes sont comptabilisées dans la mémoire et provoquent en même temps l'éveil du microprocesseur pour que celui-ci puisse gérer l' événement.

Sur le plan de la programmation, le message transmis par le capteur est composé d'une suite de caractères (octets). Ces caractères seront toujours précédés d'un "mot de synchronisation" ou "caractère de pré-alerte" reconnaissable par tous les capteurs. Ceci permet de prolonger la courte période de réveil aussi longtemps que ces mots de synchronisation sont présents (période d'alerte) afin de permettre au releveur de transmettre intégralement son message.

Dans le cas du capteur, la suite de caractères comporte :

- Un préambule de synchronisation pour l'horloge de réception du releveur (composé de 2 caractères),
- Un caractère spécial précisant que le message est issu du capteur,
- Un caractère formant le numéro de la version du programme interne au capteur,
- Un caractère pour le type de réponse,

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- 4 caractères comprenant l'index à relever,
- Un CRC 16 (Cyclic redundant check) inclus dans 3 caractères permettant au capteur d'analyser la vraisemblance du message.

2°) Le releveur

Le schéma de principe du releveur (cfr.fig.1) comporte 3 éléments physiques importants :

- Un PC portable ou industriel (1) équipé d'un programme de gestion,
- Un récepteur GPS (2),
- Un modem HF (communication haute fréquence avec les capteurs) (3).

Grâce au récepteur GPS, le programme de gestion permet de localiser le véhicule à tout moment. Lorsqu'une position quelconque est définie, notamment au travers d'un fichier client, il est possible de déterminer dans le champ d'un rayon d'action (≅ 300 m) les capteurs susceptibles d' être interrogés.

Pendant ce temps, le véhicule parcourt une certaine distance et le cycle peut recommencer.

Dans l'hypothèse où un capteur ne réponde pas – suite, par exemple, à un parasitage momentané -, celui-ci sera interrogé à nouveau autant de fois qu'il sera nécessaire pour peu qu'il reste dans le rayon d'action du releveur.

Dans le cas du releveur, la suite de caractères comporte :

- Un préambule de synchronisation pour l'horloge de réception du capteur (2 caractères),
- Un caractère spécial précisant que le message est issu du releveur,
- Un caractère indiquant le nombre de caractères transmis depuis le caractère suivant jusqu'à y compris le CRC,
- 4 caractères formant le numéro du capteur à atteindre,
- Un caractère pour le type de commande,
- Un CRC16 (Cyclic redundant check).

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REVENDICATIONS

1. Un émetteur-récepteur (MODEM HF) et un récepteur GPS, tous deux montés sur un ordinateur portable **caractérisé en ce que** leur utilisation simultanée et combinée permet d'établir une communication avec un émetteur HF à faible puissance à une distance inférieure ou égale à 300 mètres par un repérage via satellite en fonction du positionnement longitudinal et latitudinal de cet émetteur.

2. Ordinateur portable muni d'un émetteur-récepteur (MODEM HF) **caractérisé en ce qu'** il est équipé d'un récepteur GPS afin de l'orienter de façon autonome.

3. Capteur constitué d'un boîtier étanche relié par sonde à quatre compteurs, muni d'une antenne et d'un émetteur de 10 mW max. (MODEM HF), d'un microprocesseur et de trois piles alcalines **caractérisé en ce qu'** il y est adjoint une horloge qui régulièrement met en éveil le microprocesseur et le récepteur pendant un laps de temps extrêmement court ce qui permet une utilisation économique de l'énergie des piles et, partant, un allongement de leur durée de vie.

4. Capteur suivant la revendication sous 3) **caractérisé en ce que** la programmation du microprocesseur permet la prolongation de la période de réveil du récepteur et du microprocesseur et le transfert automatique par voie hertzienne des données (c'est à dire les différents indices des compteurs) en cas et pendant la durée de réception d'une information plausible distincte du simple bruit hertzien, appelée "mot de synchronisation".

5. Capteur suivant la revendication sous 4) et ordinateur portable muni d'un émetteur-récepteur (MODEM HF) et équipé d'un récepteur GPS **caractérisé en ce que** leur utilisation combinée permet la lecture automatique à distance d'indices de compteurs pour une durée d'autonomie de 12 années consécutives.

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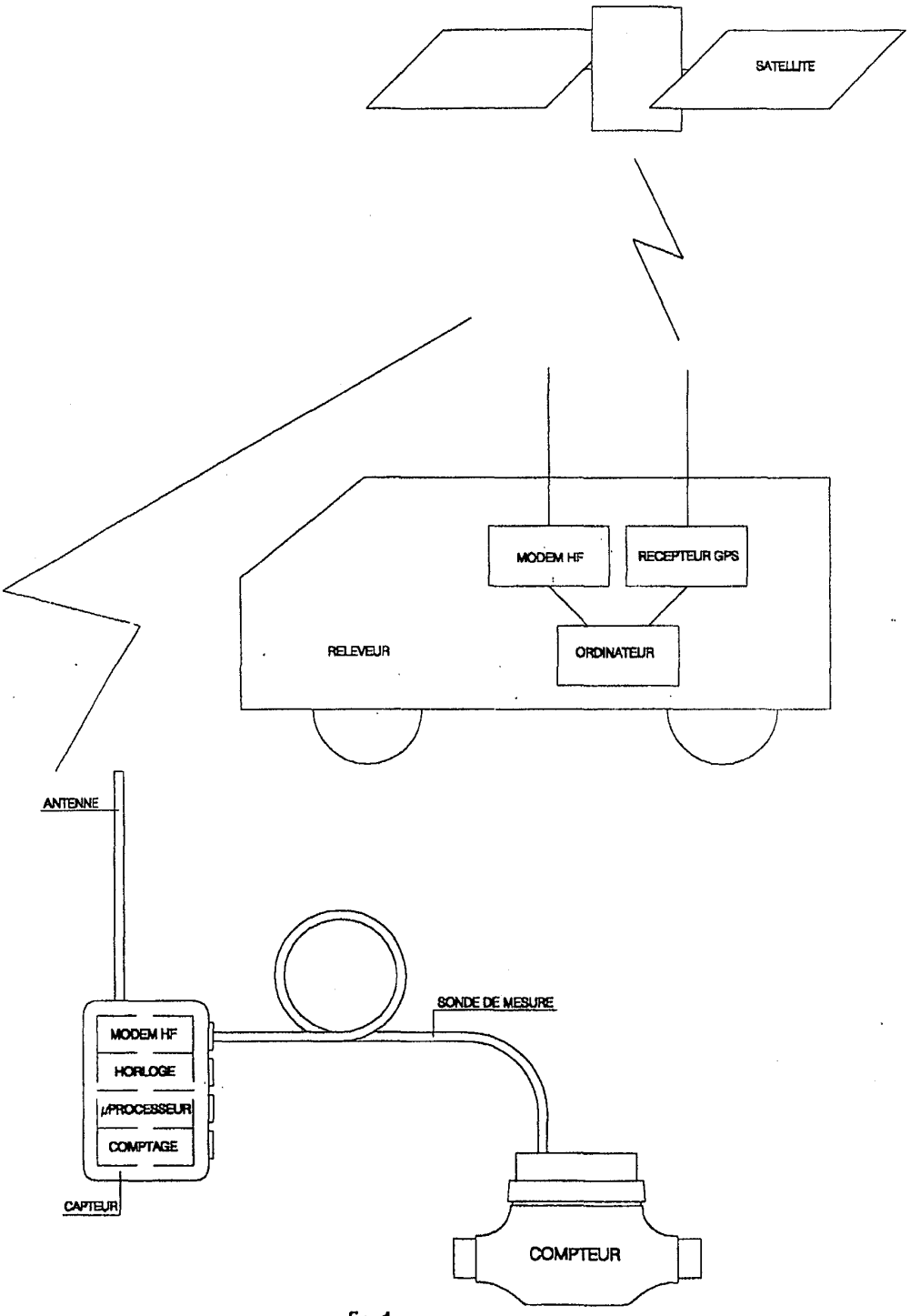


fig.1

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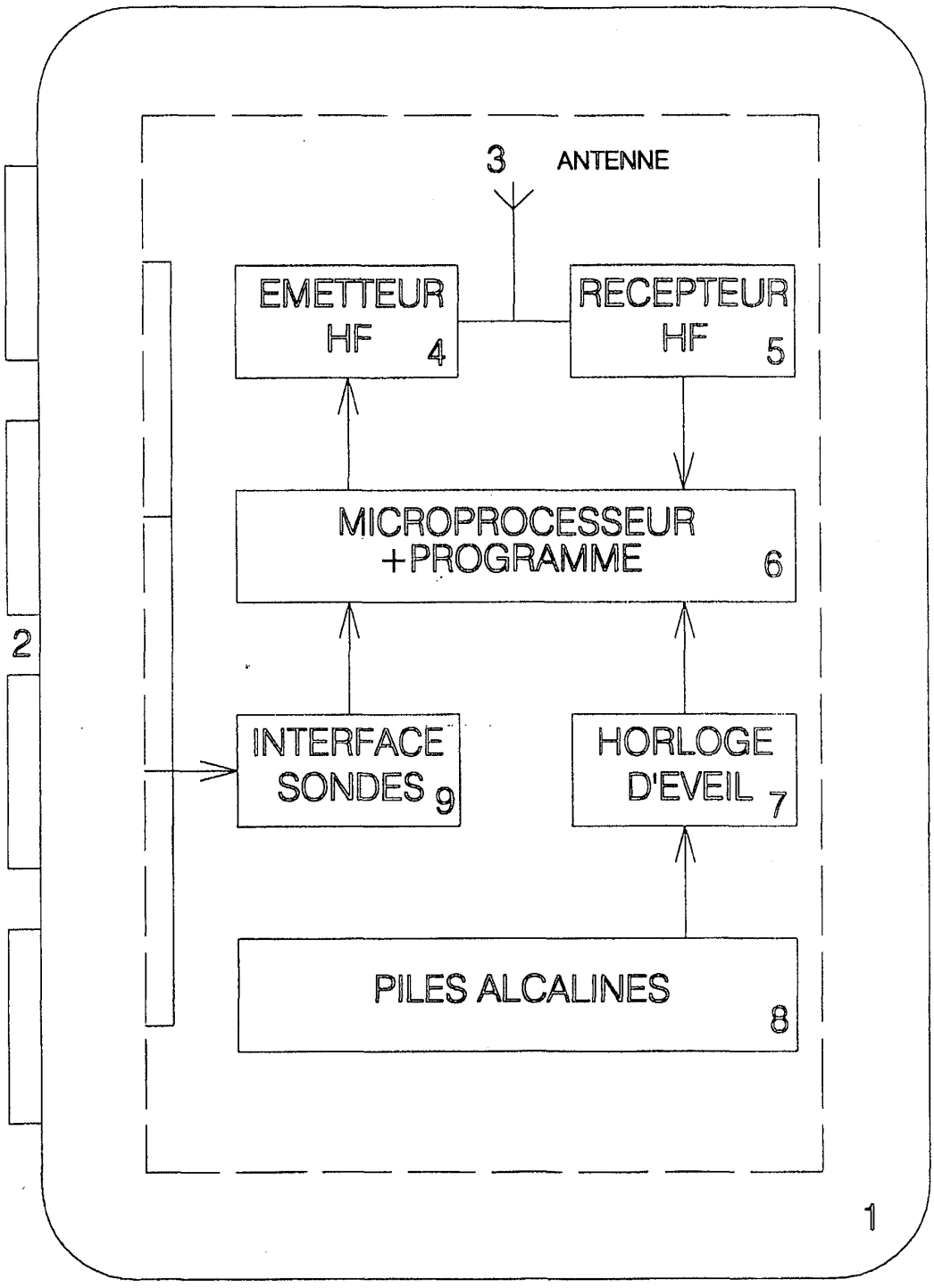


fig.2

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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	James Ashley Jr.	Examiner:	Kwang Bin Yao
Serial No.:	12/350,817	Group Art Unit:	2473
Filed:	January 8, 2009	Docket No.:	081221-011500/US
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 February 10, 2011.

Michele Peña

Name: Michele I. Peña

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 office action on the merits**, and therefore, Applicant believes no fee is required;

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☐ 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.

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(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

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☐ 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: February 10, 2011

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CLAIMS

What is Claimed is:

1. A system for remote data collection, assembly, and storage comprising:

a computer configured to execute at least one computer program that formats and stores select information for retrieval upon demand from a remotely located device, said computer integrated with a wide area network (WAN);

at least one wireless transmitter configured to transmit select information and transmitter identification information;

a plurality of transceivers dispersed geographically at defined locations configured to receive select information transmitted from at least one nearby wireless transmitter and further configured to transmit the select information, the transmitter identification information and transceiver identification information; and

at least one gateway connected to the wide area network configured to receive and translate the select information, the transmitter identification information, and transceiver identification information, said gateway further configured to further transmit the translated information to the computer over the WAN.

2. The system defined in claim 1, the computer program further comprising:

a first segment for evaluating received information to identify an originating transmitter;

a second segment for evaluating the received information and identifying transceivers that relayed the select information from the originating transmitter to the gateway;

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a third segment for evaluating the select information transmitted from the originating transmitter embedded within the received information; and

a fourth segment responsive to the first, second, and third segments for determining an action to be taken based upon the select information, the identified originating transmitter, and the identified transceivers.

3. The system as defined in claim 1, wherein each wireless transmitter is configured to transmit a relatively low-power radio-frequency (RF) signal.

4. The system as defined in claim 1, wherein each wireless transmitter is integrated with a sensor.

5. The system as defined in claim 1, wherein each transceiver is configured to receive a RF signal.

6. The system as defined in claim 5, wherein each transceiver is further configured to transmit a RF signal.

7. The system as defined in claim 6, wherein the RF signal contains a concatenation of information comprising select information and transmitter identification information from the originating transmitter and transceiver identification information for each transceiver that receives and repeats the RF signal.

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8. The system as defined in claim 7, wherein the at least one transmitter is replaced by a transceiver, the transceiver further integrated with an actuator.

9. The system as defined in claim 8, wherein the transceivers are configured to communicate with the gateway via a RF signal.

10. The system as defined in claim 9, wherein the computer is further configured to respond to received select information by communicating a control signal to at least one transceiver, wherein the actuator integrated with the transceiver is responsive to the control signal.

11. The system as defined in claim 10, wherein select transceivers further include a microphone, a speaker, and means for communicating two-way voice information to the WAN via the transceivers.

12. The system as defined in claim 1, wherein the gateway is permanently connected to the WAN.

13. The system as defined in claim 1, wherein the gateway includes one selected from the group consisting of: a modem for establishing a dial-up connection with a remote computer; a network card for communicating across a local area network; a network card for communicating across the WAN; a DSL modem; and an ISDN card to permit backup access to the computer.

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14. The system as defined in claim 1, wherein the gateway translates the select information, the transmitter identification, and the transceiver identification information into TCP/IP for communication over the WAN.

15. The system as defined in claim 1, wherein the WAN is the Internet.

16. The system as defined in claim 1, wherein the WAN is a dedicated Intranet.

17. The system as defined in claim 1, further including a first lookup table that is utilized by the first segment, wherein the first lookup table is configured to associate a plurality of unique transmitter identification numbers with a plurality of unique transmitter identifiers, wherein each transmitter identification number is uniquely associated a unique transmitter identifier.

18. The system as defined in claim 17, further including a second lookup table that is utilized by the second segment, wherein the second lookup table is configured to associate a plurality of unique transceiver identification numbers with a plurality of unique geographic locations, wherein each transceiver identification number is uniquely associated with a unique geographic location.

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19. The system as defined in claim 18, further including a third lookup table that is utilized by the third segment, wherein the first lookup table is configured to associate a plurality of unique transmitter codes with a plurality of unique information fields associated with the transmitter codes, wherein each transmitter code is uniquely associated with a unique information field.

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

adaptively configuring at least one transmitter with a sensor wherein the transmitter generates an information signal consisting of a transmitter identification code and an information field;

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

translating the information signal within the gateway into a WAN compatible data transfer protocol;

transferring the information signal via the WAN to a computer wherein the computer is configured to manipulate and store data provided in the information signal; and

granting client access to the computer.

21. The method of claim 20, wherein the WAN is the Internet.

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22. The method of claim 20, wherein the WAN is an Intranet.

23. The method of claim 20, wherein the computer is configured to provide the information in hypertext mark-up language (HTML).

24. The method of claim 20, wherein clients access the information using a web browser.

25. The method of claim 20, wherein the step of adaptively configuring at least one transmitter is modified to replace the sensor with a global positioning system receiver.

26. A method for controlling a system comprising:

remotely collecting data from at least one sensor;

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;

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transmitting the RF control signal;

receiving the RF control signal;

translating the received RF control signal into an analog signal; and

applying the analog signal to an actuator to effect the desired system response.

27. The method of claim 26, wherein the RF signal contains a concatenation of information comprising encoded data information and transmitter identification information from an originating transmitter.

28. The method of claim 27, wherein the step of transmitting the RF signal is further performed by at least one transceiver, wherein the transceiver is configured to concatenate a transceiver identification code to the RF signal.

29. The method of claim 27, 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.

30. The method of claim 27, wherein the steps of translating and applying the received RF control signal are performed only by an identified transceiver electrically integrated with an actuator.

31. The method of claim 27, wherein the network is the Internet.

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32. The method of claim 27, wherein the network is an Intranet.

33. The method of claim 27, wherein the network transfer protocol is TCP/IP.

34. A system for monitoring remote devices comprising:

at least one sensor adapted to generate an electrical signal in response to a physical condition;

at least one wireless transmitter configured to encode the electrical signal, the wireless transmitter further configured to transmit the encoded electrical signal and transmitter identification information in a radio-frequency (RF) signal;

at least one gateway connected a wide area network (WAN) configured to receive and translate the RF signal, the gateway further configured to deliver the encoded electrical signal and transmitter identification information to a computer on the WAN; and

a computer configured to execute at least one computer program that formats and stores select information responsive to the electrical signal for retrieval upon demand from a remotely located device.

35. The system defined in claim 34, the at least one computer program further comprising:

a first segment for evaluating received information to identify an originating transmitter;

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a second segment for evaluating the received information and identifying transceivers that relayed the select information from the originating transmitter to the gateway;

a third segment for evaluating the select information transmitted from the originating transmitter embedded within the received information; and

a fourth segment responsive to the first, second, and third segments for determining an action to be taken based upon the select information, the identified originating transmitter, and the identified transceivers.

36. The system as defined in claim 34, wherein each wireless transmitter is configured to transmit a relatively low-power radio-frequency (RF) signal.

37. The system as defined in claim 34, wherein the at least one gateway is permanently connected to the WAN.

38. The system as defined in claim 34, wherein the gateway translates the encoded electrical signal, the transmitter identification, and the transceiver identification information into TCP/IP for communication over the WAN.
wherein the WAN is the Internet.

39. The system as defined in claim 34, wherein the WAN is the Internet.

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40. The system as defined in claim 34, wherein the WAN is a dedicated Intranet.

41. The system as defined in claim 35, further including a first lookup table that is utilized by the first segment, wherein the first lookup table is configured to associate a plurality of unique transmitter identification numbers with a plurality of unique transmitter identifiers, wherein each transmitter identification number is uniquely associated a unique transmitter identifier.

42. The system as defined in claim 41, further including a second lookup table that is utilized by the second segment, wherein the second lookup table is configured to associate a plurality of unique transceiver identification numbers with a plurality of unique geographic locations, wherein each transceiver identification number is uniquely associated with a unique geographic location.

43. The system as defined in claim 41, further including a third lookup table that is utilized by the third segment, wherein the first lookup table is configured to associate a plurality of unique transmitter codes with a plurality of unique information fields associated with the transmitter codes, wherein each transmitter code is uniquely associated with a unique information field.

44. A system for controlling remote devices comprising:

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a computer configured to execute at least one computer program that generates at least one control signal responsive to a system input signal; said computer integrated with a wide area network (WAN);

at least one gateway connected to the WAN configured to receive and translate the at least one control signal; said gateway further configured to transmit an RF signal containing the control signal and destination information;

at least one wireless transceiver 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

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.

45. The system defined in claim 44, the system input signal comprising:

a concatenation of information including data from a sensor, transceiver identification information from the originating transceiver, and transceiver identification information for each transceiver that receives and repeats the RF signal.

46. The system defined in claim 44, at least one computer program further comprising:

a first segment for evaluating a system input signal to identify an originating transceiver;

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