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PTO/SB/05 (4/98)

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11/21/00 JC921 U.S. PTO

UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 C.F.R. ∋1.53(b))

Attorney Docket No.	705835US1RAF
First Inventor or Application Identifier	Xi Jiang
Title	ROUTE-BASED COMMUNICATION PLANNING ARCHITECTURE AND METHOD FOR WIRELESS COMMUNICATION
Express Mail Label No.	Express Mail Label No. EL536120471US

APPLICATION ELEMENTS
See MPEP Chapter 600 concerning utility patent application contents.

ADDRESS TO: Assistant Commissioner for Patents
Box Patent Application
Washington, D.C. 20231

JC921 U.S. PTO 09/718007 11/21/00

1. _X_ *Fee Transmittal Form (e.g. PTO/SB/17)
(Submit an original and a duplicate for fee processing)

2. _X_ Specification [Total Pages _37_]
(preferred arrangement set forth below)
-Descriptive title of the Invention
-Cross References to Related Applications
-Statement Regarding Fed Sponsored R&D
-Reference to Microfiche Appendix
-Background of the Invention
-Brief Summary of the Invention
-Brief Description of the Drawings (if filed)
-Detailed Description
-Claims(s)
-Abstract of the Disclosure

3. _X_ Drawing(s) (35 U.S.C. 113) [Total Sheets _8_]

4. Oath or Declaration [Total Pages _2_]
a. _X_ Newly executed (original or copy)
b. __ Copy from a prior application (37 C.F.R.∋ 1.63 (d))
(for continuation/divisional with Box 16 completed)

i. __ DELETION OF INVENTOR(S)

Signed statement attached deleting inventor(s) Named in the prior application, see 37 C.F.R. ∋∋ 1.63(d)(2) and 1.33 (b).

5. __ Microfiche Computer Program (Appendix)

6. Nucleotide and/or Amino Acid Sequence Submission
(If applicable, all necessary)

a. __ Computer Readable Copy

b. __ Paper Copy (identical to computer copy)

c. __ Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

7. __ Assignment Papers (cover sheet & document(s))

8. __ 37 C.F.R. ∋ 3.37(b) Statement __ Power of *(when there is an assignee)* Attorney

9. __ English Translation Document (if applicable)

10. __ Information Disclosure Statement (IDS)/PTO-1449 __ Copies of IDS Citations

11. __ Preliminary Amendment

12. _X_ Return Receipt Postcard MPEP 503)

13. __ Statement (s) (PTO/SB/09-12) __ Statement filed in prior application, Status still proper and desired

14. __ Certified Copy of Priority Document(s) (if foreign priority is claimed)

15. __ Other:

**NOTE FOR ITEMS 1 & 13: IN ORDER TO BE ENTITLED TO PAY SMALL ENTITY FEES, A SMALL ENTITY STATEMENT IS REQUIRED (37 C.F.R. ∋ 1.27), EXCEPT IF ONE FILED IN A PRIOR APPLICATION IS RELIED UPON (37 C.F.R. ∋ 1.28).*

16. **If a CONTINUING APPLICATION**, Check appropriate box, and supply the requisite information below and in a preliminary amendment:
__ Continuation __ Divisional __ Continuation-in-part (CIP) of prior application No._____
Prior application information: Examiner_____
FOR CONTINUATION OR DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 4b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

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Signature	R. A. Fuller III	Date	11/20/00

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FEE TRANSMITTAL For FY 1999

Patent fees are subject to annual revision.
Small Entity payments must be supported by a small entity statement, otherwise large entity fees must be paid. See Forms PTO/SB/09-12.

Complete if Known	
Application Number	Unknown
Filing Date	November 21, 2000 (Express Mail)
First Named Inventor	Xi Jiang
Examiner Name	Unknown
Group / Art Unit	Unknown
Attorney Docket No.	705835US1RAF

JC921 U.S. PTO 09/718007 11/21/00

TOTAL AMOUNT OF PAYMENT	($) 1594.00

METHOD OF PAYMENT (check one)

1. ☒ The Commissioner is hereby authorized to charge indicated fees and credit any over payments to:

Deposit Account Number: 03-1800

Deposit Account Name: DaimlerChrysler Intellectual Capital Corporation

☒ Charge Any Additional Fee Required Under 37 CFR 1.16 and 1.17

2. ☐ Payment Enclosed:
☐ Check ☐ Money Order ☐ Other

FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
101	710	201	355	Utility filing fee	710
106	320	206	160	Design filing fee	
107	490	207	245	Plant filing fee	
108	710	208	355	Reissue filing fee	
114	150	214	75	Provisional filing fee	
				SUBTOTAL (1)	710

2. EXTRA CLAIM FEES

			Extra Claim		Fee from below		Fee Paid
Total Claims	38	-20** =	18	X	324	=	324
Independent Claims	10	- 3** =	7	X	560	=	560
Multiple Dependent					270	=	0

**or number previously paid, if greater; For Reissues, see below

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
103	18	203	9	Claims in excess of 20
102	80	202	40	Independent claims in excess of 3
104	270	204	135	Multiple dependent claim, if not paid
109	80	209	40	** Reissue independent claims over original patent
110	18	210	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($) 884

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
105	130	205	65	Surcharge-late filing fee or oath	
127	50	227	25	Surcharge-late provisional filing fee or cover sheet.	
139	130	139	130	Non-English specification	
147	2,520	147	2,520	For filing a request for examination	
112	920*	112	920*	Requesting publication of SIR prior to Examiner action	
113	1,840*	113	1,840*	Requesting publication of SIR after Examiner action	
115	110	215	55	Extension for reply within first month	
116	390	216	195	Extension for reply within second month	
117	890	217	445	Extension for reply within third month	
118	1,390	218	695	Extension for reply within fourth month	
128	1,890	228	945	Extension for reply within fifth month	
119	310	219	155	Notice of Appeal	
120	310	220	155	Filing a brief in support of an appeal	
121	270	221	135	Request for oral hearing	
138	1,510	138	1,510	Petition to institute a public use proceeding	
140	110	240	55	Petition to revive – unavoidable	
141	1,210	241	605	Petition to revive – unintentional	
142	1,240	242	620	Utility issue fee (or reissue)	
143	440	243	220	Design issue fee	
144	600	244	300	Plant issue fee	
122	130	122	130	Petitions to the Commissioner	
123	50	123	50	Petitions related to provisional applications	
126	240	126	240	Submission of Information Discl. Stmt.	
581	40	581	40	Recording of each patent assignment per property (times number of properties)	
146	710	246	355	Filing a submission after final rejection (37 CFR 1.129(a))	
149	710	249	355	For each additional invention to be examined (34 CFR 1.129(b))	
Other fee (specify)					
Other fee (specify)					

* Reduced by Basic Filing Fee Paid SUBTOTAL (3) ($) 0

SUBMITTED BY				Complete (if applicable)	
Typed or Printed Name	Roland A Fuller III			Reg. Number	31,160
Signature	R A. Fuller III	Date	11/20/00	Deposit Account User ID	

APPLICATION FOR LETTERS PATENT OF
THE UNITED STATES OF AMERICA

Entitled

ROUTE-BASED COMMUNICATION PLANNING ARCHITECTURE AND METHOD FOR WIRELESS COMMUNICATION

Inventor:

Xi Jiang

Docket #: 705835US1RAF

Attorney Docket No. 705835US1RAF

Route-Based Communication Planning Architecture and Method for Wireless Communication

This invention relates to mobile wireless communication, and more particularly, to a method of planning which of various wireless communication options to utilize for wireless communication in a mobile environment when one or more wireless communication options may be available for use, based on the location of the mobile user, the route the mobile user is travelling, and the availability of the various wireless communication options along the route.

Background of the Invention

Increasing numbers of vehicles come equipped with some form of "telematics" service platforms. Telematics services are those services enabled by a three-way marriage among vehicles, computing and communication technologies, and is sometimes used to mean the wireless linkage of vehicles to data networks, particularly the internet. These telematics service platforms are able to carry out various intelligent transportation system services, such as reporting a vehicle's status and position to a service center and provide certain applications such as emergency and safety assistance. In the next few years, more telematics products will be made available and eventually, most if not all vehicles will have some form of telematics platform that will offer various services, such as emergency services (*e.g.,* emergency communication in the event of an incident, such as airbag deployment), navigation services, concierge and transaction services (*e.g.,* restaurant information, hotel reservation), communication and personal information

services (*e.g.*, E-mail, calendar services), information services (*e.g.*, stock information, personalized news, sightseeing information), entertainment services (*e.g.*, interactive games, music downloads), and so forth.

These telematics service platforms require the use of some type of wireless communication. Since wireless communication is generally expensive relative to non-wireless communication (e.g., cellular phone calls versus land line phone calls), the ability of these telematics products to use wireless communication options in the most cost effective manner will be an important factor in the success of vehicular telematics. By wireless communication options, it is meant the various wireless communication networks available, discussed below, the various levels of service that each type of wireless communication network has available (i.e. transmission power level), as well as any other option that may now be available or will be available in the future for wireless communication.

In the near future, a variety of wireless communication options will be available for use by wireless communication devices in vehicles, such as satellite, cellular phone and short-range radio frequency (RF) links. These systems differ in cost, bandwidth and coverage. For example, in urban areas and along the major highways, emerging technologies, such as GPRS (general packet radio service) will be deployed in the U.S. in the next few years and will offer "always-on connections" and packet oriented data communications at higher bandwidths than today. Improved code division multiple access (CDMA) technology such as W-CDMA will also likely be established. Also, the Ricochet 2 metropolitan area access (MAN) wireless network will soon be available in 48 major metropolitan areas in the United States covering a very large percentage of the

population . These new wireless networks typically provide a higher bandwidth than existing wireless networks, such as the first generation cellular network (AMPS -- Advanced Mobile Phone System) and the second-generation cellular networks (GSM -- Global System for Mobile Communications; CDMA – Code Division Multiple Access; and TDMA -- Time Division Multiple Access).

A general method to evaluate the existing and emerging wireless communication networks and services for data communication is to examine their cost and performance levels. The first generation AMPS cellular systems typically have a maximum data transfer rate of 9600 bps and the second generation digital wireless communication systems have a maximum bandwidth of 14.4 kbps. The new third generation cellular systems will have maximum bandwidths of around 128 kbps or even 384 kbps. Since the charge for cellular communication is high, particularly when compared to even interstate land line phone calls, the cost for transferring data using these systems can be quite high. For example, the cost to transfer one mega-byte of data using the second generation digital wireless communication systems runs around $15.00 or higher. If a mobile user wants to obtain a large amount of content, the cost of doing so with cellular wireless communication can be quite high, making mobile data communication involving large amounts of data cost prohibitive to many potential users.

Fig. 1 provides a general illustration of the presently available wireless communication systems. They include regional area wireless networks 10, wide area wireless networks 12, metropolitan area networks 14, and local area networks 16. Regional area wireless networks 10 provide coverage over a large geographic region, such as the coverage provided by satellite based cellular communication networks and its

cost varies greatly. Wide area networks 12 are exemplified by the existing land based cellular phone systems mentioned above. They provide coverage over a relatively large geographic region, but to a lesser extent than regional area networks because the wide area networks utilized land based base station systems that individually have only a small geographic coverage. To obtain the wide area coverage, multiple base station systems must be spread throughout the coverage area with some degree of overlap in coverage. Thus, the geographic coverage provided by a given cellular phone system is often determined by population density and/or travel density in that locating base station systems in sparsely populated, lightly traveled geographic areas may not be cost justified. Metropolitan area networks 14, as the name implies, provide coverage only in metropolitan areas. The most well known type of metropolitan area network is Metricom's Richochet2 network architecture. Wireless local area networks 16 provide very limited geographic coverage, typically on the order of 100 yards or less. Because of this limited geographic coverage, wireless local area networks have not been used to any extent in mobile communications and their application has been pretty much limited to use in office environments and the like where the work stations that are connected to the wireless local area network are located in close proximity to each other. One such of wireless local area network is the 802.11 wireless LAN.

Initially, when the cellular systems first became popular, the wide area network AMPS network was used. More recently, cellular systems have added the second-generation digital networks to the wide area networks being used as well as the satellite based regional area networks and the metropolitan area networks. As these additional networks have been added to the networks available for mobile communication use,

cellular in particular, mobile communication devices such as newer generation cell phones have been provided the capability to switch between various networks. For example, a cellular phone can utilize the first generation AMPS network or the second generation digital networks (such as GPRS, GSM and CDMA), and even the satellite based networks.

When the mobile communication device switches among wireless networks, this is known as vertical handoff. A simple form of vertical hand-off would involve a cell phone having multi-network capability selecting which network to use based upon factors such as cost, availability and performance and switching to a second network if coverage from the first network is lost. Vertical handoff is more than just the ability to use more than one wireless network. In this regard, the cellular phone must maintain the same phone number even when it has switched networks. For example, a user having a cell phone that has both analog and digital capability might select the digital network if it was available because it has better quality than the analog network, but select the analog network if digital coverage was not available. (In today's environment, the analog network has broader coverage than digital coverage.)

More sophisticated mobile communication devices will perform the vertical handoff automatically. For example, if a cellular phone has tri-mode capability of using the analog network, digital network, and satellite network, the phone might select the network to use based in order of preference and availability. The user would have entered an order of preference into the phone telling it to use the analog network if its available, then the digital network and then the satellite network. Assuming that the phone first connected to the analog network, the phone would switch to the digital

network if the user moves out of the analog coverage area, and then to the satellite network if the user moves out of both the analog and digital coverage area. Typically, the phone decides to switch based upon whether it is in the coverage area of a given network usually determined by signal strength from the network's antennas. One of the problems that this technique has is that by the time a determination is made that the network being used should be switched, there may be a loss of service due to the time that it takes to make the switchover. Also, if the switch is from a more expensive network to a lesser expensive network, such as from the satellite network to either the digital or analog network, the switch from the satellite network may not be accomplished when the user first enters the coverage area for the analog or digital network, resulting the user paying longer than necessary for the more expensive satellite network.

Vertical handoff is a well-understood technology in the mobile computing field. In general, it is about how to automate the connection status and routing table updates on top of the mobile Internet Protocol (Mobile IP) technology. However, due to the unpredictable nature of wireless network boundaries, there is often an abrupt cut-off of service when the boundary is reached. Consequently, the overall direction of vertical hand-off research is generally focused on quick recovery schemes, such as preventative multicast to neighboring base stations.

Accordingly, it is an objective of the present invention to provide a predictive method of achieving seamless vertical handoff in a wireless communication system.

It is a further objective of the present invention to utilize the bandwidth available with local area networks for mobile communication, even though the geographic coverage of local area networks is limited.

Summary of the Invention

In order to achieve the forgoing objectives, a method is provided for selecting which of a plurality of wireless communication options will be used by a mobile communication device based on the location of the mobile communication device on a route, the route, and the availability for use of each of the plurality of wireless communication options along the route. In a further embodiment of the inventive method, information indicative of coverage areas for the wireless communication options available along the route are stored in a database by storing boundary locations of the coverage areas for the wireless communication options along the route where the boundary locations stored are boundary locations that are on streets of the route. In a further embodiment, updated information about the coverage areas is periodically obtained and the database updated accordingly.

In another embodiment of the invention, a uniform content layer application program interface is provided for application programs that use mobile communication provided by a mobile communication device. Information concerning any wireless communication options that are available for use by the mobile communication device as it traverses a route is stored in a database. The application program decide which wireless communication option to use based upon the information about the wireless communication options in the database.

In a further embodiment of the invention, a method of fueling a vehicle with information through a wireless communication device in the vehicle is provided. A predicted time when the vehicle will be able to communicate with an info-fueling station having a predictable geographic position is determined. A request for information from

the vehicle is sent through the wireless communication device to at least one wireless communication network. The information is routed from an information source in communication with the wireless communication network to the info-fueling station. The requested information is downloaded to the vehicle through the info-fueling station during the time that the wireless communication device in the vehicle is in communication range of the info-fueling station.

Brief Description of the Drawings

The present invention will become more fully understood from the detailed description and the accompanying drawings, in which:

Fig. 1 is a pictorial illustration of "prior art" wireless communication systems;

Fig. 2 is a systems interaction diagram of an embodiment of the present invention;

Fig. 3 is a pictorial illustration of wireless communication options used in the method of Fig. 2;

Fig. 4 is a pictorial representation a wireless coverage database record format in accordance with an embodiment of the present invention;

Fig. 5 is a block diagram of a route-dependent communication planning architecture according to an embodiment of the present invention;

Fig. 6 is a schematic of a data structure for monitoring and reporting wireless coverage along routes in accordance with an embodiment of the present invention;

Fig. 7 is a flow chart of a monitoring routine used in an embodiment of the present invention;

Fig. 8 is a system interaction diagram of a method of performing route dependent vertical handoff in accordance with an embodiment of the present invention;

Fig 9 is a map of the route traversed by a vehicle containing a wireless communication device with reference to Fig. 8; and

Fig 10 is an illustrative graph showing how an application may describe its preferred wireless communication requirements in accordance with an embodiment of the present invention.

Detailed Description of the Preferred Embodiments

Referring to Figs. 2 and 3, the route-based communication planning method of according to the present invention is described. (The elements of Fig. 1 that are common to Figs. 2 and 3 are identified with the same reference number.) This method is particularly advantageous for use with mobile wireless data communication applications, such as telematics applications, where data is being transmitted to and from the vehicle and will be described in that context, although the method is not limited to mobile wireless data communication applications.

A vehicle 18 has a mobile data communications device 20, illustratively, a computer having one or more wireless modems. This computer could be an off the shelf computer, such as a notebook computer, a personal digital assistant, or a computer built into the vehicle or another mobile device (*e.g.*, a cellular phone having data communication capability). The mobile communications device 20 has a communication availability monitor 34 which has a database of wireless communication network coverage information 22 (shown representatively in Fig. 4) and a communication

manager 36. Vehicle 18 also has a navigation system 26, such as that currently available in Mercedez-Benz vehicles. The navigation system 26 provides information describing a route 24 that the vehicle traverses and the location of the vehicle in the route, which it determines in a known fashion, such as from information obtained from a global positioning satellite 28.

As vehicle 18 traverses route 24, the mobile data communications device 20 is checking to determine what wireless communication networks and systems are available at particular points in the route, as described in more detail below. Based on the availability of the various wireless communication networks, the mobile communications device 20 determines which one it should use when it reaches each particular point and more specifically, if it should switch networks. If mobile communications device 20 determines that it should switch networks, such as from WAN 12 to MAN 14, it initiates the vertical handoff. Preferably, it does so in advance of reaching the predetermined point in the route, so that when the vehicle 18 reaches the predetermined point, the vertical hand-off occurs seamlessly and with minimum delay. Illustratively, the mobile communication device 20 knows how much time it takes to accomplish the vertical hand-off and, based on data such as the vehicle speed and the route the vehicle will take to reach the particular point, and initiates the request for the vertical handoff an appropriate amount of time in advance of the vehicle reaching the particular point so that the vertical handoff occurs seamlessly when the vehicle reaches the predetermined point.

More specifically, when vehicle 18 starts, communication availability monitor 34 obtains information about route 24, illustratively from an external source such as the vehicle's navigation system 26. It then creates a database of the coverage areas of the

wireless networks and systems that mobile communication device 20 can use as it traverses route 24. Communication availability monitor 34 at T0 informs communication manager 36 what wireless networks and systems are available, which in the example of Figs. 2 and 3, are WAN 12 and satellite network 10. Communication manager 36 then determines which wireless network to use, illustratively WAN 12 for reasons such as better cost or performance, and at T1 connects mobile communication device 20 to WAN 12.

As vehicle 18 traverses route 24, it reaches a point along the route that is a coverage boundary for MAN 14, indicated at T2-T4 (or just before the coverage boundary), where MAN 14 coverage is available. At T2, communication service availability monitor 34 informs communication manager 36 that MAN 14 coverage is now available. Communication manager 36 determines, based on factors such as cost and performance, that the network to which mobile data communication device 20 is connected should be switched from WAN 12 to MAN 12. At T3, communication manager 36 connects mobile data communication device 20 to MAN 14 and after the connection is established, disconnects mobile data communication device 20 from WAN 12 at T4.

Skipping to T14 (T5 – T13 are described below), when communication service availability monitor 34 determines that the vehicle will travel out of the coverage area for MAN 14 within a certain period of time, such as thirty seconds, it informs communication manager 36. At T15, communication manager 36 connects vehicle 18 to WAN 12, which communication manager determined was the best available choice, and at T16, disconnects vehicle 18 from MAN 12.

Referring to Fig. 5, an illustrative architecture 40 for the route dependent communication planning invention is shown. Architecture 40 includes wireless service availability monitor 34, communication manager 36 and communication protocol stacks 38, all of which are illustratively implemented in software as part of mobile communication device 20. Wireless service availability monitor 34 includes wireless coverage manager 42, location manager 44 and integrated position sensors 46. Integrated position sensors 46 are illustratively known types of position sensors that can determine the geographic location of an object, such as an inertial guidance system, a GPS system, and can also comprise an interface with the navigation system 26 of vehicle 18. Architecture 40 also includes navigation system 26, that is coupled to wireless coverage manager 42, and one or more applications 47 that communicate with communication manager 36 as described below.

Although shown separately from wireless coverage manager 42 in Fig. 5, location manager 44 and wireless coverage manager 42 logically interact to the point where they can both be considered part of wireless coverage manager 42. Location manager 44 keeps track of the current location of vehicle 18 and notifies wireless coverage manager 42 when vehicle 18 reaches a location registered by wireless coverage manager 42. Wireless coverage manager 42 maintains network coverage database 22 and issues commands to communication manager 36 to initiate route based vertical handoff. Integrated position sensors 46 obtain data indicative of the vehicle's geographic position, such as latitude and longitude, from sources such as the vehicle's navigation system 26 regarding the route 24 and the location of vehicle 18 on route 24.

As mentioned, wireless coverage manager 42 maintains network coverage database 22 (Fig. 4). Information regarding the coverage for each particular network is obtained from available sources, such as the network provider and signal strength monitoring by mobile communication device 20. Illustratively, this information is obtained by communication manager 36 and passed on to wireless coverage manager 42 for processing and eventual storage in network coverage database 22. From this information, the boundary locations of the network coverage on all the streets are determined and these boundary locations stored in network coverage database 22.

In an illustrative embodiment, the streets are divided into sections where a street section is a portion of a street in a digital map used in the navigational software used by the vehicle's navigational system 26. Each street section is illustratively identified with a unique integer, which allows easy sorting of the whole database by street. Network boundary locations are the locations on particular street sections where boundaries for the wireless networks lies. Latitude and longitude values, illustratively obtained by integrated position sensors 46, are stored to pinpoint each boundary location. A radius is also specified for each boundary location so that its location is precisely specified. An illustrative organization of database 22 is shown in Fig. 6.

Wireless coverage manager 42 also updates the network coverage database 22 as updated network coverage information is received, such as from communication manager 36. Wireless coverage manager 42 illustratively reacts to updated coverage information in one of two ways. If the update is for a location not presently in network coverage database 22, wireless coverage manager 42 processes and stores it in network coverage database 22 in the manner described above. If the update is for a location that is

presently in network coverage database 22, it compares the information for that location stored in network coverage database 22 with the update information (as processed), and if the update information is different, updates the information in network coverage database 22 for that location.

Preferably the running average method is used to make the update. The location value generated by the running average method lies somewhere between the old value and the update value. The exact position is determined by a parameter, illustratively determined heuristically, that shifts the location value a certain percentage toward the update location value. In this way, an abnormal update value would not destroy the integrity of the network coverage database. If the update value persists in subsequent updates, then the value stored in the network coverage database for that location will eventually align itself to the update value.

Wireless coverage manager 42 also predicts the network coverage for a particular route. Information regarding route 24 that vehicle 18 is taking can be read in from a file or, as discussed above, obtained from the vehicle's navigation system 26. Wireless coverage manager 42 then develops a list of wireless network and systems boundary locations along route 24 that vehicle 18 is traversing and registers this list with location manager 44, *e.g,* communicates the list to location manager 44 which stores it. Wireless coverage manager 42 also determines route turning points and registers these points with location manager 44. When wireless coverage manager 42 is notified by location manager 44 that a registered location is about to be reached, as described below, it checks to see if this registered location is a network boundary and if so, whether it is appropriate to switch networks. It may be that the preferred network is being used and the network

boundary about to be reached is for a different network. Also, it may be that even if the preferred network is not being used and the registered location about to be reached is a network boundary for the preferred location, the amount of time that the vehicle will be in a coverage area for the preferred network is so small that switching is not justified. If coverage manager determines that networks should be switched, it sends a command to communication manager 36 to initiate the vertical hand-off to switch networks.

Location manager 44 accepts the list of boundary locations along route 24 from wireless coverage manager 42 and stores it. Each location is specified in terms of the following information:

- Street section (same information that is stored in the network coverage data base 22 for the particular street section)
- Latitude, longitude (the location that location manager monitors for)
- Notification radius (specifies how far ahead of reaching the registered location either in distance or in time that location manager 44 notifies the registering component, usually, wireless coverage manager 42)
- Notification status (specifies whether this location should be continuously monitored or if it is to be checked one time only)
- Call back address (handler through which location manager 44 gives the notification)

Illustratively, the data base structure for the database where location manager 44 stores the registered location information is very similar to the structure of network coverage database 22.

Location manager 44 also obtains information regarding the street on which vehicle 18 is traveling from an external component, such as vehicle navigation system 26. Each time vehicle 18 turns onto a new street, location manager 44 accesses its database for the list of registered locations on the new street and uses this list as the monitoring list.

Fig. 7 is an illustrative monitoring routine used by location manager 44. At step 100, location manager 44 obtains the current location of vehicle 18 and its speed from integrated position sensors 46. At step 102, location manager 44 determines whether any of the locations in the monitoring list will be reached in the next time period, illustratively, one second. Location manager 44 makes this determination illustratively based on the speed of vehicle 18. In this regard, the speed information obtained by location manager 44 from integrated position sensors 46 is illustratively averaged with the prior speed information, using the running average method, and the averaged speed used to make the determination of whether a registered location will be reached in the next time period, illustratively, one second. This prevents the use of speed information that might not be representative of the speed of the vehicle over the next second, which might be the case in the event of quick braking or acceleration. If location manager 44 determines that a registered location will be reached in the next time period, it notifies the component that registered the location, usually wireless coverage manager 42, at step 104, and proceeds to step 106. If not, location manager proceeds to step 106. At step 106, location manager updates its monitoring list if appropriate, such as removing a registered location that was reached if it was registered for one time notification only. Location manager then waits for one time period at 108 and returns to step 100 and starts

the monitoring routine over. Once the vehicle travels within the radius for the registered location, location manager 44 notifies the registering component that the registered location has been reached.

Fig. 10 is a graph showing an example of how applications 47 can interact with communications manager 36 to describe its communication requirement. This figure shows time to obtain content versus acceptable cost. This curve could be implemented as part of an application 47, as part of communication manager 36 and accessed by each application 47 via communication manager 36, or as a separate database to which each application 47 has access. An application 47 illustratively decides to request all the content from the current day's Internet edition of a major newspapers. The application 47 then can use the curve of Fig. 10 to decide the amount of time to request that the content be obtained in. For example, the requesting application 47 can review the curve of Fig. 10 and determine that the content can be obtained in less than five seconds at a cost of $0.50 or obtained in less than five minutes at a cost of $0.01. Since a ten minutes difference in delivery time makes little difference when dealing with news content published daily, the application 47 requests communication manager 36 to obtain the content within ten minutes at the lowest possible cost. Communication manager 36 then utilizes this information in determining which wireless service to use to obtain the content and when to use it. This interaction process between applications 47 and communications manager 36 will be termed herein as the unified content access layer API (applications program interface).

In an illustrative embodiment, the curve, such as shown in Fig. 10, would not need to be defined in its totality, but could be approximated by a few points, such as the

highest cost/ shortest time, median cost, median time, and lowest cost/longest time. Also, in the example of Fig. 10, the factors considered are cost versus time, but it should be understood that these factors are illustrative only and the decision curve used by communication manager 36 can include other or alternative factors, such as power consumption, security, and others, and the methodology described will be equally applicable.

The key importance of Fig. 10 is that it shows a particular method to design and implement the API for unified content access layer. The unified content access layer is mainly composed of communication manager 36 and various other supporting components such as wireless service availability monitor 34. The general method to communicate in today's Internet is the TCP/IP socket based programming model in which an application interacts with the operating system's TCP/IP stack and open TCP channels for communication with other network computers. This model is fully supported by the unified content access layer. By allowing applications to describe their communication requirements such as cost and performance, the direct TCP/IP socket based communication method is even enhanced because wireless network options will be chosen accordingly to accommodate each application's needs. Furthermore, a general delayed communication transaction model will be provided to applications so that they can simply request the sending and receiving of some data objects. This model is similar to FTP or HTTP GET method, in which an application describes a data object it needs to receive or send using a URL (for example a web page address) to the communication manager along with its requirement as shown in Fig. 10. The communication manager is

in turn responsible for using the best wireless communication method at right place/time for the applications in the right order to attempt to satisfy all the applications' needs.

In particular, an application now has an API for the following features:

1. An application can describe its communication requirements in terms of duration, bandwidth, cost, etc. to the unified content access layer.
2. The unified content access layer can describe the available wireless options along the route and a general wireless communication quality prediction to the applications so that they would be able to decide when to use a particular wireless option.
3. An application can now describe a data object for sending/receiving and associated timing and cost requirements to the unified content access layer. The unified content access layer will find the best way to achieve the requests received from all the applications.

An example of the interaction of elements of architecture 40 is described with reference to Figs. 8 and 9. At T100, vehicle 18 (not shown in Figs. 9 and 10) starts and navigation system 26 determines the location of vehicle 18 on route 300, illustratively, the street location that vehicle 18 is at. At T101, navigation system 26 passes this information, such as vehicle 18 is on highway 82 at location (x,y), to wireless coverage manager 42. At T102, wireless coverage manager 42 looks up what wireless services are available at this location in network coverage database 22, which in the example shown in Figs. 9 and 10, is MAN and WAN, and passes this information to communications manager 36. At T103, communication manager 36 decides which wireless service to use, which in the example shown is MAN, based on factors such as cost and performance.

At T104, navigation system 26 figures out the details of route 300 and passes this information to wireless coverage manager 42, such as vehicle 18 will travel south on highway 82 for ten minutes, turn south onto highway 85 and travel south on highway 85 for fifteen minutes, turn south on highway 280 and travel south on highway 280 for twenty minutes, and so on. At T105, wireless coverage manager 42, using the details about route 300 passed to it by navigation system 26, accesses network coverage database 22 and develops a prediction of the wireless communication services availability for route 300, for example, as vehicle 18 travels route 300, it will have seventeen minutes of MAN coverage availability and thereafter will only have WAN coverage available. At T106, wireless coverage manager 42 requests location manager 44 to monitor for the MAN coverage boundary on highway 85.

At T107, navigation system 26 informs location manager 44 of the location of vehicle 18 on route 300 and its speed. At T108, location manager 44 determines that vehicle 18 is about to cross the MAN coverage boundary on highway 85 and informs wireless coverage manager 42 that vehicle 18 will cross the MAN coverage boundary on highway 85 in a certain time, such as ten seconds. At T109, wireless coverage manager 42 informs communication manager 36 that vehicle 18 will travel out of the MAN coverage area in the certain period of time, such as ten seconds, and of the wireless communication services that will be available when that occurs, which in the example shown is WAN coverage. At T110, communication manger 36 instructs communication protocol stacks 38 to switch to WAN before the MAN connection is disrupted.

A further embodiment of this invention utilizes the bandwidth available with wireless local area networks, such as the 802.11 wireless LAN, to burst data to mobile

communication device 20 in the vehicle 18. . This method will be referred to herein as "Drive-By InfoFueling." As has been mentioned previously, wireless LAN technology has generally not been used for mobile data communication due to its very limited geographic coverage. However, many data communications do not need to be communicated to the mobile communication device 20 in real time. Therefore, InfoFueling Stations 45, which are LAN wireless base stations, can be spaced along streets and be used to burst data to the mobile communication device 20 at high speeds using the bandwidth available with LAN wireless technology, which is currently around 11 megabits per second, when the vehicle enters the coverage area of a LAN wireless base station. An InfoFueling Station 45 would illustratively comprise a computer, such as an Internet server type of computer, a wireless LAN system, and be connected to the Internet via a high speed Internet connection, such as a DSL connection, cable connection, or T1 connection. In this regard, it is important to know which InfoFueling Station's coverage area that the vehicle will encounter next and the route-based communication planning method described above can be effectively utilized to provide this information.

With reference to Figs. 2 and 3, Drive-By InfoFueling will now be described As vehicle 18 traverses route 24, communication availability monitor 34 informs communication manager 36 at T5 that an Info-Fueling Station 45 will be reached in a certain period of time, such as five minutes. At T6, an application 47, such as a News Reader, sends a request to communication manager 36 that a large amount of content be downloaded from the content provider, such as all of the day's new stories from the Internet edition of a major newspaper, within a certain period of time, such as ten minutes

and at the lowest cost. At T7, T8 communications manager 36 requests through the current wireless network connection, MAN 14 in the example shown, that content/service provider 49 (which is illustratively the server handling the Internet edition of the major newspaper) forward this content to the InfoFueling station 45 that vehicle 18 is approaching. In this regard, when communication manager 36 requests the content, it accompanies the request with the identity (illustratively, the IP address) of the InfoFueling Station 45 to which the content is to be transferred, which is the Info-Fueling Station 45 that vehicle 18 is approaching as advised by coverage manager 42.

At T9, content/service provider transfers the content to the specified InfoFueling Station 45 and the content is cached at the specified InfoFueling Station 45. Communication availability monitor determines when vehicle 18 enters the coverage area of that InfoFueling Station 45 and when it does, informs communication manager 36 at T10 that vehicle 18 has entered this coverage area. Alternatively, mobile data communication device 20 could determine when vehicle 18 enters the coverage area for that InfoFueling Station 45 based upon the signal strength of that InfoFueling Station 45. In any event, at T11 communication manager 36 requests that the InfoFueling Station 45 download the cached content to vehicle 18, which InfoFueling Station 45 does at T12. At T13, downloading is complete and the communication manager 36 transfers the downloaded content back to the application 47 requested it.

In another embodiment of the above Drive-By InfoFueling invention, the wireless LAN base stations, InfoFueling Stations 45, can be mobile and moved to locations to optimize the performance of Drive-By InfoFueling. For example, during rush hour, additional InfoFueling Stations 45 can be moved into the most heavily traveled areas to

provide additional capacity, locate the InfoFueling Stations 45 closer together, and so forth.

Although the invention has been described in detail with reference to certain preferred embodiments and specific examples, variations and modification exist within the scope and spirit of the invention as described and as defined in the following claims.

Date Recue/Date Received 2020-04-17

What is claimed is:

1. A method of selecting which of a plurality of wireless communication options will be used by a mobile communication device, comprising the step of selecting which wireless communication option to use based on a location of the mobile communication device on a route, the route, and the availability for use of each of the plurality of wireless communication options along the route.

2. The method of Claim 1, wherein one of the plurality of wireless communication options is not using any wireless communication.

3. In a mobile communication device, a method of selecting which of a plurality of wireless communication options will be used by the mobile communication device, comprising the steps of:

(a) storing in the mobile communication device route information that is indicative of the route that the mobile communication device will be traversing;

(b) storing in the mobile communication device information indicative of coverage areas for each of the plurality of wireless communication options along the route that the mobile communication device will be traversing;

(c) determining where on the route that the mobile communication device is at as it traverses the route;

(d) determining whether to switch from a first one of the wireless communication options presently being used to a second one of the wireless

communication options when the mobile communication device approaches a boundary of a coverage area of one of the wireless communication options; and

(e) switching from the first one of the wireless communication options to the second one of the wireless communication options when the mobile communication device crosses the boundary if the determination was made to switch to that second one of the wireless communication options.

4. The method of Claim 3, wherein the wireless communication options include a plurality of wireless networks.

5. The method of Claim 4, wherein the wireless communication options include at least one of the wireless networks having a plurality of service levels.

6. The method of Claim 4, wherein the wireless communication options include the option of using not using wireless communication.

7. A method of selecting which of a plurality of wireless communication options will be used by a, comprising the steps of:

(a) storing in a database information indicative of coverage areas for the wireless communication options along a route that the mobile communication device will be traversing;

(b) determining where on the route that the mobile communication device is at as it traverses the route;

(d) accessing the database to obtain information regarding the communication options available along the route and determining whether to switch from a first one of the wireless communication options presently being used to a second one of the wireless communication options when the mobile communication device approaches a boundary of a coverage area of one of the wireless networks based on the wireless communication options available once the boundary is crossed and those that will be available further along the route; and

(f) switching from the first one of the wireless communication options to the second one of the wireless communication options if the determination was made to switch to that second one of the wireless communication options.

8. The method of Claim 7 wherein the step of switching from the first one of the wireless communication options to the second one of the wireless communication options comprises establishing a connection with the second one of the wireless communication options and dropping a connection to the first one of the wireless communication options only after the connection with the second one of the wireless communication options has been established.

9. The method of Claim 7, wherein the step of storing in a database information indicative of coverage areas for the wireless communication options along a route that the mobile communication device will be traversing includes storing boundary locations of the coverage areas for the wireless communication options along the route

where the boundary locations stored are limited to boundary locations that are on streets of the route.

10. The method of Claim 9 and further including the step of obtaining updated information concerning the coverage areas of the wireless communication options and updating the database with the updated information.

11. The method of Claim 10 wherein the step of obtaining updated information concerning the coverage areas of the wireless communication options includes obtaining this information from providers of the wireless communication options.

12. The method of Claim 10, wherein the step of obtaining updated information concerning the coverage areas of the wireless communication options includes the mobile communication device monitoring signal strengths of the wireless communication options as it passes through the coverage areas for the wireless communication options and developing updated information concerning coverage areas for the wireless communication options based on the monitored signal strengths of the wireless communication options.

13. The method of Claim 12 wherein the step of updating the database with the updated information includes determining whether the updated information is for a location presently in the database,

(a) if the updated information is for a location not presently in the database, then storing the updated information in the database for the location;

(b) if the updated information is for a location presently in the database, comparing the updated information with the information stored in the database for the location and updating the stored information if updated information is different from the stored information.

14. The method of Claim 10 wherein the step of updating the database with the updated information includes determining whether the updated information is for a location for which information is presently stored in the database,

(a) if the updated information is for a location not presently in the database, then storing the updated information in the database for the location;

(b) if the updated information is for a location presently in the database, comparing the updated information with the information stored in the database for the location and updating the stored information if updated information is different from the stored information.

15. The method of claim 14, wherein the step of updating stored information comprises shifting the stored information toward the updated information by a parameter and replacing the stored information with the shifted stored information.

16. The method of claim 15 wherein the step of updating the stored information comprises doing so with a running average method wherein the stored

information is the running average of initial information and subsequent update information.

17. A method of storing data in a database that is indicative of coverage areas for wireless communication options along a route that a mobile communication device is traversing, comprising the steps of:

(a) storing boundary locations of the coverage areas for the wireless communication options along the route in the database where the boundary locations are boundary locations on streets of the route;

(b) periodically obtaining updated information concerning the coverage areas of the wireless communication options as the mobile communication device traverses the route; and

(c) updating the database with the updated information.

18. The method of Claim 17 wherein the step of updating the database with the updated information includes determining whether the updated information is for a location for which information is presently stored in the database,

(a) if the updated information is for a location not presently in the database, then storing the updated information in the database for the location;

(b) if the updated information is for a location presently in the database, comparing the updated information with the information stored in the database for the location and updating the stored information if updated information is different from the stored information.

19. The method of claim 18, wherein the step of updating stored information comprises shifting the stored information toward the updated information by a parameter and replacing the stored information with the shifted stored information.

20. The method of claim 18 wherein the step of updating the stored information comprises doing so with a running average method wherein the stored information is the running average of initial information and subsequent update information.

21. A method of determining which of a plurality of wireless communication options to use for data transmission with a mobile wireless communication device that is traversing a route, comprising the steps of determining where the mobile wireless communication device is on the route, determining which wireless communication option to use for the data communications and when to use it based upon the location of the mobile wireless communication device on the route and the availability of the wireless communication options at the location where the mobile wireless communication device is at on the route and locations on the route where the mobile wireless communication device will subsequently be at as it travels the route.

22. The method of claim 21, wherein the step of determining which wireless communication to use and when to use it includes making the determination based upon the cost to use each wireless communication option.

23. The method of claim 21, wherein the step of determining which wireless communication option to use and when to use it includes making the determination based upon the cost to and performance level of each wireless communication option.

24. A method of providing a uniform content access layer application program interface for application programs that use mobile communication provided by a mobile communication device, comprising the steps of:

(a) providing a database accessible by the application program;

(b) storing in the database information concerning any wireless communication options that are available for use by the mobile communication device as it traverses a route;

(c) the application program deciding its requirements for data transfer via wireless communication based on the information about the wireless communication options stored in the database.

25. The method of claim 24 wherein the information about the wireless communication options stored in the database includes information concerning cost and performance of the wireless communication options.

26. A method of providing a uniform content layer application program interface for application programs that use mobile communication provided by a mobile communication device, comprising the steps of:

(a) providing a database accessible by the application program; and

(b) storing in the database information concerning any wireless communication options that are available for use by the mobile communication device as it traverses a route.

27. The method of claim 26 wherein the information about the wireless communication options stored in the database includes information concerning cost and performance of the wireless communication options.

28. A method of wireless transmission of data to mobile data communication devices using wireless communication technology that has high bandwidth but low geographic coverage, comprising the steps of:

(a) providing multiple wireless communication base stations along roads, each base station having a high bandwidth and low geographic coverage;

(a) storing in the mobile data communication device route information that is indicative of the route that the mobile communication device will be traversing;

(b) storing in the mobile communication device information indicative of coverage areas for each base station located along the route that the mobile communication device will be traversing;

(c) determining which base station to use to send data to the mobile data communication device based on the location of the mobile data communication device on the route that it is travelling;

(d) transferring data to be sent to the mobile data communication device from a content provider to the base station that it was determined to use to send the data to the mobile data communication device; and

(e) the base station to which the data was transferred transmitting the data to the mobile data communication device when the mobile data communication device enter that base stations coverage area.

29. A method of fueling a vehicle with information through a wireless communication device in said vehicle, comprising the steps of:

(a) determining a predicted time when said vehicle will be able to communicate with an info-fueling station having a predictable geographic position;

(b) sending a request for information from said vehicle through said wireless communication device to at least one wireless communication network;

(c) routing said information from an information source in communication with said wireless communication network to said info-fueling station; and

(d) downloading said requested information to said vehicle through said info-fueling station during the time that said wireless communication device in said vehicle is in communication range of said info-fueling station.

30. The method according to Claim 29, wherein said info-fueling station has a fixed position relative to vehicles.

31. The method according to Claim 29, wherein said information request identifies said info-fueling station.

32. The method according to Claim 29, wherein said wireless communication network identifies said info-fueling station.

33. The method according to Claim 29, wherein said wireless communication device is coupled to an on-board communication network in said vehicle.

34. The method according to Claim 29, wherein said downloading of information commences once the detected signal strength of communication between said wireless communication device in said vehicle with said info-fueling station reaches a predetermined level.

35. The method according to Claim 29, wherein said wireless communication network also routes previously stored requests for information to said vehicle through said info-fueling station.

36. The method according to Claim 29, wherein said info-fueling station is mobile.

37. The method according to Claim 36, and further including the steps of moving each mobile info-fueling station to a location to optimize performance of info-fueling communication.

38. A method of wireless transmission of data to mobile data communication devices using wireless communication technology that has high bandwidth but low geographic coverage, comprising the steps of:

(b) providing multiple mobile wireless communication base stations on roads, each base station having a high bandwidth and low geographic coverage;

(a) storing in the mobile data communication device route information that is indicative of the route that the mobile communication device will be traversing;

(b) storing in the mobile communication device information indicative of coverage areas for each base station located along the route that the mobile communication device will be traversing;

(c) determining which base station to use to send data to the mobile data communication device based on the location of the mobile data communication device on the route that it is travelling;

(d) transferring data to be sent to the mobile data communication device from a content provider to the base station that it was determined to use to send the data to the mobile data communication device;

(e) the base station to which the data was transferred transmitting the data to the mobile data communication device when the mobile data communication device enter that base stations coverage area; and

(f) moving the base stations to locations to optimize communication between base stations and a plurality of mobile data communication devices.

Date Printed: 2008-12-30

Abstract of the Disclosure

A method for selecting which of a plurality of wireless communication options will be used by a mobile communication device based on the location of the mobile communication device on a route, the route, and the availability for use of each of the plurality of wireless communication options along the route. Information indicative of coverage areas for the wireless communication options available along the route are stored in a database by storing boundary locations of the coverage areas for the wireless communication options along the route where the boundary locations stored are boundary locations that are on streets of the route.

A method of providing a uniform content layer application program interface for application programs that use mobile communication provided by a mobile communication device stores information concerning any wireless communication options that are available for use by the mobile communication device as it traverses a route is stored in a database. The application program decide which wireless communication option to use based upon the information about the wireless communication options in the database.

A method of fueling a vehicle with information through a wireless communication device determines a predicted time when the vehicle will be able to communicate with an info-fueling station having a predictable geographic position. A request for information from the vehicle is sent through the wireless communication device to at least one wireless communication network. The information is routed from an information source in communication with the wireless communication network to the info-fueling station and downloaded to the vehicle.

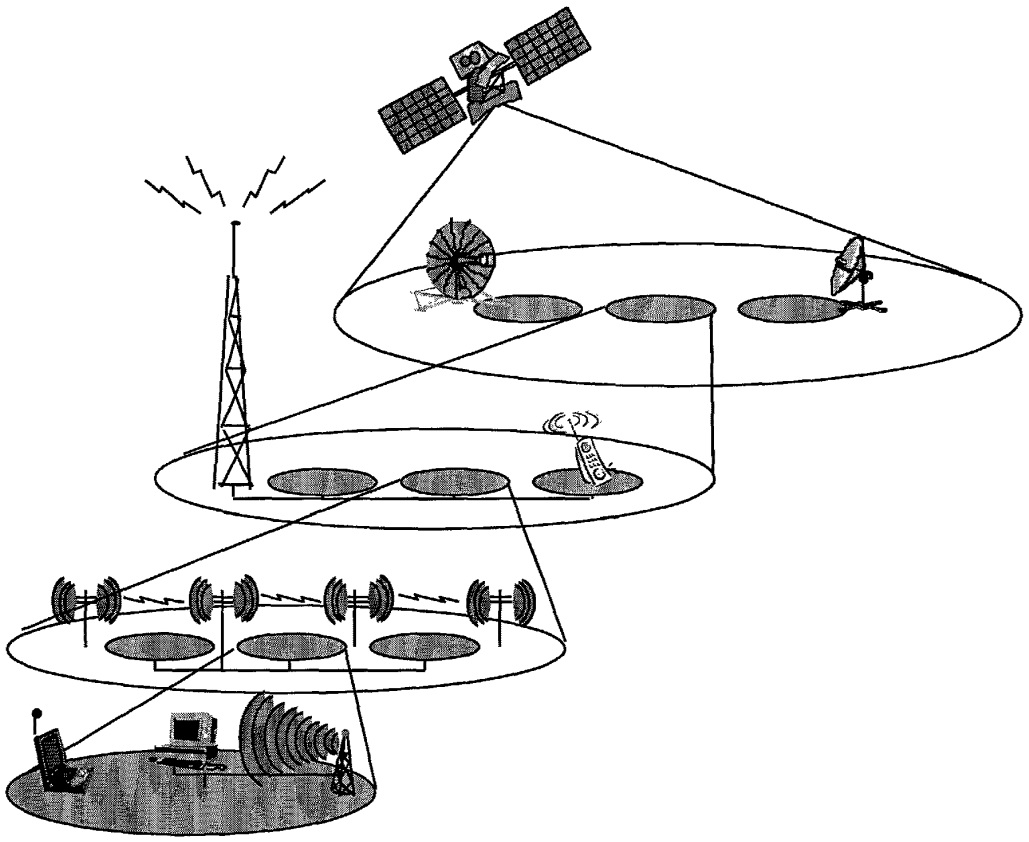


FIG. 1
(Prior Art)

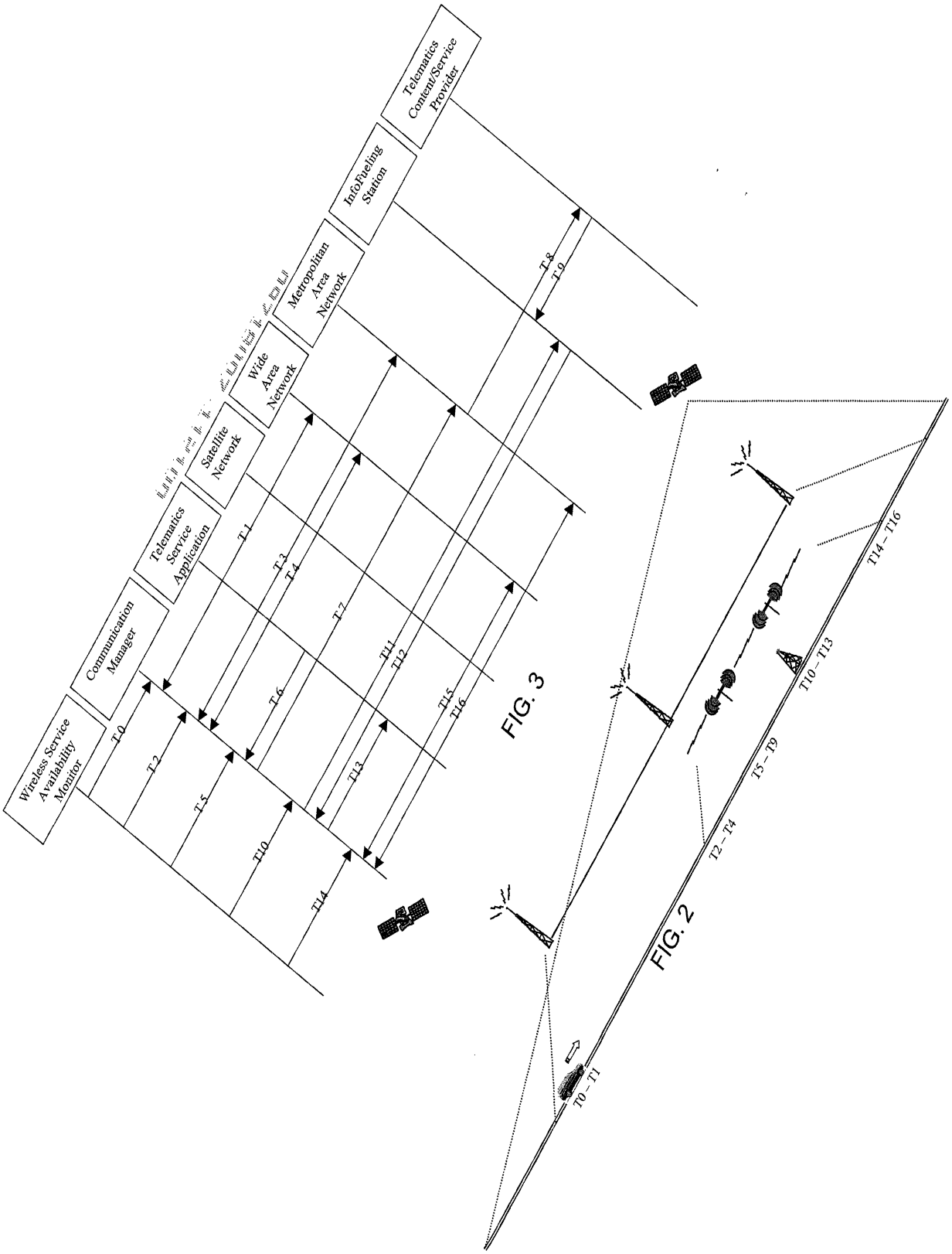
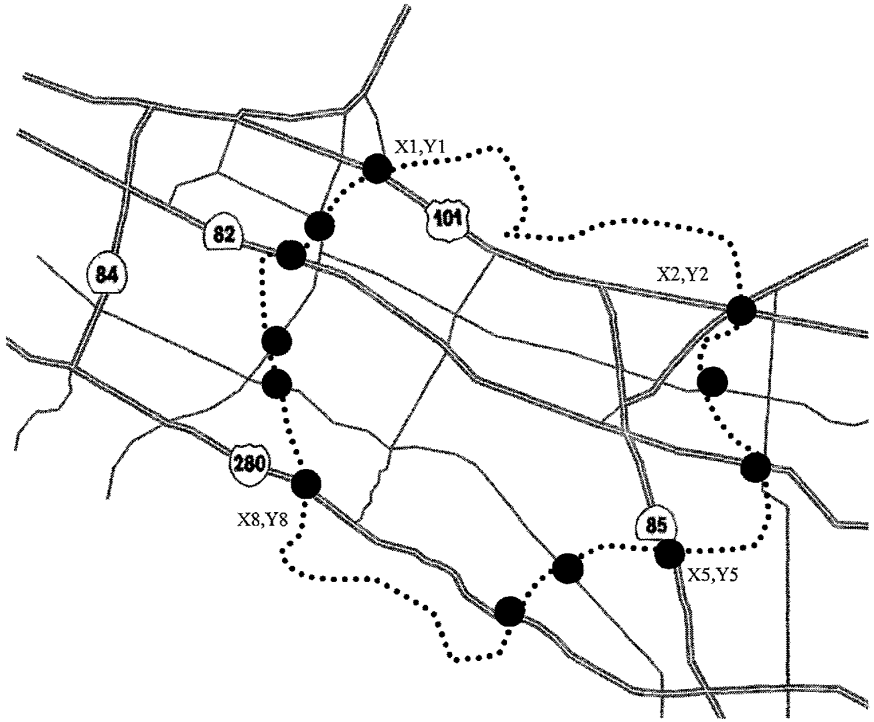

Telematics Content/Service Provider
InfoFueling Station
Metropolitan Area Network
Wide Area Network
Satellite Network
Telematics Service Application
Communication Manager
Wireless Service Availability Monitor
T0
T1
T2
T3
T4
T5
T6
T7
T8
T9
T10
T11
T12
T13
T14
T15
T16

FIG. 3

T0 – T1
T2 – T4
T5 – T9
T10 – T13
T14 – T16

FIG. 2



<HW101, (x1,y1), MAN boundary>
<HW101, (x2,y2), MAN boundary>
…
<HW85, (x5,y5), MAN boundary>
…
…
<HW280, (x8,y8), MAN boundary>
…
…

FIG. 4

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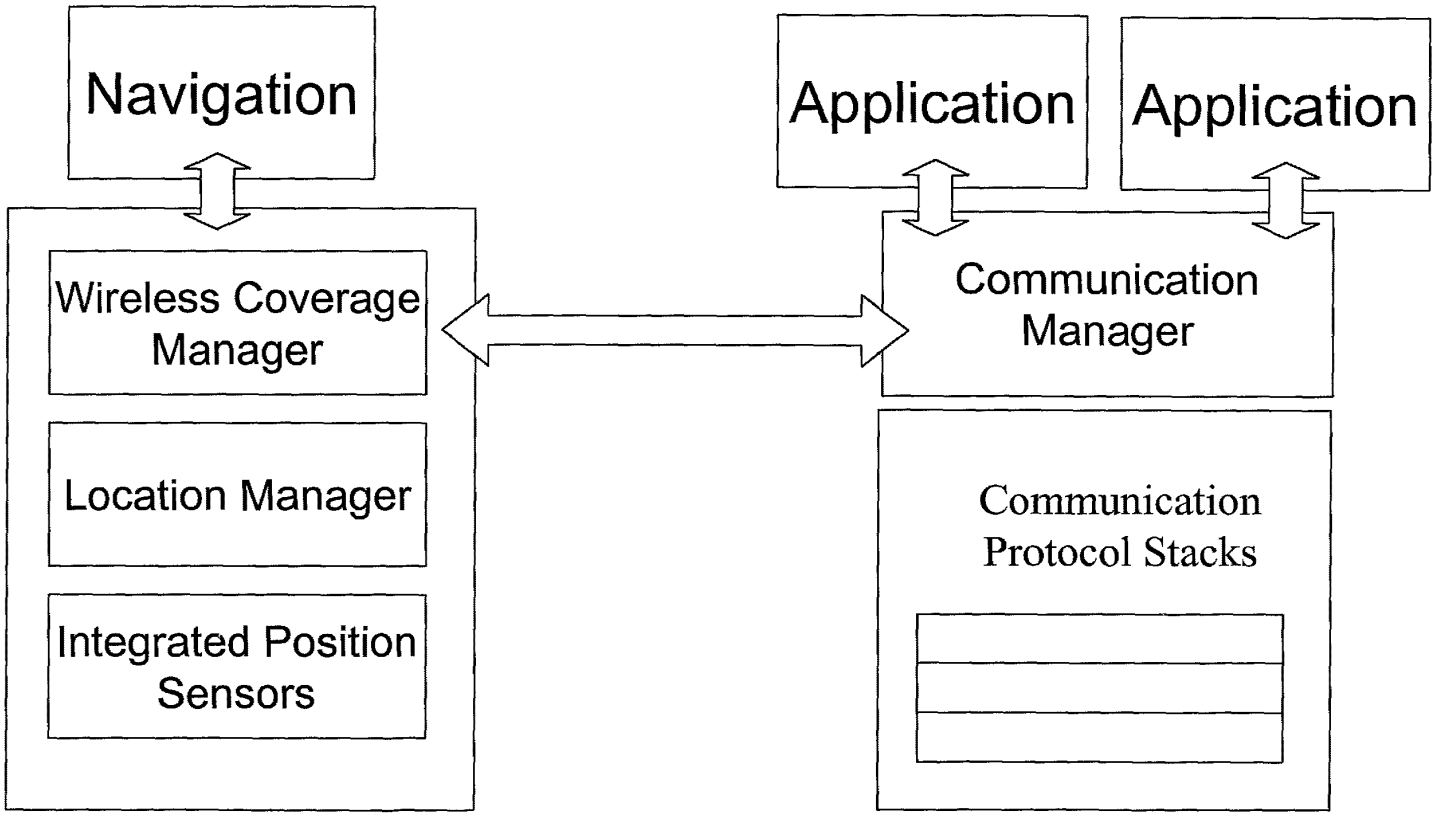


FIG. 5

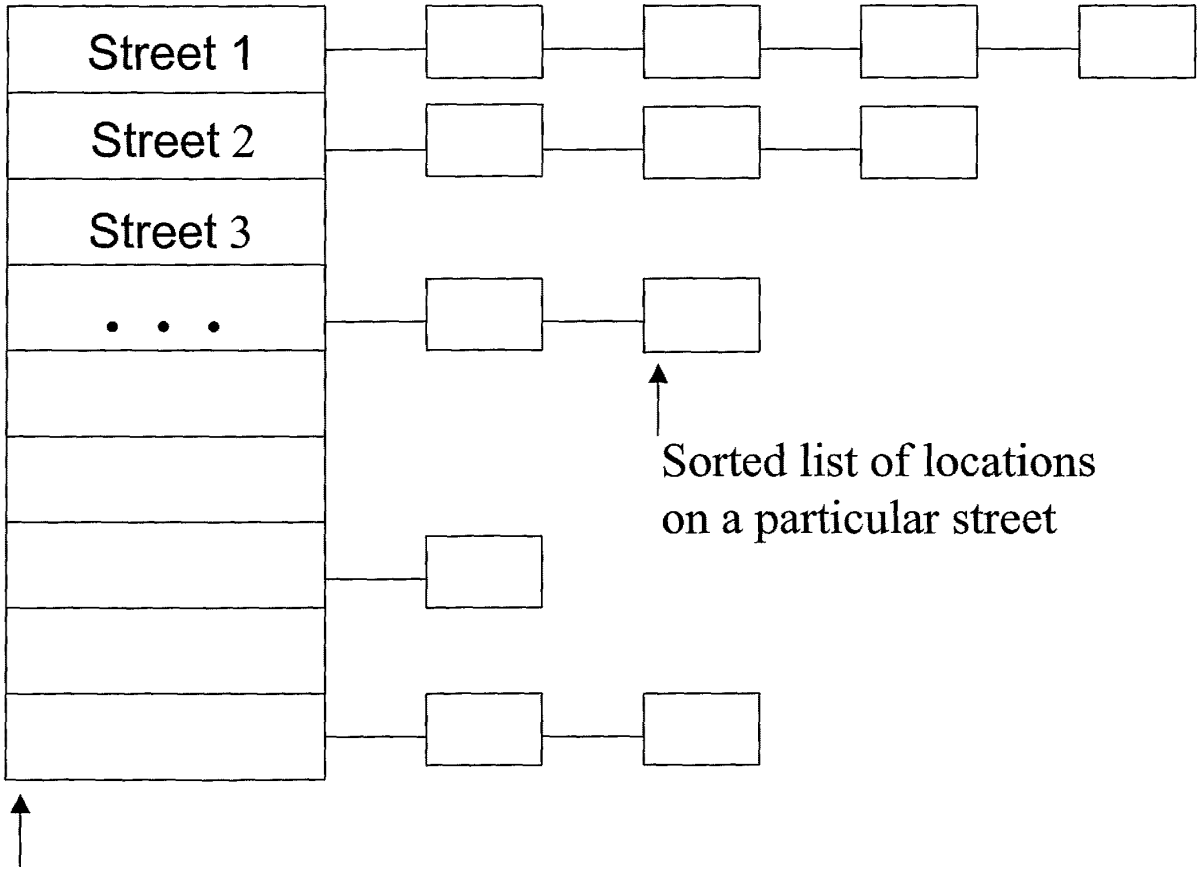

Street 1
Street 2
Street 3
• • •
Sorted list of locations
on a particular street
Registered locations
sorted by street

FIG. 6

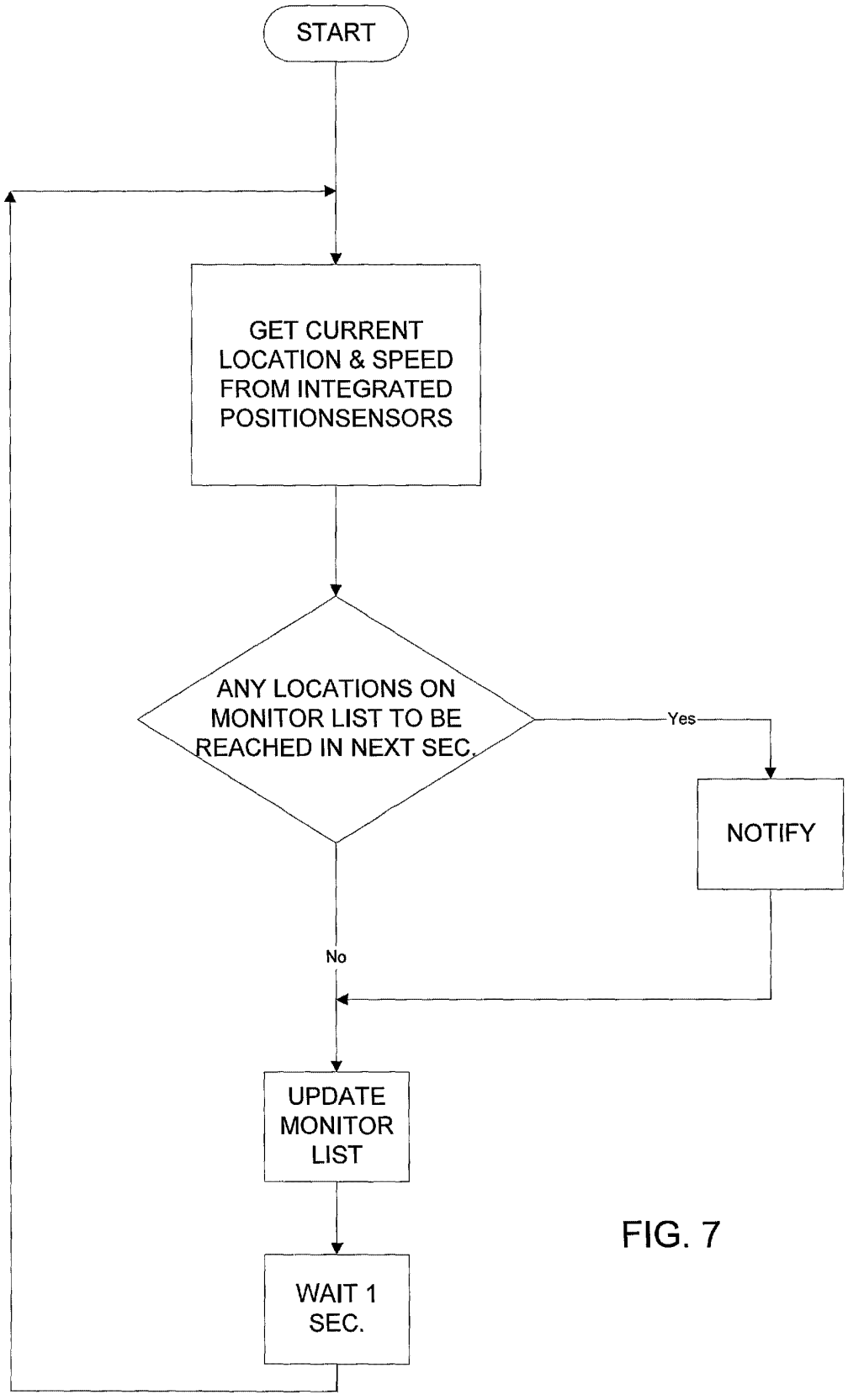

START
GET CURRENT LOCATION & SPEED FROM INTEGRATED POSITIONSENSORS
ANY LOCATIONS ON MONITOR LIST TO BE REACHED IN NEXT SEC.
Yes
NOTIFY
No
UPDATE MONITOR LIST
WAIT 1 SEC.

FIG. 7

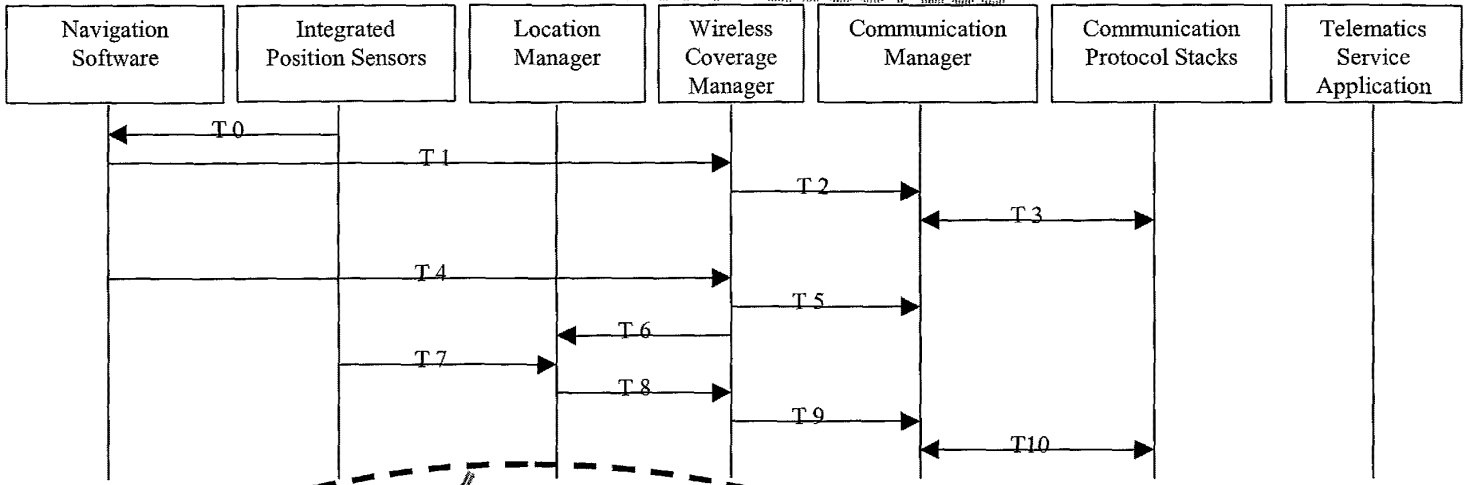

Navigation Software
Integrated Position Sensors
Location Manager
Wireless Coverage Manager
Communication Manager
Communication Protocol Stacks
Telematics Service Application
T0
T1
T2
T3
T4
T5
T6
T7
T8
T9
T10

FIG. 8

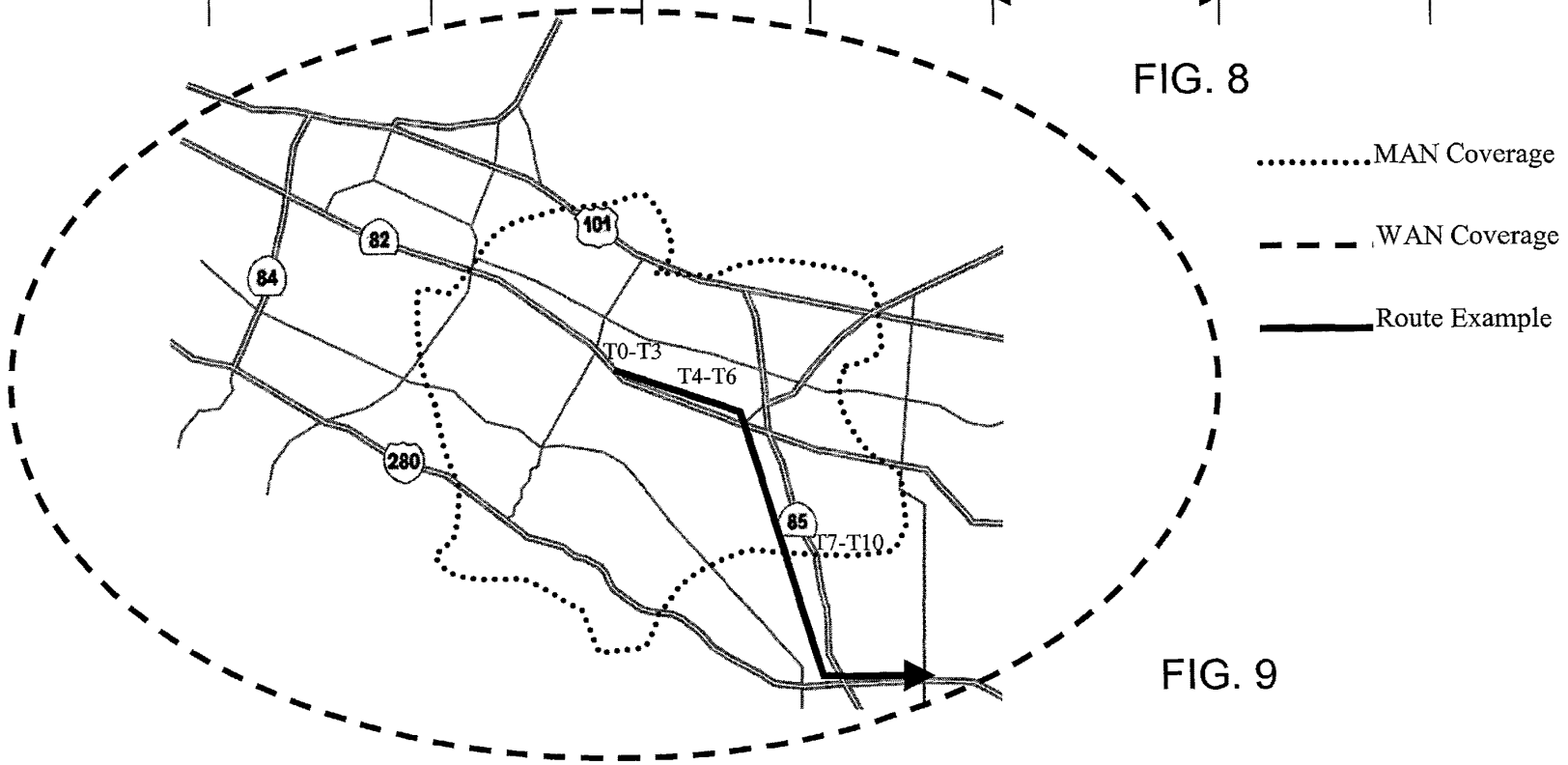

MAN Coverage
WAN Coverage
Route Example
82
101
84
280
85
T0-T3
T4-T6
T7-T10

FIG. 9

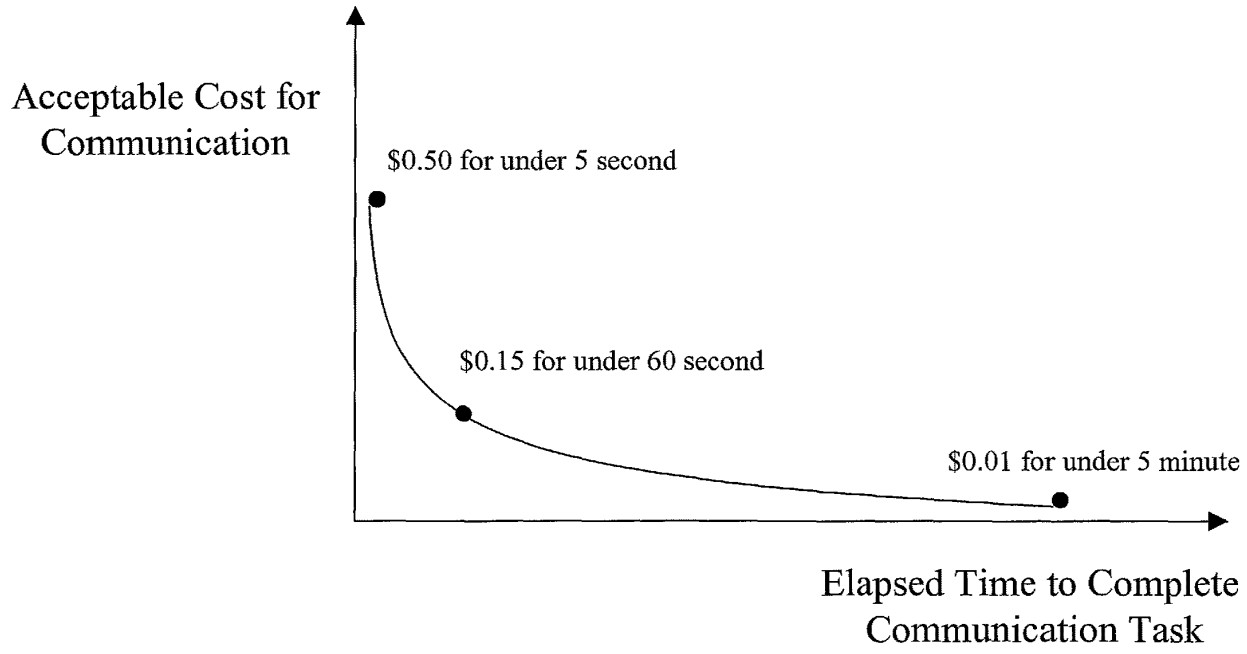

Acceptable Cost for Communication
$0.50 for under 5 second
$0.15 for under 60 second
$0.01 for under 5 minute
Elapsed Time to Complete Communication Task

FIG. 10

Attorney Docket No. 705835US1RAF

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As below named inventor, I hereby declare that:

My residence, post office address and citizenship is as stated below next to my name.

I believe I am the original, first and sole inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled:

ROUTE-BASED COMMUNICATION PLANNING ARCHITECTURE AND METHOD FOR WIRELESS COMMUNICATION

the specification of which is attached hereto.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56(a).

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Power of Attorney: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:

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11/21/00 JC921 U.S. PTO

UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 C.F.R. ∋1.53(b))

Attorney Docket No.	705835US1RAF
First Inventor or Application Identifier	Xi Jiang
Title	ROUTE-BASED COMMUNICATION PLANNING ARCHITECTURE AND METHOD FOR WIRELESS COMMUNICATION
Express Mail Label No.	Express Mail Label No. EL536120471US

APPLICATION ELEMENTS
See MPEP Chapter 600 concerning utility patent application contents.

ADDRESS TO: Assistant Commissioner for Patents
Box Patent Application
Washington, D.C. 20231

JC921 U.S. PTO 09/718007 11/21/00

1. _X_ *Fee Transmittal Form (e.g. PTO/SB/17)
(Submit an original and a duplicate for fee processing)

2. _X_ Specification [Total Pages _37_]
(preferred arrangement set forth below)
-Descriptive title of the Invention
-Cross References to Related Applications
-Statement Regarding Fed Sponsored R&D
-Reference to Microfiche Appendix
-Background of the Invention
-Brief Summary of the Invention
-Brief Description of the Drawings (if filed)
-Detailed Description
-Claims(s)
-Abstract of the Disclosure

3. _X_ Drawing(s) (35 U.S.C. 113) [Total Sheets _8_]

4. Oath or Declaration [Total Pages _2_]
a. _X_ Newly executed (original or copy)
b. __ Copy from a prior application (37 C.F.R.∋ 1.63 (d))
(for continuation/divisional with Box 16 completed)

i. __ DELETION OF INVENTOR(S)

Signed statement attached deleting inventor(s) Named in the prior application, see 37 C.F.R. ∋∋ 1.63(d)(2) and 1.33 (b).

5. __ Microfiche Computer Program (Appendix)

6. Nucleotide and/or Amino Acid Sequence Submission
(If applicable, all necessary)

a. __ Computer Readable Copy

b. __ Paper Copy (identical to computer copy)

c. __ Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

7. __ Assignment Papers (cover sheet & document(s))

8. __ 37 C.F.R. ∋ 3.37(b) Statement __ Power of *(when there is an assignee)* Attorney

9. __ English Translation Document (if applicable)

10. __ Information Disclosure Statement (IDS)/PTO-1449 __ Copies of IDS Citations

11. __ Preliminary Amendment

12. _X_ Return Receipt Postcard MPEP 503)

13. __ Statement (s) (PTO/SB/09-12) __ Statement filed in prior application, Status still proper and desired

14. __ Certified Copy of Priority Document(s) (if foreign priority is claimed)

15. __ Other:

**NOTE FOR ITEMS 1 & 13: IN ORDER TO BE ENTITLED TO PAY SMALL ENTITY FEES, A SMALL ENTITY STATEMENT IS REQUIRED (37 C.F.R. ∋ 1.27), EXCEPT IF ONE FILED IN A PRIOR APPLICATION IS RELIED UPON (37 C.F.R. ∋ 1.28).*

16. **If a CONTINUING APPLICATION**, Check appropriate box, and supply the requisite information below and in a preliminary amendment:
__ Continuation __ Divisional __ Continuation-in-part (CIP) of prior application No._____
Prior application information: Examiner_____
FOR CONTINUATION OR DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 4b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

17. CORRESPONDENCE ADDRESS

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PTO/SB/17 (12-98)
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For FY 1999

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Small Entity payments must be supported by a small entity statement, otherwise large entity fees must be paid. See Forms PTO/SB/09-12.

Complete if Known	
Application Number	Unknown
Filing Date	November 21, 2000 (Express Mail)
First Named Inventor	Xi Jiang
Examiner Name	Unknown
Group / Art Unit	Unknown
Attorney Docket No.	705835US1RAF

TOTAL AMOUNT OF PAYMENT ($) 1594.00

METHOD OF PAYMENT (check one)

1. ☒ The Commissioner is hereby authorized to charge indicated fees and credit any over payments to:

Deposit Account Number: 03-1800

Deposit Account Name: DaimlerChrysler Intellectual Capital Corporation

☒ Charge Any Additional Fee Required Under 37 CFR 1.16 and 1.17

2. ☐ **Payment Enclosed:**
☐ Check ☐ Money Order ☐ Other

FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
101	710	201	355	Utility filing fee	710
106	320	206	160	Design filing fee	
107	490	207	245	Plant filing fee	
108	710	208	355	Reissue filing fee	
114	150	214	75	Provisional filing fee	

SUBTOTAL (1) 710

2. EXTRA CLAIM FEES

			Extra Claim		Fee from below		Fee Paid
Total Claims	38	-20** =	18	X	324	=	324
Independent Claims	10	- 3** =	7	X	560	=	560
Multiple Dependent					270	=	0

**or number previously paid, if greater; For Reissues, see below

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
103	18	203	9	Claims in excess of 20
102	80	202	40	Independent claims in excess of 3
104	270	204	135	Multiple dependent claim, if not paid
109	80	209	40	** Reissue independent claims over original patent
110	18	210	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($) 884

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
105	130	205	65	Surcharge-late filing fee or oath	
127	50	227	25	Surcharge-late provisional filing fee or cover sheet.	
139	130	139	130	Non-English specification	
147	2,520	147	2,520	For filing a request for examination	
112	920*	112	920*	Requesting publication of SIR prior to Examiner action	
113	1,840*	113	1,840*	Requesting publication of SIR after Examiner action	
115	110	215	55	Extension for reply within first month	
116	390	216	195	Extension for reply within second month	
117	890	217	445	Extension for reply within third month	
118	1,390	218	695	Extension for reply within fourth month	
128	1,890	228	945	Extension for reply within fifth month	
119	310	219	155	Notice of Appeal	
120	310	220	155	Filing a brief in support of an appeal	
121	270	221	135	Request for oral hearing	
138	1,510	138	1,510	Petition to institute a public use proceeding	
140	110	240	55	Petition to revive – unavoidable	
141	1,210	241	605	Petition to revive – unintentional	
142	1,240	242	620	Utility issue fee (or reissue)	
143	440	243	220	Design issue fee	
144	600	244	300	Plant issue fee	
122	130	122	130	Petitions to the Commissioner	
123	50	123	50	Petitions related to provisional applications	
126	240	126	240	Submission of Information Discl. Stmt.	
581	40	581	40	Recording of each patent assignment per property (times number of properties)	
146	710	246	355	Filing a submission after final rejection (37 CFR 1.129(a))	
149	710	249	355	For each additional invention to be examined (34 CFR 1.129(b))	
Other fee (specify)					
Other fee (specify)					

* Reduced by Basic Filing Fee Paid **SUBTOTAL (3)** ($) 0

SUBMITTED BY				Complete (if applicable)	
Typed or Printed Name	Roland A Fuller III			Reg. Number	31,160
Signature	R A. Fuller III	Date	11/20/00	Deposit Account User ID	

APPLICATION FOR LETTERS PATENT OF
THE UNITED STATES OF AMERICA

Entitled

ROUTE-BASED COMMUNICATION PLANNING ARCHITECTURE AND METHOD FOR WIRELESS COMMUNICATION

Inventor:

Xi Jiang

Docket #: 705835US1RAF

Attorney Docket No. 705835US1RAF

Route-Based Communication Planning Architecture and Method for Wireless Communication

This invention relates to mobile wireless communication, and more particularly, to a method of planning which of various wireless communication options to utilize for wireless communication in a mobile environment when one or more wireless communication options may be available for use, based on the location of the mobile user, the route the mobile user is travelling, and the availability of the various wireless communication options along the route.

Background of the Invention

Increasing numbers of vehicles come equipped with some form of "telematics" service platforms. Telematics services are those services enabled by a three-way marriage among vehicles, computing and communication technologies, and is sometimes used to mean the wireless linkage of vehicles to data networks, particularly the internet. These telematics service platforms are able to carry out various intelligent transportation system services, such as reporting a vehicle's status and position to a service center and provide certain applications such as emergency and safety assistance. In the next few years, more telematics products will be made available and eventually, most if not all vehicles will have some form of telematics platform that will offer various services, such as emergency services (*e.g.,* emergency communication in the event of an incident, such as airbag deployment), navigation services, concierge and transaction services (*e.g.,* restaurant information, hotel reservation), communication and personal information

services (*e.g.*, E-mail, calendar services), information services (*e.g.*, stock information, personalized news, sightseeing information), entertainment services (*e.g.*, interactive games, music downloads), and so forth.

These telematics service platforms require the use of some type of wireless communication. Since wireless communication is generally expensive relative to non-wireless communication (e.g., cellular phone calls versus land line phone calls), the ability of these telematics products to use wireless communication options in the most cost effective manner will be an important factor in the success of vehicular telematics. By wireless communication options, it is meant the various wireless communication networks available, discussed below, the various levels of service that each type of wireless communication network has available (i.e. transmission power level), as well as any other option that may now be available or will be available in the future for wireless communication.

In the near future, a variety of wireless communication options will be available for use by wireless communication devices in vehicles, such as satellite, cellular phone and short-range radio frequency (RF) links. These systems differ in cost, bandwidth and coverage. For example, in urban areas and along the major highways, emerging technologies, such as GPRS (general packet radio service) will be deployed in the U.S. in the next few years and will offer "always-on connections" and packet oriented data communications at higher bandwidths than today. Improved code division multiple access (CDMA) technology such as W-CDMA will also likely be established. Also, the Ricochet 2 metropolitan area access (MAN) wireless network will soon be available in 48 major metropolitan areas in the United States covering a very large percentage of the

population . These new wireless networks typically provide a higher bandwidth than existing wireless networks, such as the first generation cellular network (AMPS -- Advanced Mobile Phone System) and the second-generation cellular networks (GSM -- Global System for Mobile Communications; CDMA – Code Division Multiple Access; and TDMA -- Time Division Multiple Access).

A general method to evaluate the existing and emerging wireless communication networks and services for data communication is to examine their cost and performance levels. The first generation AMPS cellular systems typically have a maximum data transfer rate of 9600 bps and the second generation digital wireless communication systems have a maximum bandwidth of 14.4 kbps. The new third generation cellular systems will have maximum bandwidths of around 128 kbps or even 384 kbps. Since the charge for cellular communication is high, particularly when compared to even interstate land line phone calls, the cost for transferring data using these systems can be quite high. For example, the cost to transfer one mega-byte of data using the second generation digital wireless communication systems runs around $15.00 or higher. If a mobile user wants to obtain a large amount of content, the cost of doing so with cellular wireless communication can be quite high, making mobile data communication involving large amounts of data cost prohibitive to many potential users.

Fig. 1 provides a general illustration of the presently available wireless communication systems. They include regional area wireless networks 10, wide area wireless networks 12, metropolitan area networks 14, and local area networks 16. Regional area wireless networks 10 provide coverage over a large geographic region, such as the coverage provided by satellite based cellular communication networks and its

cost varies greatly. Wide area networks 12 are exemplified by the existing land based cellular phone systems mentioned above. They provide coverage over a relatively large geographic region, but to a lesser extent than regional area networks because the wide area networks utilized land based base station systems that individually have only a small geographic coverage. To obtain the wide area coverage, multiple base station systems must be spread throughout the coverage area with some degree of overlap in coverage. Thus, the geographic coverage provided by a given cellular phone system is often determined by population density and/or travel density in that locating base station systems in sparsely populated, lightly traveled geographic areas may not be cost justified. Metropolitan area networks 14, as the name implies, provide coverage only in metropolitan areas. The most well known type of metropolitan area network is Metricom's Richochet2 network architecture. Wireless local area networks 16 provide very limited geographic coverage, typically on the order of 100 yards or less. Because of this limited geographic coverage, wireless local area networks have not been used to any extent in mobile communications and their application has been pretty much limited to use in office environments and the like where the work stations that are connected to the wireless local area network are located in close proximity to each other. One such of wireless local area network is the 802.11 wireless LAN.

Initially, when the cellular systems first became popular, the wide area network AMPS network was used. More recently, cellular systems have added the second-generation digital networks to the wide area networks being used as well as the satellite based regional area networks and the metropolitan area networks. As these additional networks have been added to the networks available for mobile communication use,

cellular in particular, mobile communication devices such as newer generation cell phones have been provided the capability to switch between various networks. For example, a cellular phone can utilize the first generation AMPS network or the second generation digital networks (such as GPRS, GSM and CDMA), and even the satellite based networks.

When the mobile communication device switches among wireless networks, this is known as vertical handoff. A simple form of vertical hand-off would involve a cell phone having multi-network capability selecting which network to use based upon factors such as cost, availability and performance and switching to a second network if coverage from the first network is lost. Vertical handoff is more than just the ability to use more than one wireless network. In this regard, the cellular phone must maintain the same phone number even when it has switched networks. For example, a user having a cell phone that has both analog and digital capability might select the digital network if it was available because it has better quality than the analog network, but select the analog network if digital coverage was not available. (In today's environment, the analog network has broader coverage than digital coverage.)

More sophisticated mobile communication devices will perform the vertical handoff automatically. For example, if a cellular phone has tri-mode capability of using the analog network, digital network, and satellite network, the phone might select the network to use based in order of preference and availability. The user would have entered an order of preference into the phone telling it to use the analog network if its available, then the digital network and then the satellite network. Assuming that the phone first connected to the analog network, the phone would switch to the digital

network if the user moves out of the analog coverage area, and then to the satellite network if the user moves out of both the analog and digital coverage area. Typically, the phone decides to switch based upon whether it is in the coverage area of a given network usually determined by signal strength from the network's antennas. One of the problems that this technique has is that by the time a determination is made that the network being used should be switched, there may be a loss of service due to the time that it takes to make the switchover. Also, if the switch is from a more expensive network to a lesser expensive network, such as from the satellite network to either the digital or analog network, the switch from the satellite network may not be accomplished when the user first enters the coverage area for the analog or digital network, resulting the user paying longer than necessary for the more expensive satellite network.

Vertical handoff is a well-understood technology in the mobile computing field. In general, it is about how to automate the connection status and routing table updates on top of the mobile Internet Protocol (Mobile IP) technology. However, due to the unpredictable nature of wireless network boundaries, there is often an abrupt cut-off of service when the boundary is reached. Consequently, the overall direction of vertical hand-off research is generally focused on quick recovery schemes, such as preventative multicast to neighboring base stations.

Accordingly, it is an objective of the present invention to provide a predictive method of achieving seamless vertical handoff in a wireless communication system.

It is a further objective of the present invention to utilize the bandwidth available with local area networks for mobile communication, even though the geographic coverage of local area networks is limited.

Summary of the Invention

In order to achieve the forgoing objectives, a method is provided for selecting which of a plurality of wireless communication options will be used by a mobile communication device based on the location of the mobile communication device on a route, the route, and the availability for use of each of the plurality of wireless communication options along the route. In a further embodiment of the inventive method, information indicative of coverage areas for the wireless communication options available along the route are stored in a database by storing boundary locations of the coverage areas for the wireless communication options along the route where the boundary locations stored are boundary locations that are on streets of the route. In a further embodiment, updated information about the coverage areas is periodically obtained and the database updated accordingly.

In another embodiment of the invention, a uniform content layer application program interface is provided for application programs that use mobile communication provided by a mobile communication device. Information concerning any wireless communication options that are available for use by the mobile communication device as it traverses a route is stored in a database. The application program decide which wireless communication option to use based upon the information about the wireless communication options in the database.

In a further embodiment of the invention, a method of fueling a vehicle with information through a wireless communication device in the vehicle is provided. A predicted time when the vehicle will be able to communicate with an info-fueling station having a predictable geographic position is determined. A request for information from

the vehicle is sent through the wireless communication device to at least one wireless communication network. The information is routed from an information source in communication with the wireless communication network to the info-fueling station. The requested information is downloaded to the vehicle through the info-fueling station during the time that the wireless communication device in the vehicle is in communication range of the info-fueling station.

Brief Description of the Drawings

The present invention will become more fully understood from the detailed description and the accompanying drawings, in which:

Fig. 1 is a pictorial illustration of "prior art" wireless communication systems;

Fig. 2 is a systems interaction diagram of an embodiment of the present invention;

Fig. 3 is a pictorial illustration of wireless communication options used in the method of Fig. 2;

Fig. 4 is a pictorial representation a wireless coverage database record format in accordance with an embodiment of the present invention;

Fig. 5 is a block diagram of a route-dependent communication planning architecture according to an embodiment of the present invention;

Fig. 6 is a schematic of a data structure for monitoring and reporting wireless coverage along routes in accordance with an embodiment of the present invention;

Fig. 7 is a flow chart of a monitoring routine used in an embodiment of the present invention;

Fig. 8 is a system interaction diagram of a method of performing route dependent vertical handoff in accordance with an embodiment of the present invention;

Fig 9 is a map of the route traversed by a vehicle containing a wireless communication device with reference to Fig. 8; and

Fig 10 is an illustrative graph showing how an application may describe its preferred wireless communication requirements in accordance with an embodiment of the present invention.

Detailed Description of the Preferred Embodiments

Referring to Figs. 2 and 3, the route-based communication planning method of according to the present invention is described. (The elements of Fig. 1 that are common to Figs. 2 and 3 are identified with the same reference number.) This method is particularly advantageous for use with mobile wireless data communication applications, such as telematics applications, where data is being transmitted to and from the vehicle and will be described in that context, although the method is not limited to mobile wireless data communication applications.

A vehicle 18 has a mobile data communications device 20, illustratively, a computer having one or more wireless modems. This computer could be an off the shelf computer, such as a notebook computer, a personal digital assistant, or a computer built into the vehicle or another mobile device (*e.g.*, a cellular phone having data communication capability). The mobile communications device 20 has a communication availability monitor 34 which has a database of wireless communication network coverage information 22 (shown representatively in Fig. 4) and a communication

manager 36. Vehicle 18 also has a navigation system 26, such as that currently available in Mercedez-Benz vehicles. The navigation system 26 provides information describing a route 24 that the vehicle traverses and the location of the vehicle in the route, which it determines in a known fashion, such as from information obtained from a global positioning satellite 28.

As vehicle 18 traverses route 24, the mobile data communications device 20 is checking to determine what wireless communication networks and systems are available at particular points in the route, as described in more detail below. Based on the availability of the various wireless communication networks, the mobile communications device 20 determines which one it should use when it reaches each particular point and more specifically, if it should switch networks. If mobile communications device 20 determines that it should switch networks, such as from WAN 12 to MAN 14, it initiates the vertical handoff. Preferably, it does so in advance of reaching the predetermined point in the route, so that when the vehicle 18 reaches the predetermined point, the vertical hand-off occurs seamlessly and with minimum delay. Illustratively, the mobile communication device 20 knows how much time it takes to accomplish the vertical hand-off and, based on data such as the vehicle speed and the route the vehicle will take to reach the particular point, and initiates the request for the vertical handoff an appropriate amount of time in advance of the vehicle reaching the particular point so that the vertical handoff occurs seamlessly when the vehicle reaches the predetermined point.

More specifically, when vehicle 18 starts, communication availability monitor 34 obtains information about route 24, illustratively from an external source such as the vehicle's navigation system 26. It then creates a database of the coverage areas of the

wireless networks and systems that mobile communication device 20 can use as it traverses route 24. Communication availability monitor 34 at T0 informs communication manager 36 what wireless networks and systems are available, which in the example of Figs. 2 and 3, are WAN 12 and satellite network 10. Communication manager 36 then determines which wireless network to use, illustratively WAN 12 for reasons such as better cost or performance, and at T1 connects mobile communication device 20 to WAN 12.

As vehicle 18 traverses route 24, it reaches a point along the route that is a coverage boundary for MAN 14, indicated at T2-T4 (or just before the coverage boundary), where MAN 14 coverage is available. At T2, communication service availability monitor 34 informs communication manager 36 that MAN 14 coverage is now available. Communication manager 36 determines, based on factors such as cost and performance, that the network to which mobile data communication device 20 is connected should be switched from WAN 12 to MAN 12. At T3, communication manager 36 connects mobile data communication device 20 to MAN 14 and after the connection is established, disconnects mobile data communication device 20 from WAN 12 at T4.

Skipping to T14 (T5 – T13 are described below), when communication service availability monitor 34 determines that the vehicle will travel out of the coverage area for MAN 14 within a certain period of time, such as thirty seconds, it informs communication manager 36. At T15, communication manager 36 connects vehicle 18 to WAN 12, which communication manager determined was the best available choice, and at T16, disconnects vehicle 18 from MAN 12.

Referring to Fig. 5, an illustrative architecture 40 for the route dependent communication planning invention is shown. Architecture 40 includes wireless service availability monitor 34, communication manager 36 and communication protocol stacks 38, all of which are illustratively implemented in software as part of mobile communication device 20. Wireless service availability monitor 34 includes wireless coverage manager 42, location manager 44 and integrated position sensors 46. Integrated position sensors 46 are illustratively known types of position sensors that can determine the geographic location of an object, such as an inertial guidance system, a GPS system, and can also comprise an interface with the navigation system 26 of vehicle 18. Architecture 40 also includes navigation system 26, that is coupled to wireless coverage manager 42, and one or more applications 47 that communicate with communication manager 36 as described below.

Although shown separately from wireless coverage manager 42 in Fig. 5, location manager 44 and wireless coverage manager 42 logically interact to the point where they can both be considered part of wireless coverage manager 42. Location manager 44 keeps track of the current location of vehicle 18 and notifies wireless coverage manager 42 when vehicle 18 reaches a location registered by wireless coverage manager 42. Wireless coverage manager 42 maintains network coverage database 22 and issues commands to communication manager 36 to initiate route based vertical handoff. Integrated position sensors 46 obtain data indicative of the vehicle's geographic position, such as latitude and longitude, from sources such as the vehicle's navigation system 26 regarding the route 24 and the location of vehicle 18 on route 24.

As mentioned, wireless coverage manager 42 maintains network coverage database 22 (Fig. 4). Information regarding the coverage for each particular network is obtained from available sources, such as the network provider and signal strength monitoring by mobile communication device 20. Illustratively, this information is obtained by communication manager 36 and passed on to wireless coverage manager 42 for processing and eventual storage in network coverage database 22. From this information, the boundary locations of the network coverage on all the streets are determined and these boundary locations stored in network coverage database 22.

In an illustrative embodiment, the streets are divided into sections where a street section is a portion of a street in a digital map used in the navigational software used by the vehicle's navigational system 26. Each street section is illustratively identified with a unique integer, which allows easy sorting of the whole database by street. Network boundary locations are the locations on particular street sections where boundaries for the wireless networks lies. Latitude and longitude values, illustratively obtained by integrated position sensors 46, are stored to pinpoint each boundary location. A radius is also specified for each boundary location so that its location is precisely specified. An illustrative organization of database 22 is shown in Fig. 6.

Wireless coverage manager 42 also updates the network coverage database 22 as updated network coverage information is received, such as from communication manager 36. Wireless coverage manager 42 illustratively reacts to updated coverage information in one of two ways. If the update is for a location not presently in network coverage database 22, wireless coverage manager 42 processes and stores it in network coverage database 22 in the manner described above. If the update is for a location that is

presently in network coverage database 22, it compares the information for that location stored in network coverage database 22 with the update information (as processed), and if the update information is different, updates the information in network coverage database 22 for that location.

Preferably the running average method is used to make the update. The location value generated by the running average method lies somewhere between the old value and the update value. The exact position is determined by a parameter, illustratively determined heuristically, that shifts the location value a certain percentage toward the update location value. In this way, an abnormal update value would not destroy the integrity of the network coverage database. If the update value persists in subsequent updates, then the value stored in the network coverage database for that location will eventually align itself to the update value.

Wireless coverage manager 42 also predicts the network coverage for a particular route. Information regarding route 24 that vehicle 18 is taking can be read in from a file or, as discussed above, obtained from the vehicle's navigation system 26. Wireless coverage manager 42 then develops a list of wireless network and systems boundary locations along route 24 that vehicle 18 is traversing and registers this list with location manager 44, *e.g,* communicates the list to location manager 44 which stores it. Wireless coverage manager 42 also determines route turning points and registers these points with location manager 44. When wireless coverage manager 42 is notified by location manager 44 that a registered location is about to be reached, as described below, it checks to see if this registered location is a network boundary and if so, whether it is appropriate to switch networks. It may be that the preferred network is being used and the network

boundary about to be reached is for a different network. Also, it may be that even if the preferred network is not being used and the registered location about to be reached is a network boundary for the preferred location, the amount of time that the vehicle will be in a coverage area for the preferred network is so small that switching is not justified. If coverage manager determines that networks should be switched, it sends a command to communication manager 36 to initiate the vertical hand-off to switch networks.

Location manager 44 accepts the list of boundary locations along route 24 from wireless coverage manager 42 and stores it. Each location is specified in terms of the following information:

- Street section (same information that is stored in the network coverage data base 22 for the particular street section)
- Latitude, longitude (the location that location manager monitors for)
- Notification radius (specifies how far ahead of reaching the registered location either in distance or in time that location manager 44 notifies the registering component, usually, wireless coverage manager 42)
- Notification status (specifies whether this location should be continuously monitored or if it is to be checked one time only)
- Call back address (handler through which location manager 44 gives the notification)

Illustratively, the data base structure for the database where location manager 44 stores the registered location information is very similar to the structure of network coverage database 22.

Location manager 44 also obtains information regarding the street on which vehicle 18 is traveling from an external component, such as vehicle navigation system 26. Each time vehicle 18 turns onto a new street, location manager 44 accesses its database for the list of registered locations on the new street and uses this list as the monitoring list.

Fig. 7 is an illustrative monitoring routine used by location manager 44. At step 100, location manager 44 obtains the current location of vehicle 18 and its speed from integrated position sensors 46. At step 102, location manager 44 determines whether any of the locations in the monitoring list will be reached in the next time period, illustratively, one second. Location manager 44 makes this determination illustratively based on the speed of vehicle 18. In this regard, the speed information obtained by location manager 44 from integrated position sensors 46 is illustratively averaged with the prior speed information, using the running average method, and the averaged speed used to make the determination of whether a registered location will be reached in the next time period, illustratively, one second. This prevents the use of speed information that might not be representative of the speed of the vehicle over the next second, which might be the case in the event of quick braking or acceleration. If location manager 44 determines that a registered location will be reached in the next time period, it notifies the component that registered the location, usually wireless coverage manager 42, at step 104, and proceeds to step 106. If not, location manager proceeds to step 106. At step 106, location manager updates its monitoring list if appropriate, such as removing a registered location that was reached if it was registered for one time notification only. Location manager then waits for one time period at 108 and returns to step 100 and starts

the monitoring routine over. Once the vehicle travels within the radius for the registered location, location manager 44 notifies the registering component that the registered location has been reached.

Fig. 10 is a graph showing an example of how applications 47 can interact with communications manager 36 to describe its communication requirement. This figure shows time to obtain content versus acceptable cost. This curve could be implemented as part of an application 47, as part of communication manager 36 and accessed by each application 47 via communication manager 36, or as a separate database to which each application 47 has access. An application 47 illustratively decides to request all the content from the current day's Internet edition of a major newspapers. The application 47 then can use the curve of Fig. 10 to decide the amount of time to request that the content be obtained in. For example, the requesting application 47 can review the curve of Fig. 10 and determine that the content can be obtained in less than five seconds at a cost of $0.50 or obtained in less than five minutes at a cost of $0.01. Since a ten minutes difference in delivery time makes little difference when dealing with news content published daily, the application 47 requests communication manager 36 to obtain the content within ten minutes at the lowest possible cost. Communication manager 36 then utilizes this information in determining which wireless service to use to obtain the content and when to use it. This interaction process between applications 47 and communications manager 36 will be termed herein as the unified content access layer API (applications program interface).

In an illustrative embodiment, the curve, such as shown in Fig. 10, would not need to be defined in its totality, but could be approximated by a few points, such as the

highest cost/ shortest time, median cost, median time, and lowest cost/longest time. Also, in the example of Fig. 10, the factors considered are cost versus time, but it should be understood that these factors are illustrative only and the decision curve used by communication manager 36 can include other or alternative factors, such as power consumption, security, and others, and the methodology described will be equally applicable.

The key importance of Fig. 10 is that it shows a particular method to design and implement the API for unified content access layer. The unified content access layer is mainly composed of communication manager 36 and various other supporting components such as wireless service availability monitor 34. The general method to communicate in today's Internet is the TCP/IP socket based programming model in which an application interacts with the operating system's TCP/IP stack and open TCP channels for communication with other network computers. This model is fully supported by the unified content access layer. By allowing applications to describe their communication requirements such as cost and performance, the direct TCP/IP socket based communication method is even enhanced because wireless network options will be chosen accordingly to accommodate each application's needs. Furthermore, a general delayed communication transaction model will be provided to applications so that they can simply request the sending and receiving of some data objects. This model is similar to FTP or HTTP GET method, in which an application describes a data object it needs to receive or send using a URL (for example a web page address) to the communication manager along with its requirement as shown in Fig. 10. The communication manager is

in turn responsible for using the best wireless communication method at right place/time for the applications in the right order to attempt to satisfy all the applications' needs.

In particular, an application now has an API for the following features:

1. An application can describe its communication requirements in terms of duration, bandwidth, cost, etc. to the unified content access layer.
2. The unified content access layer can describe the available wireless options along the route and a general wireless communication quality prediction to the applications so that they would be able to decide when to use a particular wireless option.
3. An application can now describe a data object for sending/receiving and associated timing and cost requirements to the unified content access layer. The unified content access layer will find the best way to achieve the requests received from all the applications.

An example of the interaction of elements of architecture 40 is described with reference to Figs. 8 and 9. At T100, vehicle 18 (not shown in Figs. 9 and 10) starts and navigation system 26 determines the location of vehicle 18 on route 300, illustratively, the street location that vehicle 18 is at. At T101, navigation system 26 passes this information, such as vehicle 18 is on highway 82 at location (x,y), to wireless coverage manager 42. At T102, wireless coverage manager 42 looks up what wireless services are available at this location in network coverage database 22, which in the example shown in Figs. 9 and 10, is MAN and WAN, and passes this information to communications manager 36. At T103, communication manager 36 decides which wireless service to use, which in the example shown is MAN, based on factors such as cost and performance.

At T104, navigation system 26 figures out the details of route 300 and passes this information to wireless coverage manager 42, such as vehicle 18 will travel south on highway 82 for ten minutes, turn south onto highway 85 and travel south on highway 85 for fifteen minutes, turn south on highway 280 and travel south on highway 280 for twenty minutes, and so on. At T105, wireless coverage manager 42, using the details about route 300 passed to it by navigation system 26, accesses network coverage database 22 and develops a prediction of the wireless communication services availability for route 300, for example, as vehicle 18 travels route 300, it will have seventeen minutes of MAN coverage availability and thereafter will only have WAN coverage available. At T106, wireless coverage manager 42 requests location manager 44 to monitor for the MAN coverage boundary on highway 85.

At T107, navigation system 26 informs location manager 44 of the location of vehicle 18 on route 300 and its speed. At T108, location manager 44 determines that vehicle 18 is about to cross the MAN coverage boundary on highway 85 and informs wireless coverage manager 42 that vehicle 18 will cross the MAN coverage boundary on highway 85 in a certain time, such as ten seconds. At T109, wireless coverage manager 42 informs communication manager 36 that vehicle 18 will travel out of the MAN coverage area in the certain period of time, such as ten seconds, and of the wireless communication services that will be available when that occurs, which in the example shown is WAN coverage. At T110, communication manger 36 instructs communication protocol stacks 38 to switch to WAN before the MAN connection is disrupted.

A further embodiment of this invention utilizes the bandwidth available with wireless local area networks, such as the 802.11 wireless LAN, to burst data to mobile

communication device 20 in the vehicle 18. . This method will be referred to herein as "Drive-By InfoFueling." As has been mentioned previously, wireless LAN technology has generally not been used for mobile data communication due to its very limited geographic coverage. However, many data communications do not need to be communicated to the mobile communication device 20 in real time. Therefore, InfoFueling Stations 45, which are LAN wireless base stations, can be spaced along streets and be used to burst data to the mobile communication device 20 at high speeds using the bandwidth available with LAN wireless technology, which is currently around 11 megabits per second, when the vehicle enters the coverage area of a LAN wireless base station. An InfoFueling Station 45 would illustratively comprise a computer, such as an Internet server type of computer, a wireless LAN system, and be connected to the Internet via a high speed Internet connection, such as a DSL connection, cable connection, or T1 connection. In this regard, it is important to know which InfoFueling Station's coverage area that the vehicle will encounter next and the route-based communication planning method described above can be effectively utilized to provide this information.

With reference to Figs. 2 and 3, Drive-By InfoFueling will now be described As vehicle 18 traverses route 24, communication availability monitor 34 informs communication manager 36 at T5 that an Info-Fueling Station 45 will be reached in a certain period of time, such as five minutes. At T6, an application 47, such as a News Reader, sends a request to communication manager 36 that a large amount of content be downloaded from the content provider, such as all of the day's new stories from the Internet edition of a major newspaper, within a certain period of time, such as ten minutes

and at the lowest cost. At T7, T8 communications manager 36 requests through the current wireless network connection, MAN 14 in the example shown, that content/service provider 49 (which is illustratively the server handling the Internet edition of the major newspaper) forward this content to the InfoFueling station 45 that vehicle 18 is approaching. In this regard, when communication manager 36 requests the content, it accompanies the request with the identity (illustratively, the IP address) of the InfoFueling Station 45 to which the content is to be transferred, which is the Info-Fueling Station 45 that vehicle 18 is approaching as advised by coverage manager 42.

At T9, content/service provider transfers the content to the specified InfoFueling Station 45 and the content is cached at the specified InfoFueling Station 45. Communication availability monitor determines when vehicle 18 enters the coverage area of that InfoFueling Station 45 and when it does, informs communication manager 36 at T10 that vehicle 18 has entered this coverage area. Alternatively, mobile data communication device 20 could determine when vehicle 18 enters the coverage area for that InfoFueling Station 45 based upon the signal strength of that InfoFueling Station 45. In any event, at T11 communication manager 36 requests that the InfoFueling Station 45 download the cached content to vehicle 18, which InfoFueling Station 45 does at T12. At T13, downloading is complete and the communication manager 36 transfers the downloaded content back to the application 47 requested it.

In another embodiment of the above Drive-By InfoFueling invention, the wireless LAN base stations, InfoFueling Stations 45, can be mobile and moved to locations to optimize the performance of Drive-By InfoFueling. For example, during rush hour, additional InfoFueling Stations 45 can be moved into the most heavily traveled areas to

provide additional capacity, locate the InfoFueling Stations 45 closer together, and so forth.

Although the invention has been described in detail with reference to certain preferred embodiments and specific examples, variations and modification exist within the scope and spirit of the invention as described and as defined in the following claims.

Date Recue/Date Received 2020-04-17

What is claimed is:

1. A method of selecting which of a plurality of wireless communication options will be used by a mobile communication device, comprising the step of selecting which wireless communication option to use based on a location of the mobile communication device on a route, the route, and the availability for use of each of the plurality of wireless communication options along the route.

2. The method of Claim 1, wherein one of the plurality of wireless communication options is not using any wireless communication.

3. In a mobile communication device, a method of selecting which of a plurality of wireless communication options will be used by the mobile communication device, comprising the steps of:

(a) storing in the mobile communication device route information that is indicative of the route that the mobile communication device will be traversing;

(b) storing in the mobile communication device information indicative of coverage areas for each of the plurality of wireless communication options along the route that the mobile communication device will be traversing;

(c) determining where on the route that the mobile communication device is at as it traverses the route;

(d) determining whether to switch from a first one of the wireless communication options presently being used to a second one of the wireless

communication options when the mobile communication device approaches a boundary of a coverage area of one of the wireless communication options; and

(e) switching from the first one of the wireless communication options to the second one of the wireless communication options when the mobile communication device crosses the boundary if the determination was made to switch to that second one of the wireless communication options.

4. The method of Claim 3, wherein the wireless communication options include a plurality of wireless networks.

5. The method of Claim 4, wherein the wireless communication options include at least one of the wireless networks having a plurality of service levels.

6. The method of Claim 4, wherein the wireless communication options include the option of using not using wireless communication.

7. A method of selecting which of a plurality of wireless communication options will be used by a, comprising the steps of:

(a) storing in a database information indicative of coverage areas for the wireless communication options along a route that the mobile communication device will be traversing;

(b) determining where on the route that the mobile communication device is at as it traverses the route;

(d) accessing the database to obtain information regarding the communication options available along the route and determining whether to switch from a first one of the wireless communication options presently being used to a second one of the wireless communication options when the mobile communication device approaches a boundary of a coverage area of one of the wireless networks based on the wireless communication options available once the boundary is crossed and those that will be available further along the route; and

(f) switching from the first one of the wireless communication options to the second one of the wireless communication options if the determination was made to switch to that second one of the wireless communication options.

8. The method of Claim 7 wherein the step of switching from the first one of the wireless communication options to the second one of the wireless communication options comprises establishing a connection with the second one of the wireless communication options and dropping a connection to the first one of the wireless communication options only after the connection with the second one of the wireless communication options has been established.

9. The method of Claim 7, wherein the step of storing in a database information indicative of coverage areas for the wireless communication options along a route that the mobile communication device will be traversing includes storing boundary locations of the coverage areas for the wireless communication options along the route

where the boundary locations stored are limited to boundary locations that are on streets of the route.

10. The method of Claim 9 and further including the step of obtaining updated information concerning the coverage areas of the wireless communication options and updating the database with the updated information.

11. The method of Claim 10 wherein the step of obtaining updated information concerning the coverage areas of the wireless communication options includes obtaining this information from providers of the wireless communication options.

12. The method of Claim 10, wherein the step of obtaining updated information concerning the coverage areas of the wireless communication options includes the mobile communication device monitoring signal strengths of the wireless communication options as it passes through the coverage areas for the wireless communication options and developing updated information concerning coverage areas for the wireless communication options based on the monitored signal strengths of the wireless communication options.

13. The method of Claim 12 wherein the step of updating the database with the updated information includes determining whether the updated information is for a location presently in the database,

(a) if the updated information is for a location not presently in the database, then storing the updated information in the database for the location;

(b) if the updated information is for a location presently in the database, comparing the updated information with the information stored in the database for the location and updating the stored information if updated information is different from the stored information.

14. The method of Claim 10 wherein the step of updating the database with the updated information includes determining whether the updated information is for a location for which information is presently stored in the database,

(a) if the updated information is for a location not presently in the database, then storing the updated information in the database for the location;

(b) if the updated information is for a location presently in the database, comparing the updated information with the information stored in the database for the location and updating the stored information if updated information is different from the stored information.

15. The method of claim 14, wherein the step of updating stored information comprises shifting the stored information toward the updated information by a parameter and replacing the stored information with the shifted stored information.

16. The method of claim 15 wherein the step of updating the stored information comprises doing so with a running average method wherein the stored

information is the running average of initial information and subsequent update information.

17. A method of storing data in a database that is indicative of coverage areas for wireless communication options along a route that a mobile communication device is traversing, comprising the steps of:

(a) storing boundary locations of the coverage areas for the wireless communication options along the route in the database where the boundary locations are boundary locations on streets of the route;

(b) periodically obtaining updated information concerning the coverage areas of the wireless communication options as the mobile communication device traverses the route; and

(c) updating the database with the updated information.

18. The method of Claim 17 wherein the step of updating the database with the updated information includes determining whether the updated information is for a location for which information is presently stored in the database,

(a) if the updated information is for a location not presently in the database, then storing the updated information in the database for the location;

(b) if the updated information is for a location presently in the database, comparing the updated information with the information stored in the database for the location and updating the stored information if updated information is different from the stored information.

19. The method of claim 18, wherein the step of updating stored information comprises shifting the stored information toward the updated information by a parameter and replacing the stored information with the shifted stored information.

20. The method of claim 18 wherein the step of updating the stored information comprises doing so with a running average method wherein the stored information is the running average of initial information and subsequent update information.

21. A method of determining which of a plurality of wireless communication options to use for data transmission with a mobile wireless communication device that is traversing a route, comprising the steps of determining where the mobile wireless communication device is on the route, determining which wireless communication option to use for the data communications and when to use it based upon the location of the mobile wireless communication device on the route and the availability of the wireless communication options at the location where the mobile wireless communication device is at on the route and locations on the route where the mobile wireless communication device will subsequently be at as it travels the route.

22. The method of claim 21, wherein the step of determining which wireless communication to use and when to use it includes making the determination based upon the cost to use each wireless communication option.

23. The method of claim 21, wherein the step of determining which wireless communication option to use and when to use it includes making the determination based upon the cost to and performance level of each wireless communication option.

24. A method of providing a uniform content access layer application program interface for application programs that use mobile communication provided by a mobile communication device, comprising the steps of:

(a) providing a database accessible by the application program;

(b) storing in the database information concerning any wireless communication options that are available for use by the mobile communication device as it traverses a route;

(c) the application program deciding its requirements for data transfer via wireless communication based on the information about the wireless communication options stored in the database.

25. The method of claim 24 wherein the information about the wireless communication options stored in the database includes information concerning cost and performance of the wireless communication options.

26. A method of providing a uniform content layer application program interface for application programs that use mobile communication provided by a mobile communication device, comprising the steps of:

(a) providing a database accessible by the application program; and

(b) storing in the database information concerning any wireless communication options that are available for use by the mobile communication device as it traverses a route.

27. The method of claim 26 wherein the information about the wireless communication options stored in the database includes information concerning cost and performance of the wireless communication options.

28. A method of wireless transmission of data to mobile data communication devices using wireless communication technology that has high bandwidth but low geographic coverage, comprising the steps of:

(a) providing multiple wireless communication base stations along roads, each base station having a high bandwidth and low geographic coverage;

(a) storing in the mobile data communication device route information that is indicative of the route that the mobile communication device will be traversing;

(b) storing in the mobile communication device information indicative of coverage areas for each base station located along the route that the mobile communication device will be traversing;

(c) determining which base station to use to send data to the mobile data communication device based on the location of the mobile data communication device on the route that it is travelling;

(d) transferring data to be sent to the mobile data communication device from a content provider to the base station that it was determined to use to send the data to the mobile data communication device; and

(e) the base station to which the data was transferred transmitting the data to the mobile data communication device when the mobile data communication device enter that base stations coverage area.

29. A method of fueling a vehicle with information through a wireless communication device in said vehicle, comprising the steps of:

(a) determining a predicted time when said vehicle will be able to communicate with an info-fueling station having a predictable geographic position;

(b) sending a request for information from said vehicle through said wireless communication device to at least one wireless communication network;

(c) routing said information from an information source in communication with said wireless communication network to said info-fueling station; and

(d) downloading said requested information to said vehicle through said info-fueling station during the time that said wireless communication device in said vehicle is in communication range of said info-fueling station.

30. The method according to Claim 29, wherein said info-fueling station has a fixed position relative to vehicles.

31. The method according to Claim 29, wherein said information request identifies said info-fueling station.

32. The method according to Claim 29, wherein said wireless communication network identifies said info-fueling station.

33. The method according to Claim 29, wherein said wireless communication device is coupled to an on-board communication network in said vehicle.

34. The method according to Claim 29, wherein said downloading of information commences once the detected signal strength of communication between said wireless communication device in said vehicle with said info-fueling station reaches a predetermined level.

35. The method according to Claim 29, wherein said wireless communication network also routes previously stored requests for information to said vehicle through said info-fueling station.

36. The method according to Claim 29, wherein said info-fueling station is mobile.

37. The method according to Claim 36, and further including the steps of moving each mobile info-fueling station to a location to optimize performance of info-fueling communication.

38. A method of wireless transmission of data to mobile data communication devices using wireless communication technology that has high bandwidth but low geographic coverage, comprising the steps of:

(b) providing multiple mobile wireless communication base stations on roads, each base station having a high bandwidth and low geographic coverage;

(a) storing in the mobile data communication device route information that is indicative of the route that the mobile communication device will be traversing;

(b) storing in the mobile communication device information indicative of coverage areas for each base station located along the route that the mobile communication device will be traversing;

(c) determining which base station to use to send data to the mobile data communication device based on the location of the mobile data communication device on the route that it is travelling;

(d) transferring data to be sent to the mobile data communication device from a content provider to the base station that it was determined to use to send the data to the mobile data communication device;

(e) the base station to which the data was transferred transmitting the data to the mobile data communication device when the mobile data communication device enter that base stations coverage area; and

(f) moving the base stations to locations to optimize communication between base stations and a plurality of mobile data communication devices.

Abstract of the Disclosure

A method for selecting which of a plurality of wireless communication options will be used by a mobile communication device based on the location of the mobile communication device on a route, the route, and the availability for use of each of the plurality of wireless communication options along the route. Information indicative of coverage areas for the wireless communication options available along the route are stored in a database by storing boundary locations of the coverage areas for the wireless communication options along the route where the boundary locations stored are boundary locations that are on streets of the route.

A method of providing a uniform content layer application program interface for application programs that use mobile communication provided by a mobile communication device stores information concerning any wireless communication options that are available for use by the mobile communication device as it traverses a route is stored in a database. The application program decide which wireless communication option to use based upon the information about the wireless communication options in the database.

A method of fueling a vehicle with information through a wireless communication device determines a predicted time when the vehicle will be able to communicate with an info-fueling station having a predictable geographic position. A request for information from the vehicle is sent through the wireless communication device to at least one wireless communication network. The information is routed from an information source in communication with the wireless communication network to the info-fueling station and downloaded to the vehicle.

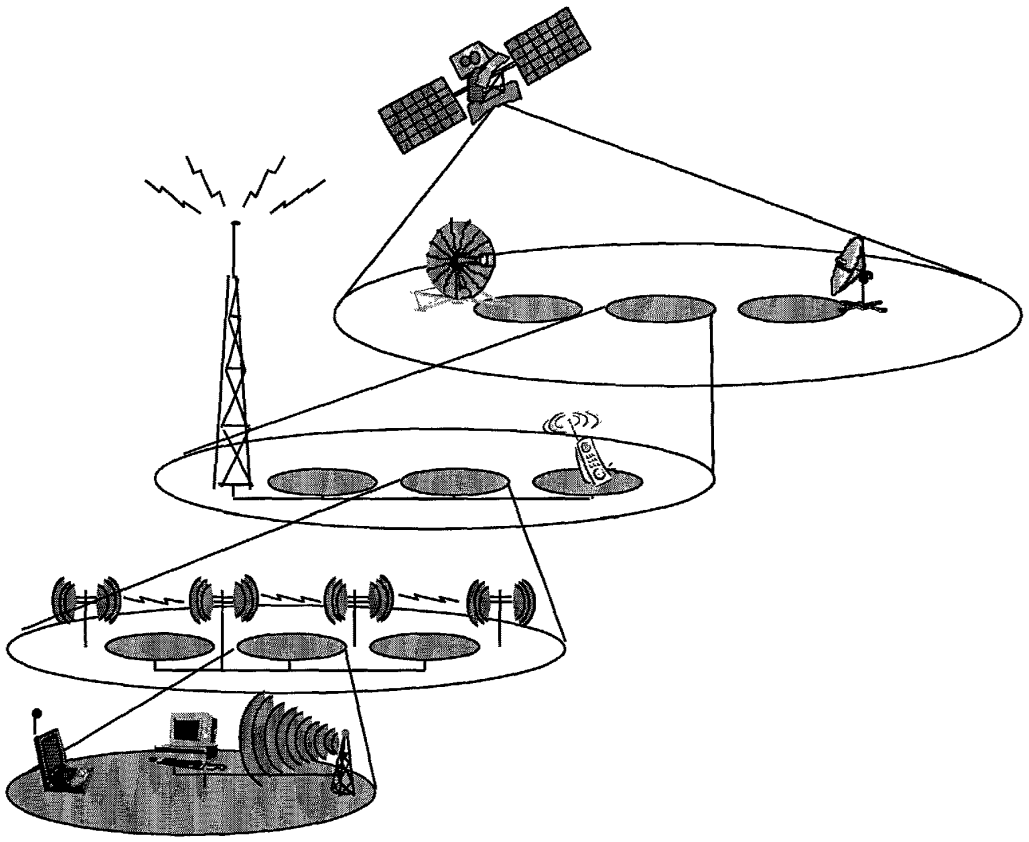


FIG. 1
(Prior Art)

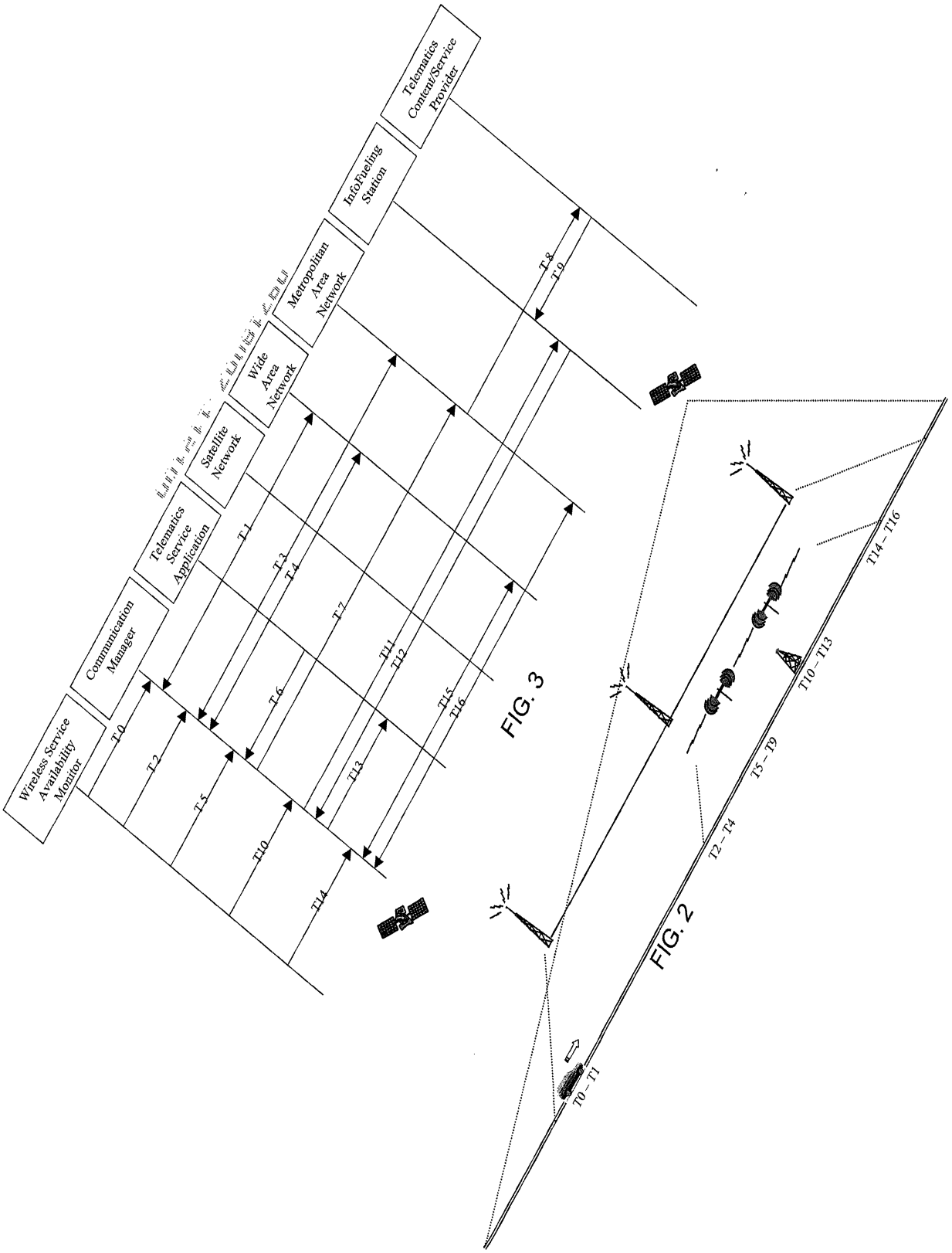
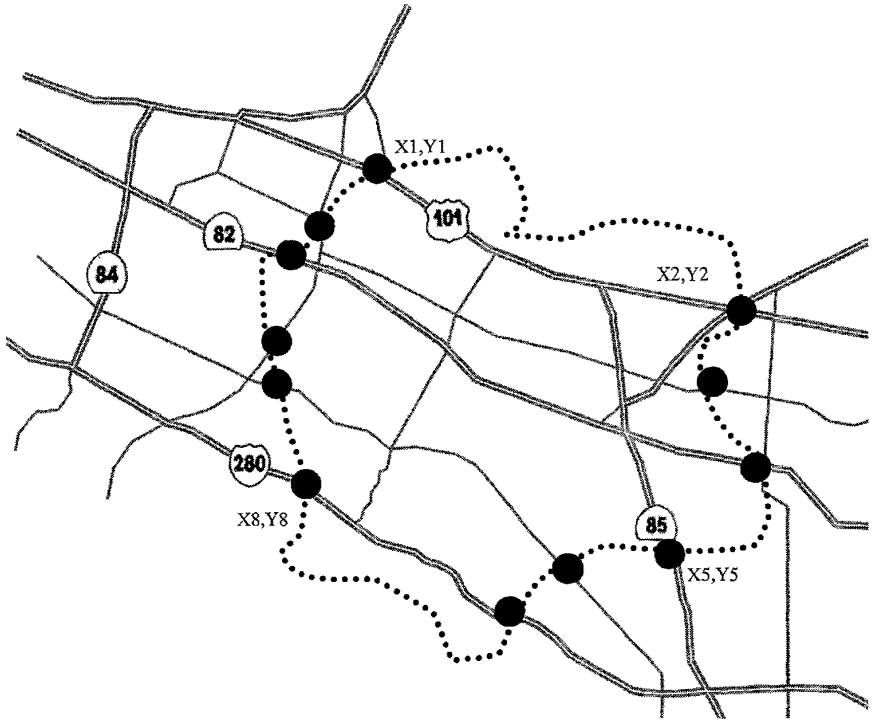

Telematics Content/Service Provider
InfoFueling Station
Metropolitan Area Network
Wide Area Network
Satellite Network
Telematics Service Application
Communication Manager
Wireless Service Availability Monitor
T0
T1
T2
T3
T4
T5
T6
T7
T8
T9
T10
T11
T12
T13
T14
T15
T16

FIG. 3

T0 – T1
T2 – T4
T5 – T9
T10 – T13
T14 – T16

FIG. 2



<HW101, (x1,y1), MAN boundary>
<HW101, (x2,y2), MAN boundary>
…
<HW85, (x5,y5), MAN boundary>
…
…
<HW280, (x8,y8), MAN boundary>
…
…

FIG. 4

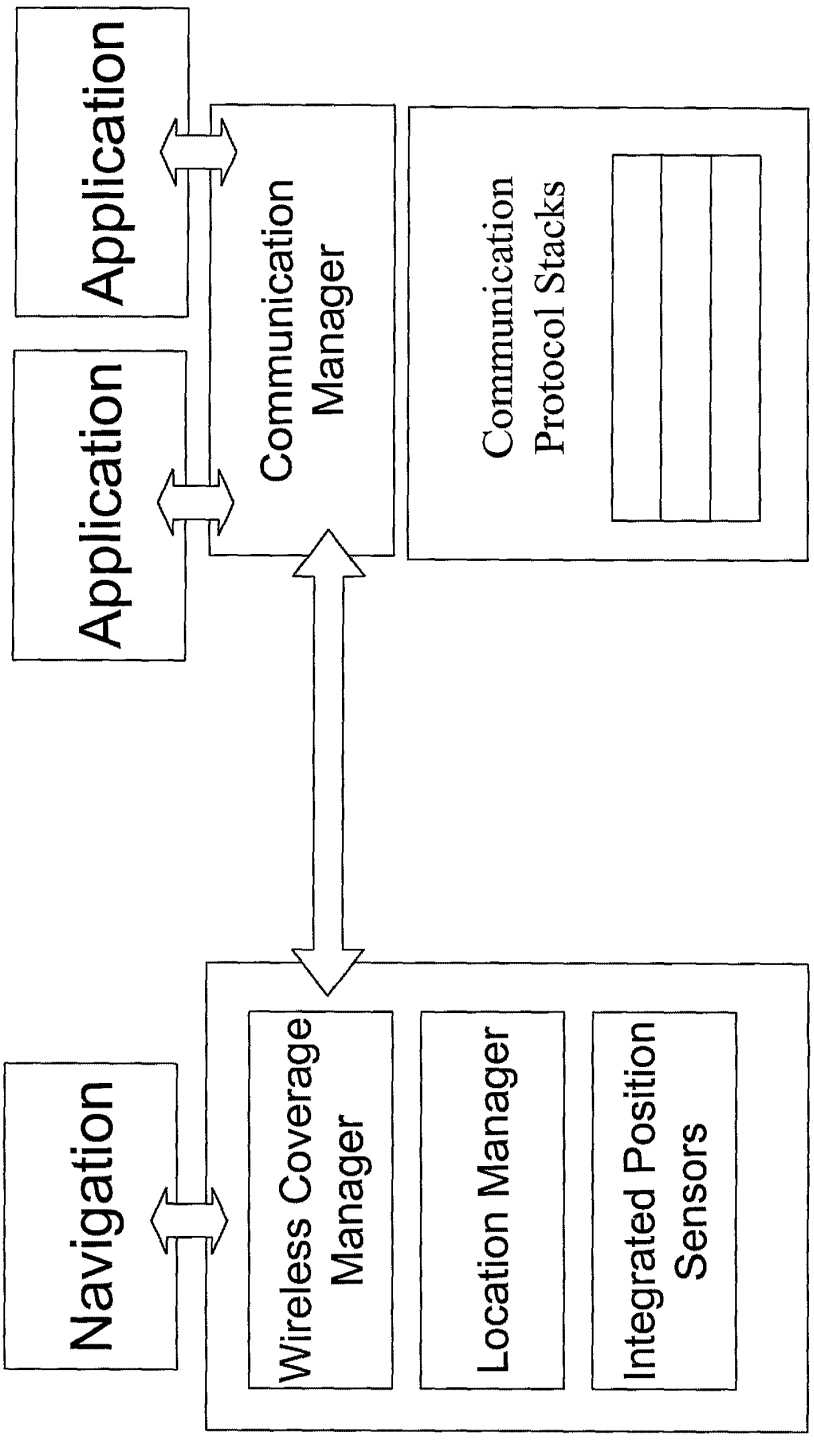

Application
Application
Communication Manager
Communication Protocol Stacks
Navigation
Wireless Coverage Manager
Location Manager
Integrated Position Sensors

FIG. 5

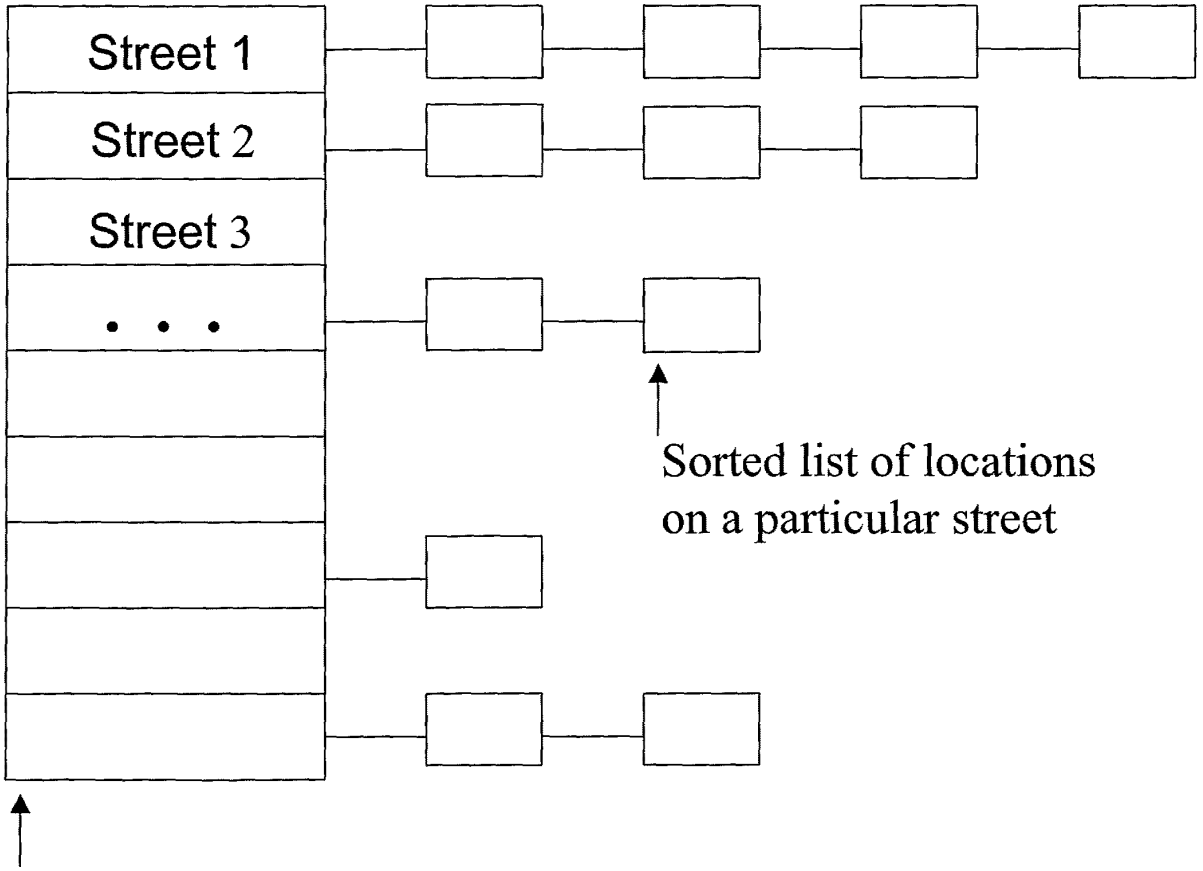

Street 1
Street 2
Street 3
• • •
Sorted list of locations
on a particular street
Registered locations
sorted by street

FIG. 6

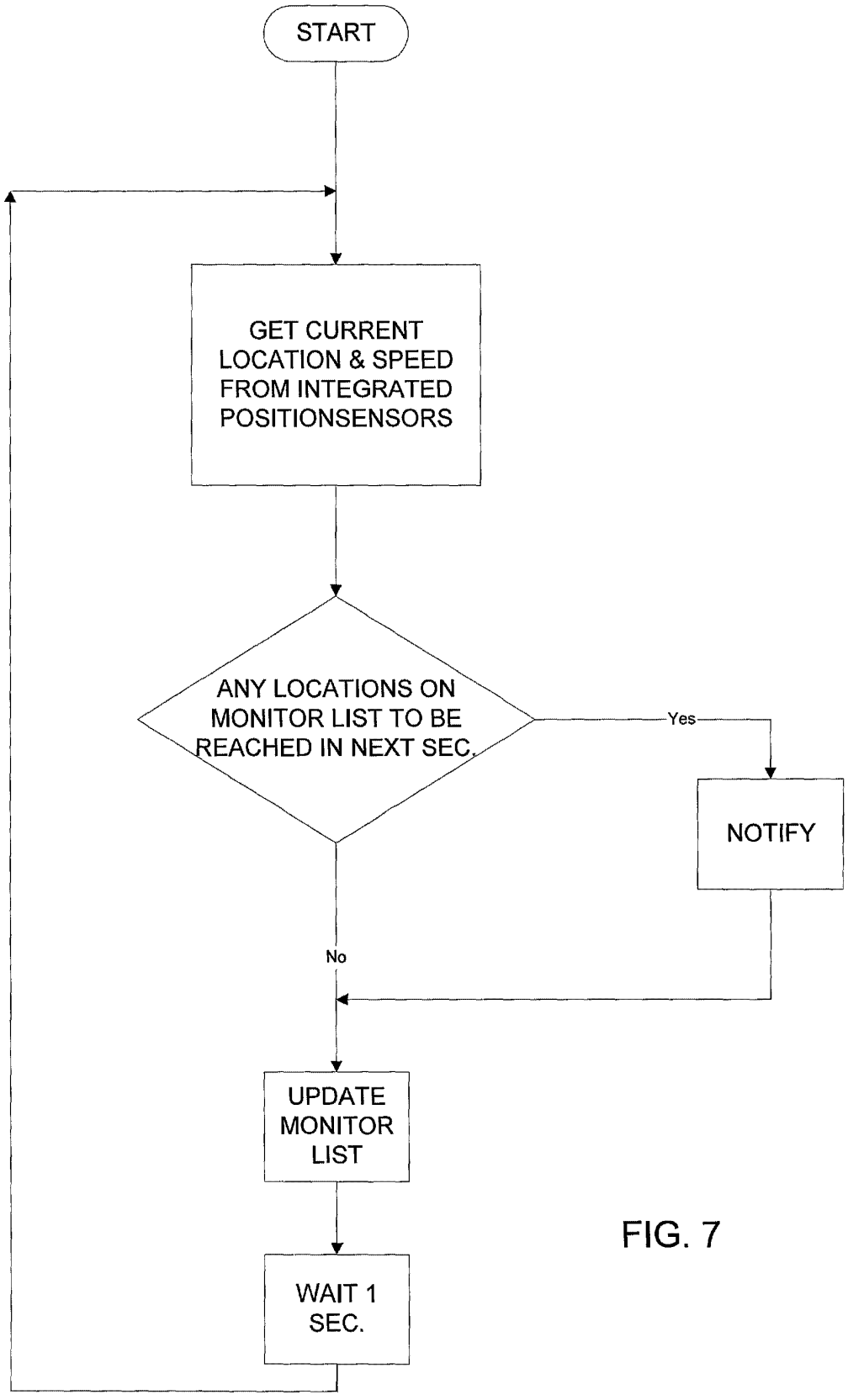

START
GET CURRENT LOCATION & SPEED FROM INTEGRATED POSITIONSENSORS
ANY LOCATIONS ON MONITOR LIST TO BE REACHED IN NEXT SEC.
Yes
NOTIFY
No
UPDATE MONITOR LIST
WAIT 1 SEC.

FIG. 7

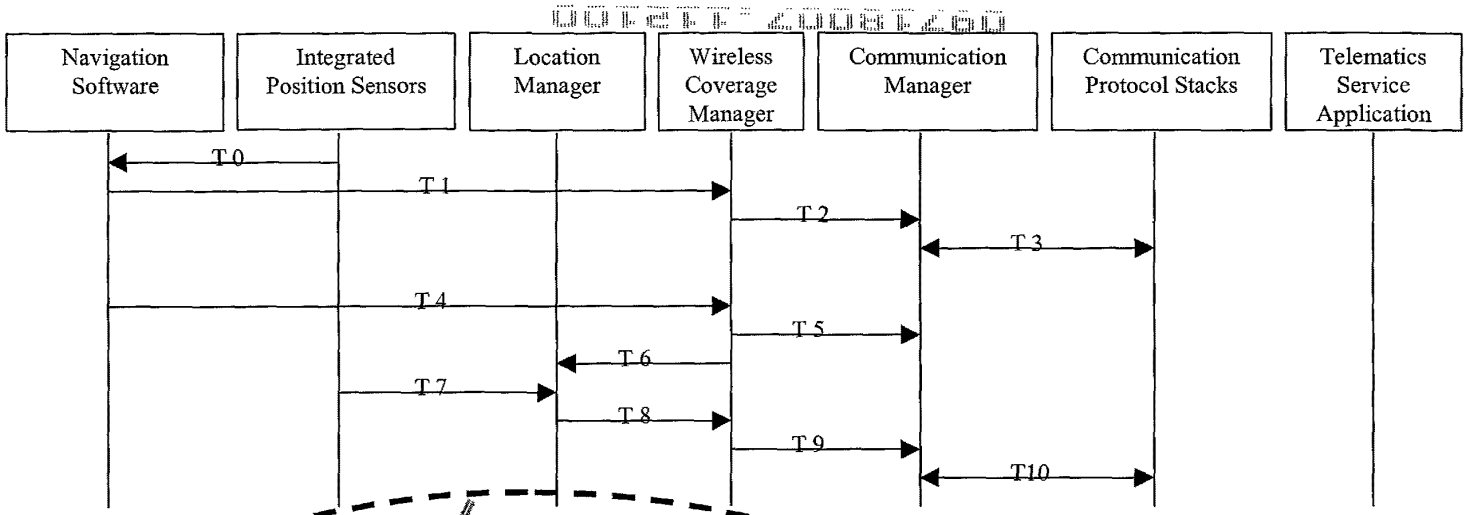

Navigation Software
Integrated Position Sensors
Location Manager
Wireless Coverage Manager
Communication Manager
Communication Protocol Stacks
Telematics Service Application
T 0
T 1
T 2
T 3
T 4
T 5
T 6
T 7
T 8
T 9
T10

FIG. 8

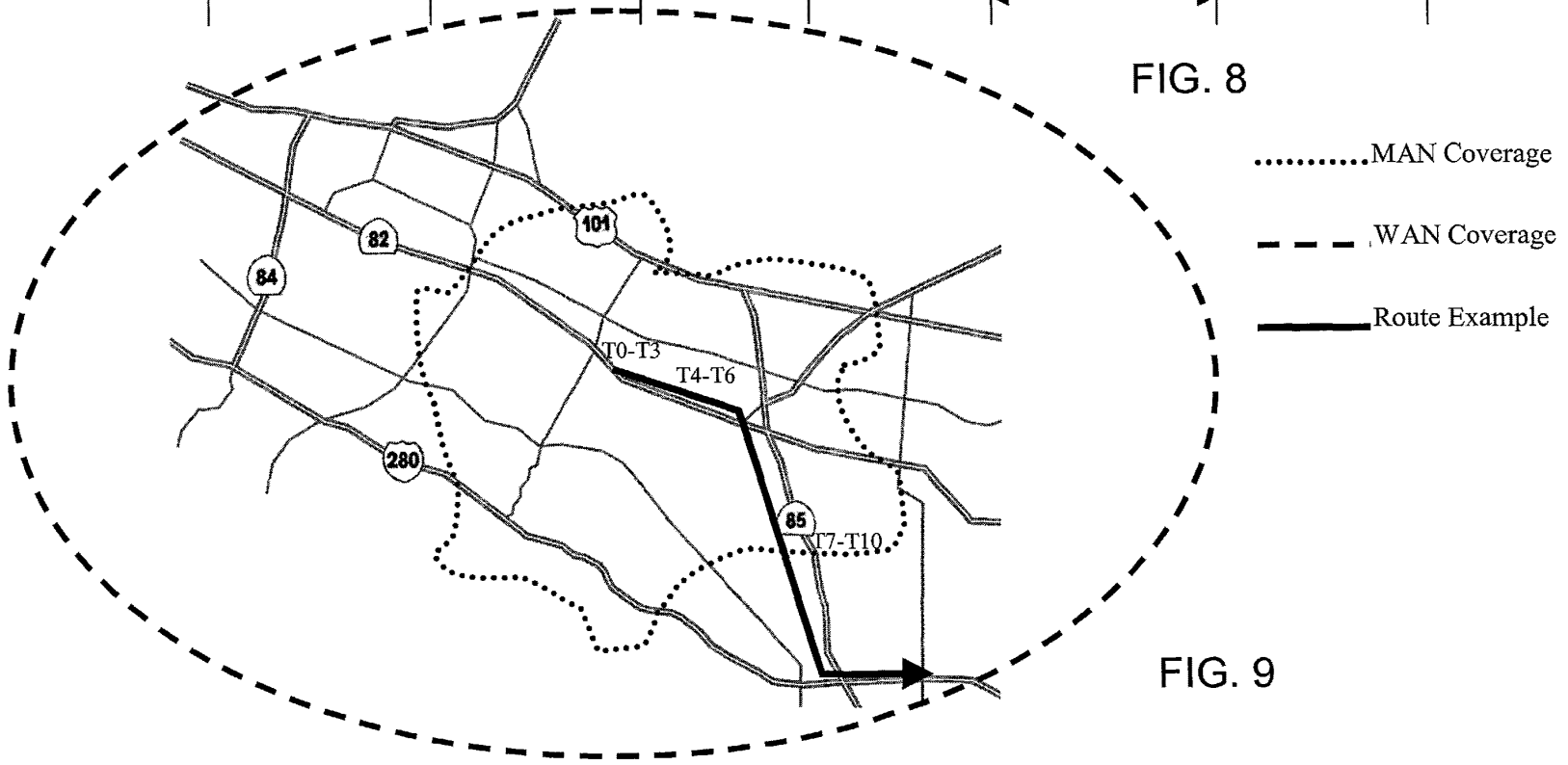

MAN Coverage
WAN Coverage
Route Example
82
101
84
280
85
T0-T3
T4-T6
T7-T10

FIG. 9

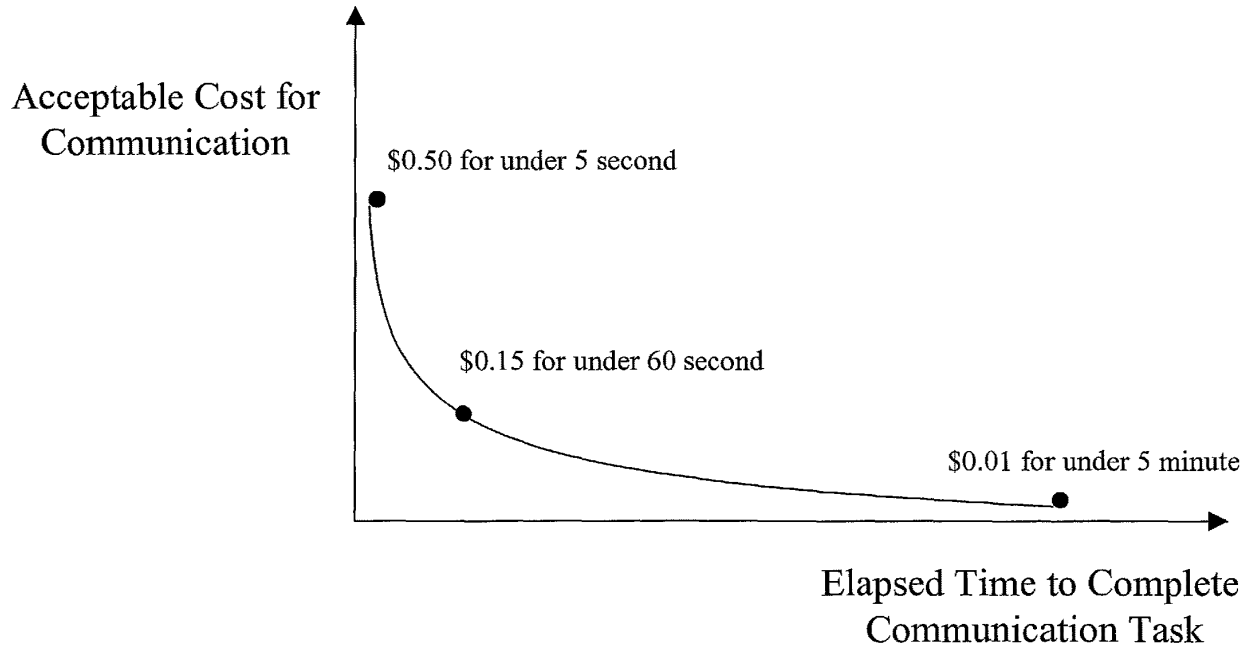

Acceptable Cost for Communication
$0.50 for under 5 second
$0.15 for under 60 second
$0.01 for under 5 minute
Elapsed Time to Complete Communication Task

FIG. 10

Attorney Docket No. 705835US1RAF

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As below named inventor, I hereby declare that:

My residence, post office address and citizenship is as stated below next to my name.

I believe I am the original, first and sole inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled:

ROUTE-BASED COMMUNICATION PLANNING ARCHITECTURE AND METHOD FOR WIRELESS COMMUNICATION

the specification of which is attached hereto.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56(a).

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Power of Attorney: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:

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DOCKET: CU-3668 FWD

JC921 U.S. PTO
09/718007
11/21/00

Class	Subclass	ISSUE CLASSIFICATION
714		

PATENT NUMBER

U.S. UTILITY Patent Application

O.I.P.E. SCANNED	Q.A.	PATENT DATE
TR	GH	

APPLICATION NO.	CONT/PRIOR	CLASS	SUBCLASS	ART UNIT	EXAMINER
09/718007		455	456	~~2681~~ 2685	ONGOSTA CRAVER, C

APPLICANTS: Xi Jiang

TITLE: Route-based communication planning architecture and method for wireless communication

PTO-2040
12/99

ISSUING CLASSIFICATION

ORIGINAL CLASS	ORIGINAL SUBCLASS	CROSS REFERENCE(S) CLASS	CROSS REFERENCE(S) SUBCLASS (ONE SUBCLASS PER BLOCK)

INTERNATIONAL CLASSIFICATION

☐ Continued on Issue Slip Inside File Jacket

☐ TERMINAL DISCLAIMER	DRAWINGS			CLAIMS ALLOWED	
	Sheets Drwg.	Figs. Drwg.	Print Fig.	Total Claims	Print Claim for O.G.
☐ The term of this patent subsequent to _____ (date) has been disclaimed.				NOTICE OF ALLOWANCE MAILED	
☐ The term of this patent shall not extend beyond the expiration date of U.S Patent. No. _____				ISSUE FEE	
				Amount Due	Date Paid
☐ The terminal ____months of this patent have been disclaimed.				ISSUE BATCH NUMBER	

(Assistant Examiner) (Date)

(Primary Examiner) (Date)

(Legal Instruments Examiner) (Date)

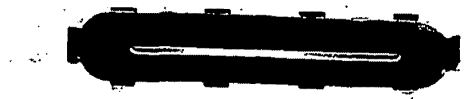
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(Rev. 6/99)

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SEARCHED

Class	Sub.	Date	Exmr.
455	414		
	422	5-13-03	
	432		
	440		
	456		
	457		
370	310.2		
	331		
	338		
UPDATED SEARCH AS ASIW		4-22-04	

SEARCH NOTES
(INCLUDING SEARCH STRATEGY)

	Date	Exmr.
Inventor Search + EAST + IDS Art		

INTERFERENCE SEARCHED

Class	Sub.	Date	Exmr.

(RIGHT OUTSIDE)

ISSUE SLIP STAPLE AREA (for additional cross references)

POSITION	INITIALS	ID NO.	DATE
FEE DETERMINATION			
O.I.P.E. CLASSIFIER		21	12/14/00
FORMALITY REVIEW		7143S	03/16/01
RESPONSE FORMALITY REVIEW			

INDEX OF CLAIMS

✔ ..... Rejected
= ..... Allowed
— (Through numeral)... Canceled
÷ ..... Restricted
N ..... Non-elected
I ..... Interference
A ..... Appeal
O ..... Objected

Claim	Date										
Final	Original	12/03	3/03	11/22/04							
	1	✔	✔								
	2	✔	✔								
	3	✔	✔								
	4	✔	✔								
	5	✔	✔								
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	12	✔	✔	O							
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	17	✔	✔	✔							
	18	✔	✔	✔							
	19	✔	✔	O							
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If more than 150 claims or 10 actions staple additional sheet here

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PTO/SB/05 (4/98)

Approved for use through 09/30/2000. OMB 0651-0032

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11/21/00 16961 U.S. PTO

UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 C.F.R. ∋1.53(b))

Attorney Docket No.	705835US1RAF
First Inventor or Application Identifier	Xi Jiang
Title	ROUTE-BASED COMMUNICATION PLANNING ARCHITECTURE AND METHOD FOR WIRELESS COMMUNICATION
Express Mail Label No.	Express Mail Label No. EL536120471US

APPLICATION ELEMENTS
See MPEP Chapter 600 concerning utility patent application contents.

ADDRESS TO: Assistant Commissioner for Patents
Box Patent Application
Washington, D.C. 20231

JC921 U.S. PTO 09/718007 11/21/00

1. _X_ *Fee Transmittal Form (e.g. PTO/SB/17)
(Submit an original and a duplicate for fee processing)

2. _X_ Specification [Total Pages _37_]
(preferred arrangement set forth below)
-Descriptive title of the Invention
-Cross References to Related Applications
-Statement Regarding Fed Sponsored R&D
-Reference to Microfiche Appendix
-Background of the Invention
-Brief Summary of the Invention
-Brief Description of the Drawings (if filed)
-Detailed Description
-Claims(s)
-Abstract of the Disclosure

3. _X_ Drawing(s) (35 U.S.C. 113) [Total Sheets _8_]

4. Oath or Declaration [Total Pages _2_]
a. _X_ Newly executed (original or copy)
b. __ Copy from a prior application (37 C.F.R.∋ 1.63 (d))
(for continuation/divisional with Box 16 completed)

i. __ DELETION OF INVENTOR(S)

Signed statement attached deleting inventor(s) Named in the prior application, see 37 C.F.R. ∋∋ 1.63(d)(2) and 1.33 (b).

5. __ Microfiche Computer Program (Appendix)

6. Nucleotide and/or Amino Acid Sequence Submission
(If applicable, all necessary)

a. __ Computer Readable Copy

b. __ Paper Copy (identical to computer copy)

c. __ Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

7. __ Assignment Papers (cover sheet & document(s))

8. __ 37 C.F.R. ∋ 3.37(b) Statement __ Power of *(when there is an assignee)* Attorney

9. __ English Translation Document (if applicable)

10. __ Information Disclosure Statement (IDS)/PTO-1449 __ Copies of IDS Citations

11. __ Preliminary Amendment

12. _X_ Return Receipt Postcard MPEP 503)

13. __ Statement (s) (PTO/SB/09-12) __ Statement filed in prior application, Status still proper and desired

14. __ Certified Copy of Priority Document(s) (if foreign priority is claimed)

15. __ Other:

**NOTE FOR ITEMS 1 & 13: IN ORDER TO BE ENTITLED TO PAY SMALL ENTITY FEES, A SMALL ENTITY STATEMENT IS REQUIRED (37 C.F.R. ∋ 1.27), EXCEPT IF ONE FILED IN A PRIOR APPLICATION IS RELIED UPON (37 C.F.R. ∋ 1.28).*

16. If a **CONTINUING APPLICATION**, Check appropriate box, and supply the requisite information below and in a preliminary amendment:
__ Continuation __ Divisional __ Continuation-in-part (CIP) of prior application No._____
Prior application information: Examiner_____

FOR CONTINUATION OR DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 4b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

17. CORRESPONDENCE ADDRESS

XXX Customer Number or Bar Code Label or __ Correspondence address below

(Insert Customer No. or Attach bar code label here)

24938

PATENT TRADEMARK OFFICE

Name	Roland A Fuller III				
	DaimlerChrysler Intellectual Capital Corporation				
Address	CIMS 483-02-19				
	800 Chrysler Drive				
City	Auburn Hills	State	Michigan	Zip Code	48326-2757
Country	United States	Telephone	(248) 944-6514	Fax	(248) 944-6537

Name (Print or Type)	Roland A Fuller III	Registration No.	31,160
Signature	R. A. Fuller III	Date	11/20/00

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FEE TRANSMITTAL
For FY 1999

Patent fees are subject to annual revision.
Small Entity payments must be supported by a small entity statement, otherwise large entity fees must be paid. See Forms PTO/SB/09-12.

Complete if Known	
Application Number	Unknown
Filing Date	November 21, 2000 (Express Mail)
First Named Inventor	Xi Jiang
Examiner Name	Unknown
Group / Art Unit	Unknown
Attorney Docket No.	705835US1RAF

TOTAL AMOUNT OF PAYMENT ($) 1594.00

METHOD OF PAYMENT (check one)

1. ☒ The Commissioner is hereby authorized to charge indicated fees and credit any over payments to:

Deposit Account Number: 03-1800
Deposit Account Name: DaimlerChrysler Intellectual Capital Corporation

☒ Charge Any Additional Fee Required Under 37 CFR 1.16 and 1.17

2. ☐ **Payment Enclosed:** ☐ Check ☐ Money Order ☐ Other

FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
101	710	201	355	Utility filing fee	710
106	320	206	160	Design filing fee	
107	490	207	245	Plant filing fee	
108	710	208	355	Reissue filing fee	
114	150	214	75	Provisional filing fee	
				SUBTOTAL (1)	710

2. EXTRA CLAIM FEES

			Extra Claim		Fee from below		Fee Paid
Total Claims	38	-20** =	18	X	324	=	324
Independent Claims	10	- 3** =	7	X	560	=	560
Multiple Dependent					270	=	0

**or number previously paid, if greater; For Reissues, see below

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
103	18	203	9	Claims in excess of 20
102	80	202	40	Independent claims in excess of 3
104	270	204	135	Multiple dependent claim, if not paid
109	80	209	40	** Reissue independent claims over original patent
110	18	210	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($) 884

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
105	130	205	65	Surcharge-late filing fee or oath	
127	50	227	25	Surcharge-late provisional filing fee or cover sheet.	
139	130	139	130	Non-English specification	
147	2,520	147	2,520	For filing a request for examination	
112	920*	112	920*	Requesting publication of SIR prior to Examiner action	
113	1,840*	113	1,840*	Requesting publication of SIR after Examiner action	
115	110	215	55	Extension for reply within first month	
116	390	216	195	Extension for reply within second month	
117	890	217	445	Extension for reply within third month	
118	1,390	218	695	Extension for reply within fourth month	
128	1,890	228	945	Extension for reply within fifth month	
119	310	219	155	Notice of Appeal	
120	310	220	155	Filing a brief in support of an appeal	
121	270	221	135	Request for oral hearing	
138	1,510	138	1,510	Petition to institute a public use proceeding	
140	110	240	55	Petition to revive – unavoidable	
141	1,210	241	605	Petition to revive – unintentional	
142	1,240	242	620	Utility issue fee (or reissue)	
143	440	243	220	Design issue fee	
144	600	244	300	Plant issue fee	
122	130	122	130	Petitions to the Commissioner	
123	50	123	50	Petitions related to provisional applications	
126	240	126	240	Submission of Information Discl. Stmt.	
581	40	581	40	Recording of each patent assignment per property (times number of properties)	
146	710	246	355	Filing a submission after final rejection (37 CFR 1.129(a))	
149	710	249	355	For each additional invention to be examined (34 CFR 1.129(b))	
				Other fee (specify)	
				Other fee (specify)	

* Reduced by Basic Filing Fee Paid **SUBTOTAL (3)** ($) 0

SUBMITTED BY				Complete (if applicable)	
Typed or Printed Name	Roland A Fuller III			Reg. Number	31,160
Signature	Roland A. Fuller III	Date	11/20/00	Deposit Account User ID	

DRAFT - 2008-260

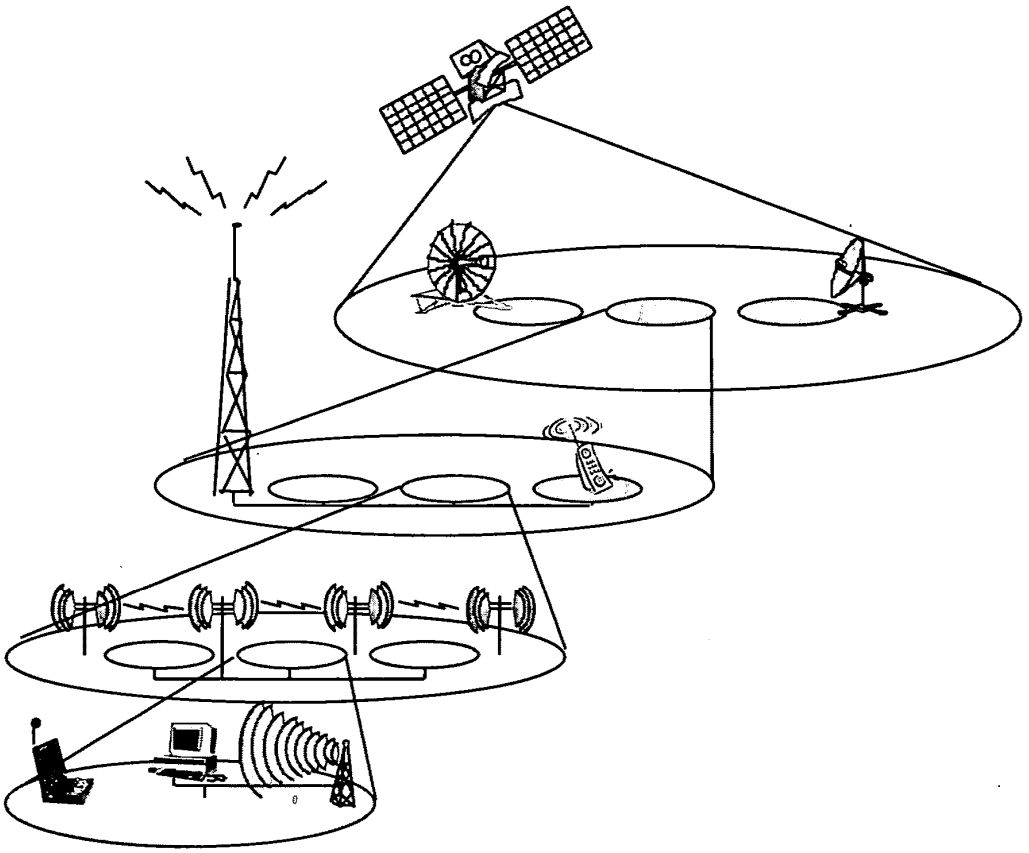


FIG. 1
(Prior Art)

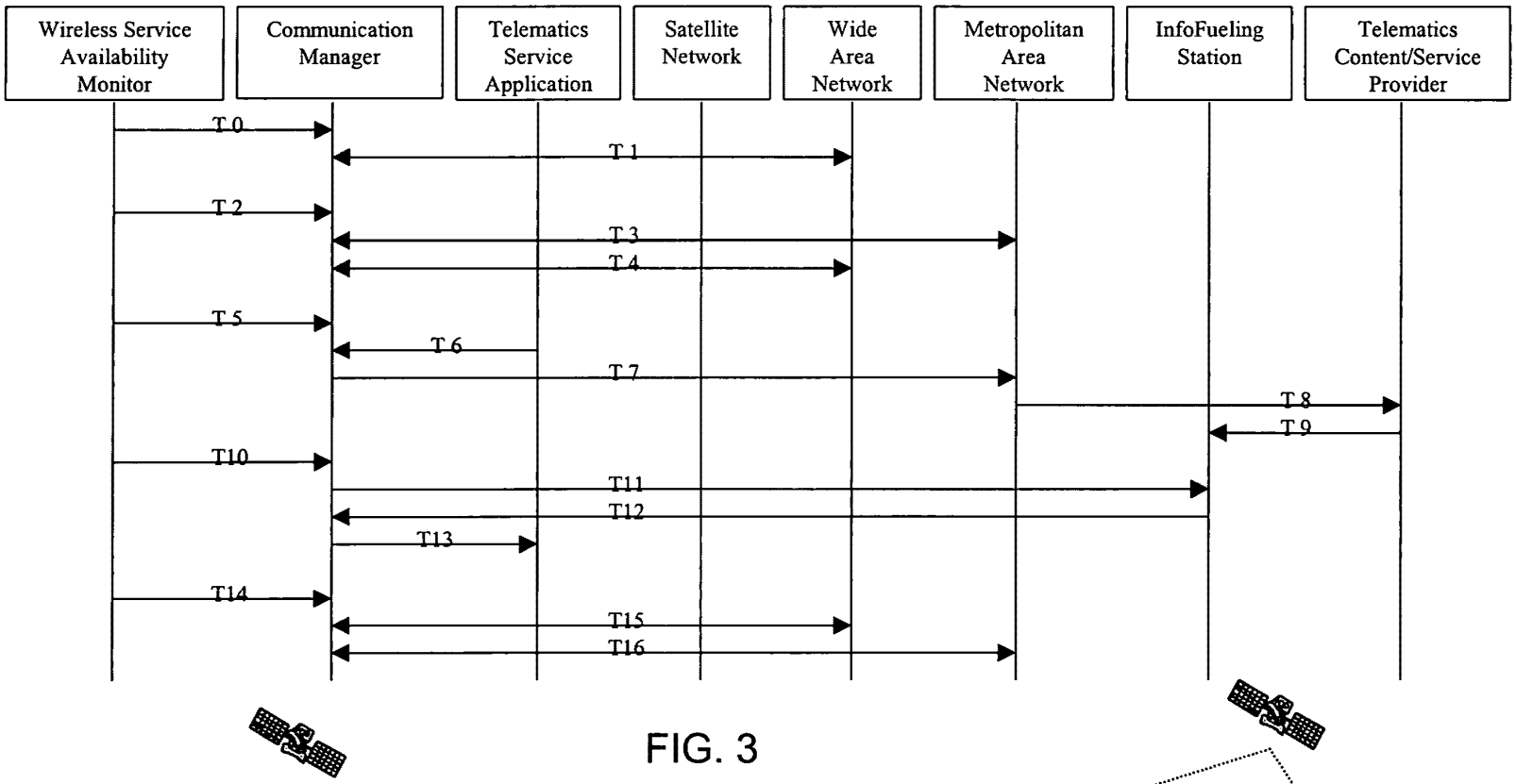

Wireless Service Availability Monitor
Communication Manager
Telematics Service Application
Satellite Network
Wide Area Network
Metropolitan Area Network
InfoFueling Station
Telematics Content/Service Provider
T0
T1
T2
T3
T4
T5
T6
T7
T8
T9
T10
T11
T12
T13
T14
T15
T16

FIG. 3

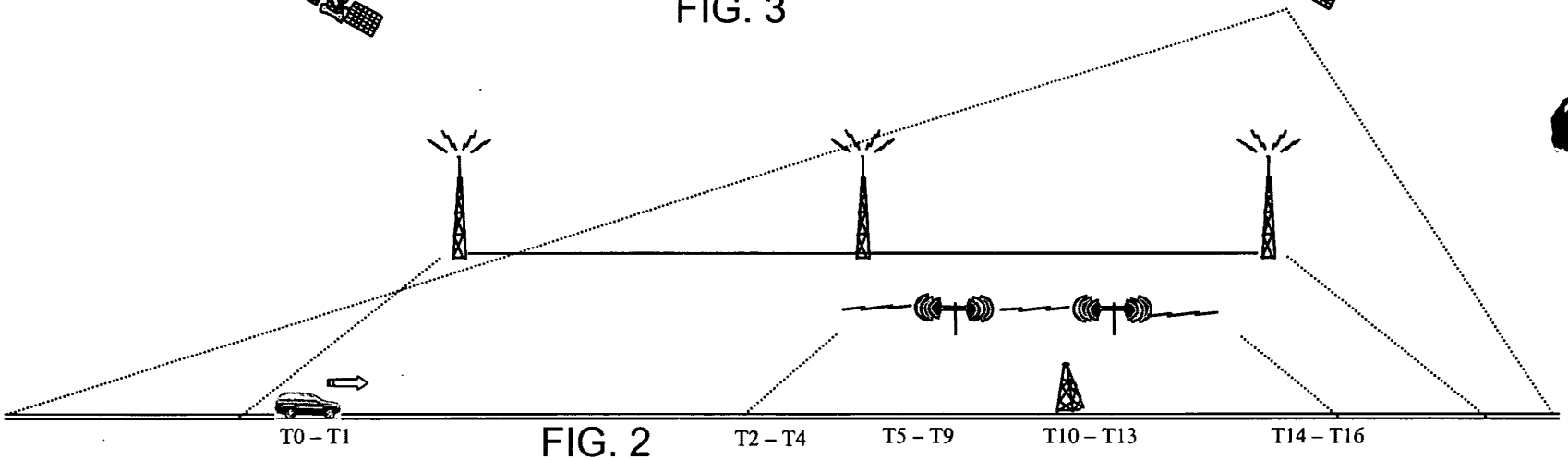
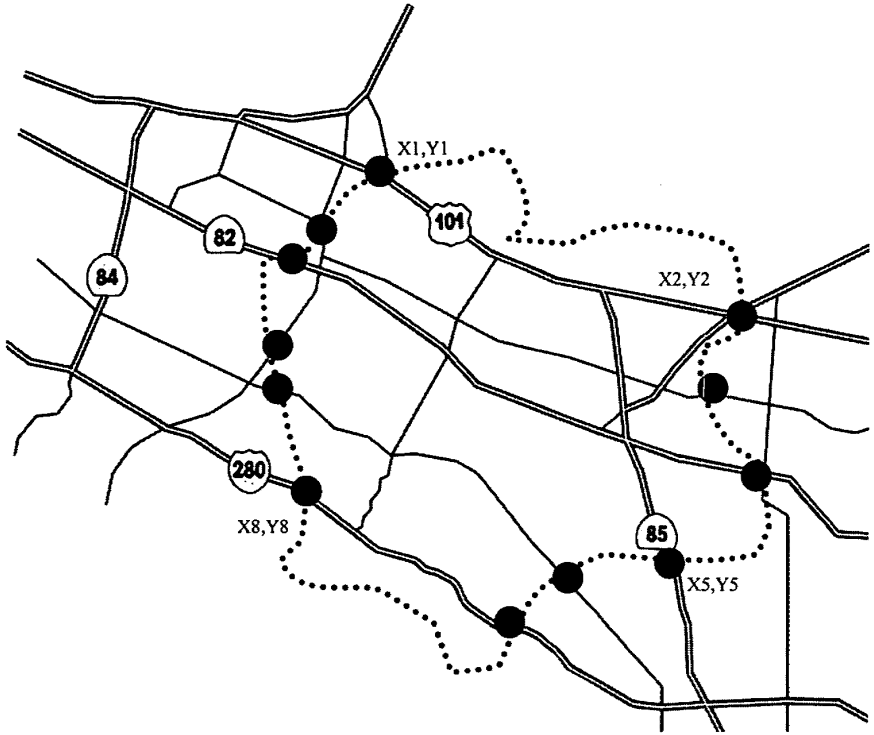

T0 – T1
T2 – T4
T5 – T9
T10 – T13
T14 – T16

FIG. 2



<HW101, (x1,y1), MAN boundary>
<HW101, (x2,y2), MAN boundary>
...
<HW85, (x5,y5), MAN boundary>
...
...
<HW280, (x8,y8), MAN boundary>
...
...

FIG. 4

DRAFT - 20080260

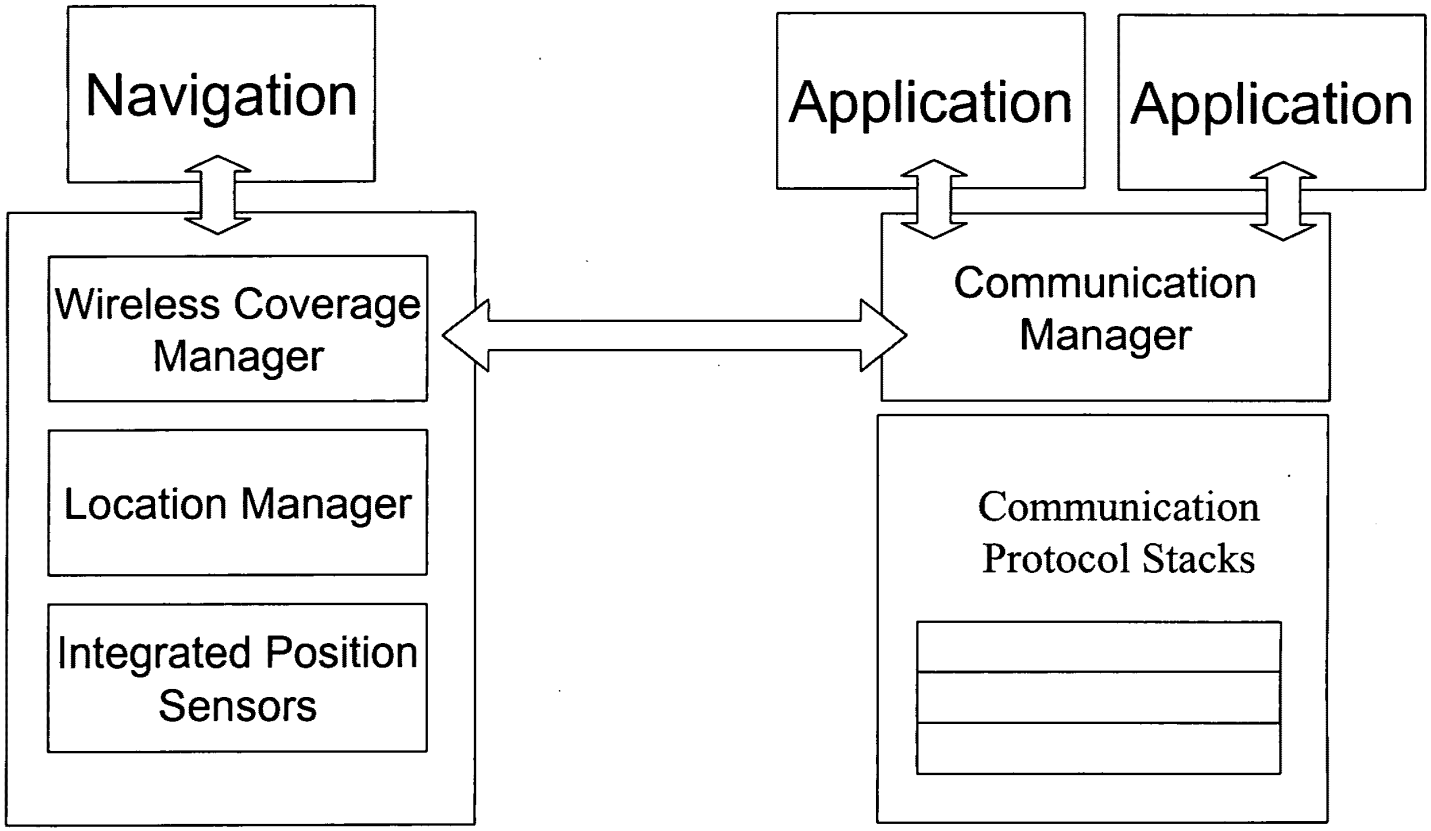


FIG. 5

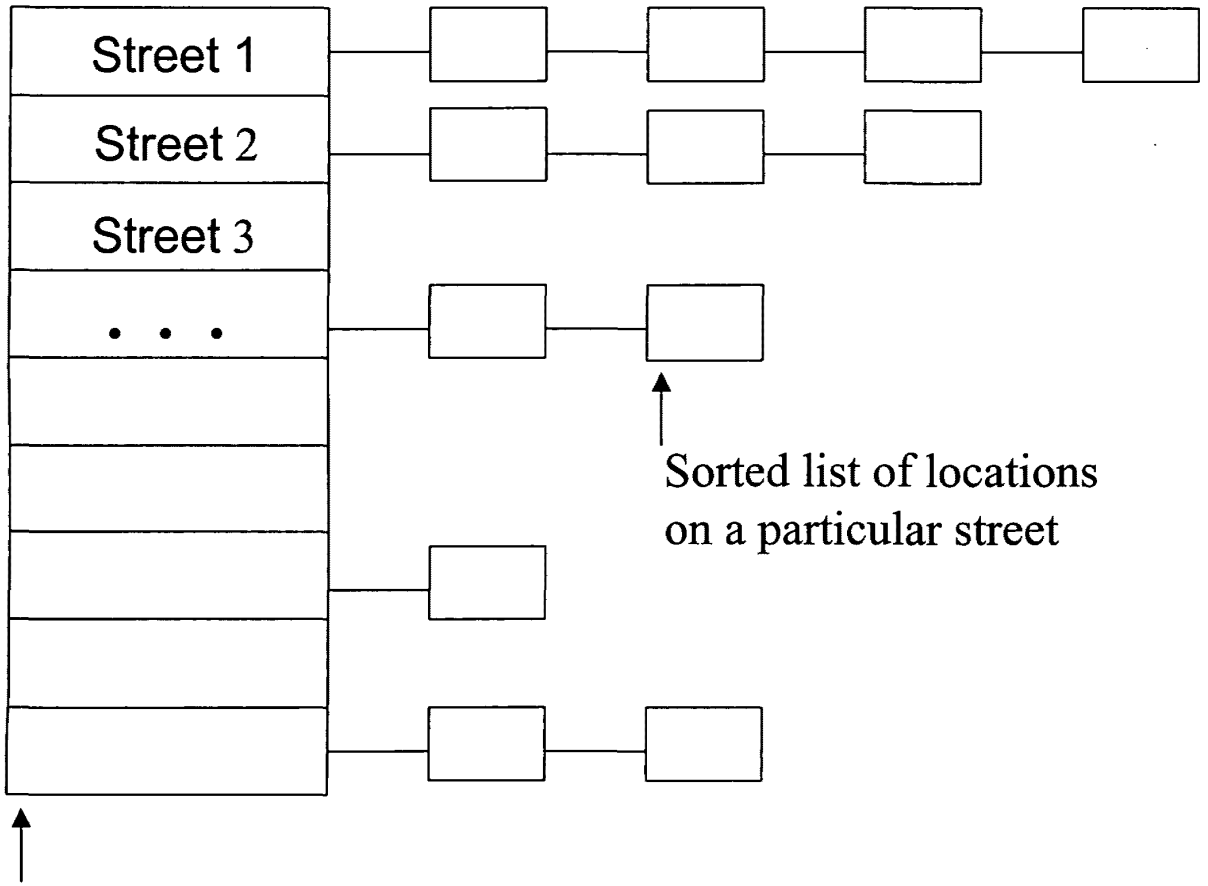

Street 1
Street 2
Street 3
• • •
Sorted list of locations
on a particular street
Registered locations
sorted by street

FIG. 6

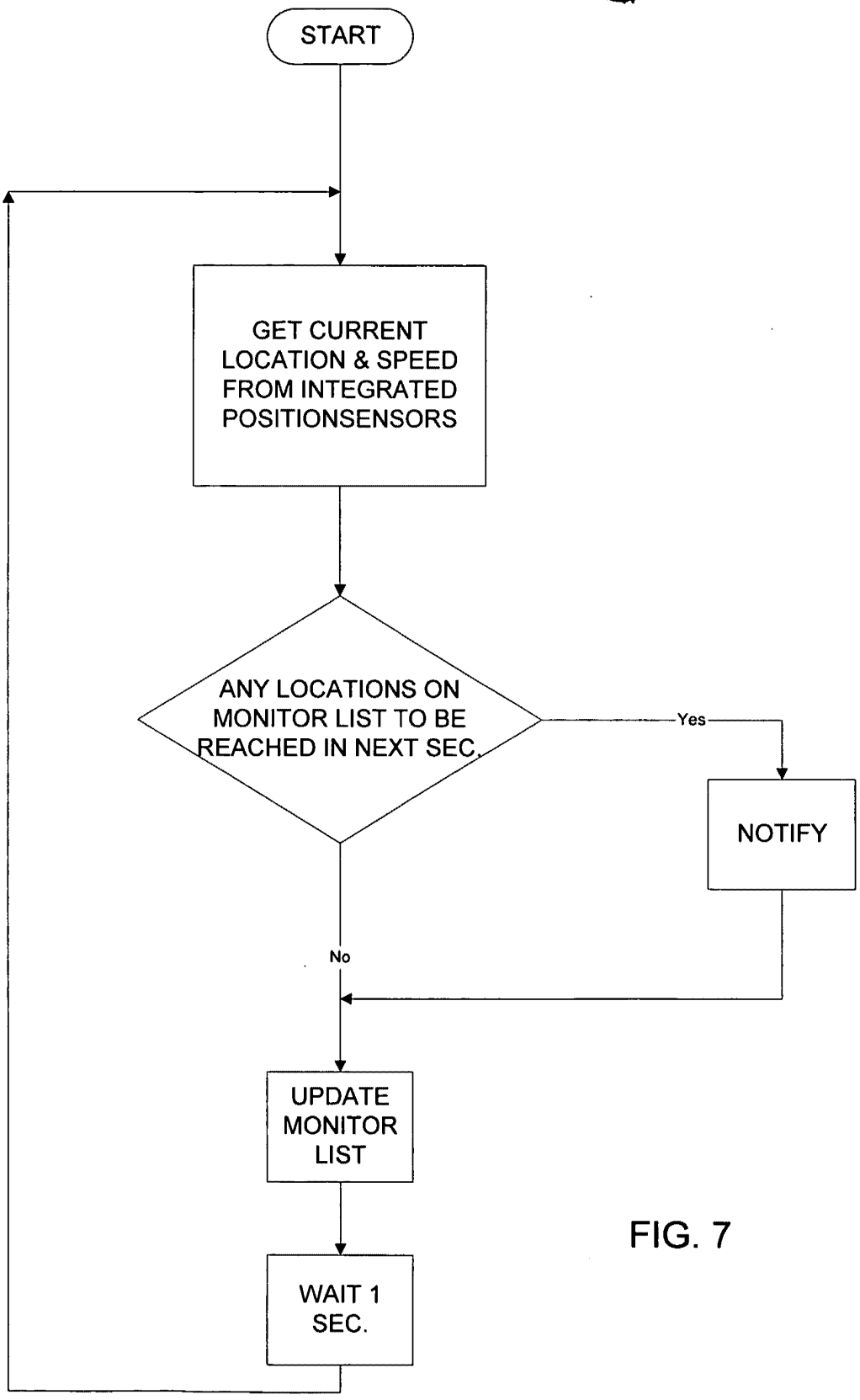

START
GET CURRENT LOCATION & SPEED FROM INTEGRATED POSITIONSENSORS
ANY LOCATIONS ON MONITOR LIST TO BE REACHED IN NEXT SEC.
Yes
NOTIFY
No
UPDATE MONITOR LIST
WAIT 1 SEC.

FIG. 7

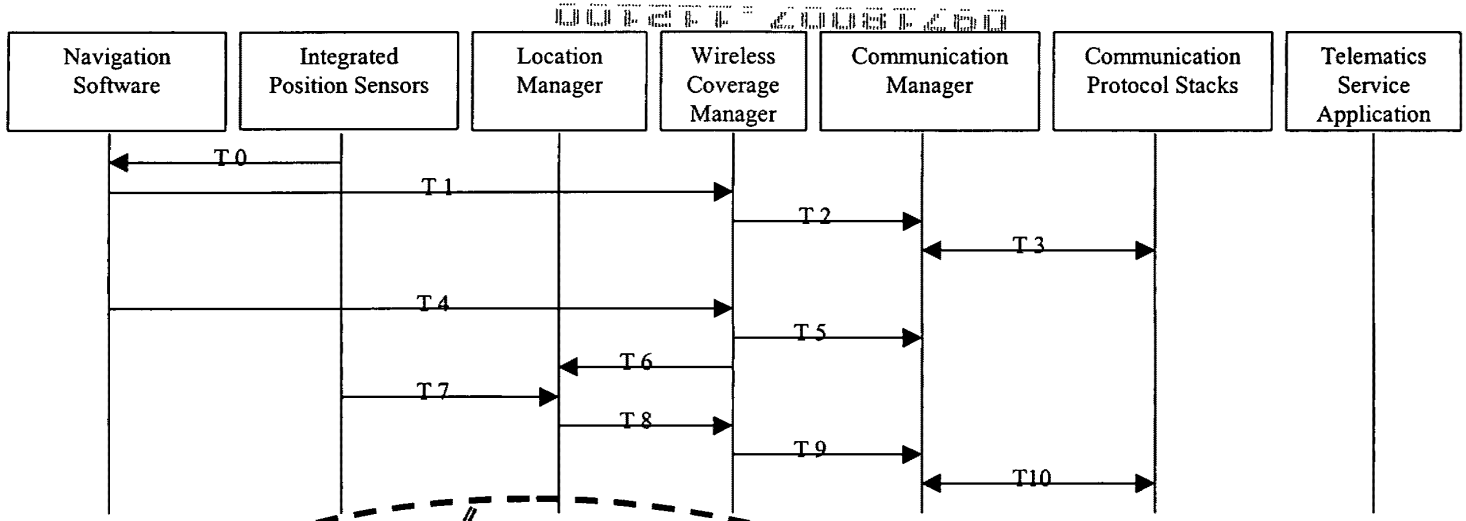

Navigation Software
Integrated Position Sensors
Location Manager
Wireless Coverage Manager
Communication Manager
Communication Protocol Stacks
Telematics Service Application
T0
T1
T2
T3
T4
T5
T6
T7
T8
T9
T10

FIG. 8

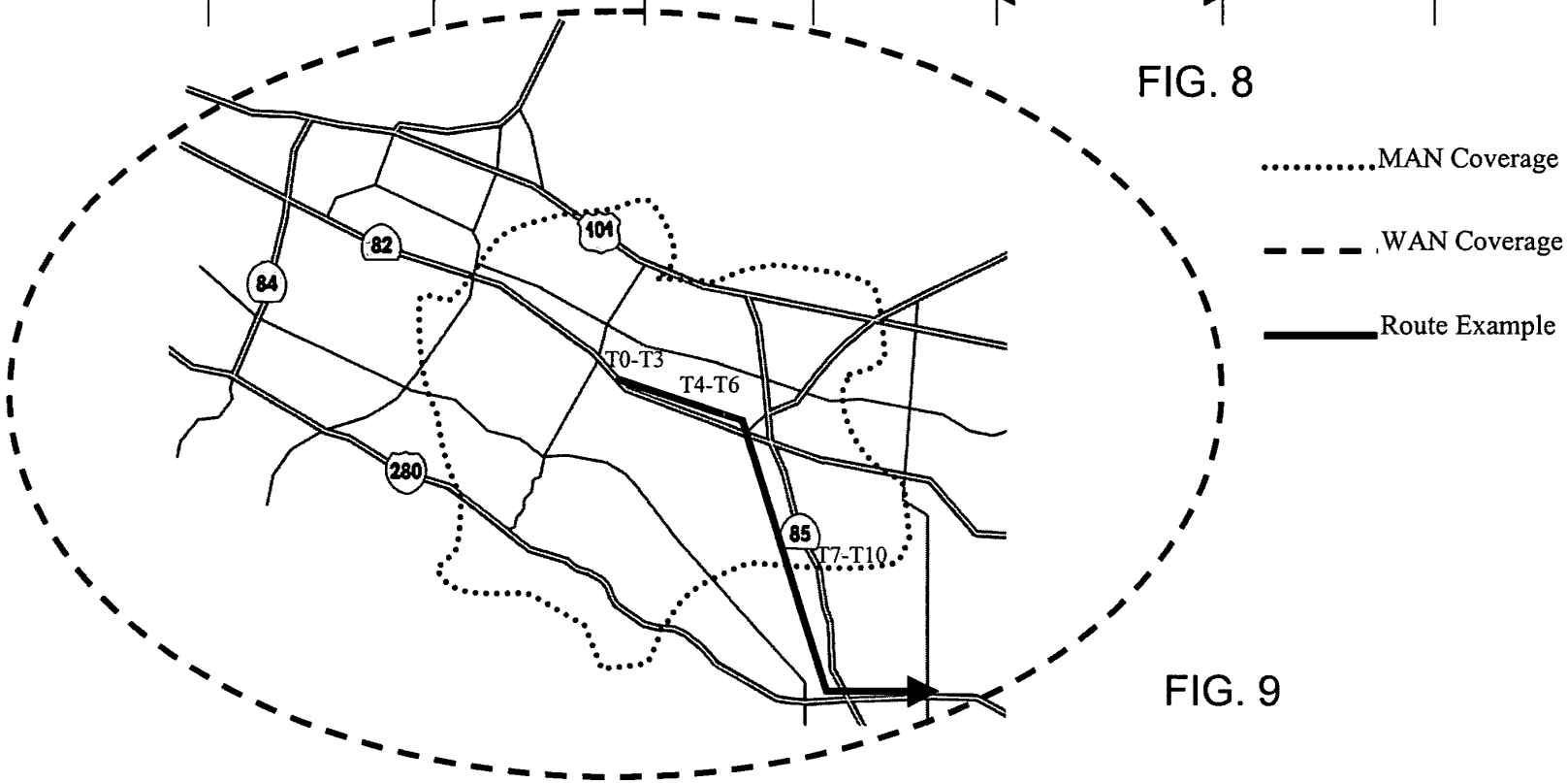

MAN Coverage
WAN Coverage
Route Example
82
84
101
280
85
T0-T3
T4-T6
T7-T10

FIG. 9

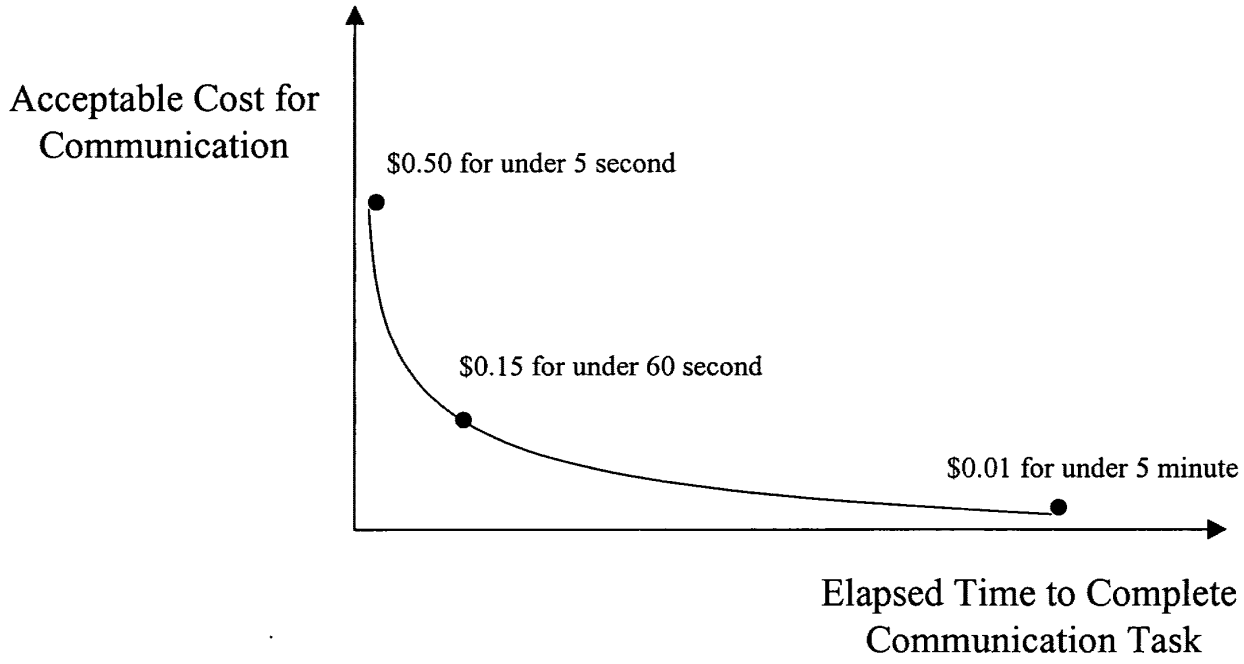

Acceptable Cost for Communication
$0.50 for under 5 second
$0.15 for under 60 second
$0.01 for under 5 minute
Elapsed Time to Complete Communication Task

FIG. 10

APPLICATION FOR LETTERS PATENT OF
THE UNITED STATES OF AMERICA

Entitled

ROUTE-BASED COMMUNICATION PLANNING ARCHITECTURE AND METHOD FOR WIRELESS COMMUNICATION

Inventor:

Xi Jiang

Docket #05835.0001

Attorney Docket No. 705835US1RAF

Route-Based Communication Planning Architecture and Method for Wireless Communication

This invention relates to mobile wireless communication, and more particularly, to a method of planning which of various wireless communication options to utilize for wireless communication in a mobile environment when one or more wireless communication options may be available for use, based on the location of the mobile user, the route the mobile user is travelling, and the availability of the various wireless communication options along the route.

Background of the Invention

Increasing numbers of vehicles come equipped with some form of "telematics" service platforms. Telematics services are those services enabled by a three-way marriage among vehicles, computing and communication technologies, and is sometimes used to mean the wireless linkage of vehicles to data networks, particularly the internet. These telematics service platforms are able to carry out various intelligent transportation system services, such as reporting a vehicle's status and position to a service center and provide certain applications such as emergency and safety assistance. In the next few years, more telematics products will be made available and eventually, most if not all vehicles will have some form of telematics platform that will offer various services, such as emergency services (*e.g.*, emergency communication in the event of an incident, such as airbag deployment), navigation services, concierge and transaction services (*e.g.*, restaurant information, hotel reservation), communication and personal information

services (*e.g.*, E-mail, calendar services), information services (*e.g.*, stock information, personalized news, sightseeing information), entertainment services (*e.g.*, interactive games, music downloads), and so forth.

These telematics service platforms require the use of some type of wireless communication. Since wireless communication is generally expensive relative to non-wireless communication (e.g., cellular phone calls versus land line phone calls), the ability of these telematics products to use wireless communication options in the most cost effective manner will be an important factor in the success of vehicular telematics. By wireless communication options, it is meant the various wireless communication networks available, discussed below, the various levels of service that each type of wireless communication network has available (i.e. transmission power level), as well as any other option that may now be available or will be available in the future for wireless communication.

In the near future, a variety of wireless communication options will be available for use by wireless communication devices in vehicles, such as satellite, cellular phone and short-range radio frequency (RF) links. These systems differ in cost, bandwidth and coverage. For example, in urban areas and along the major highways, emerging technologies, such as GPRS (general packet radio service) will be deployed in the U.S. in the next few years and will offer "always-on connections" and packet oriented data communications at higher bandwidths than today. Improved code division multiple access (CDMA) technology such as W-CDMA will also likely be established. Also, the Ricochet 2 metropolitan area access (MAN) wireless network will soon be available in 48 major metropolitan areas in the United States covering a very large percentage of the

population . These new wireless networks typically provide a higher bandwidth than existing wireless networks, such as the first generation cellular network (AMPS -- Advanced Mobile Phone System) and the second-generation cellular networks (GSM -- Global System for Mobile Communications; CDMA – Code Division Multiple Access; and TDMA -- Time Division Multiple Access).

A general method to evaluate the existing and emerging wireless communication networks and services for data communication is to examine their cost and performance levels. The first generation AMPS cellular systems typically have a maximum data transfer rate of 9600 bps and the second generation digital wireless communication systems have a maximum bandwidth of 14.4 kbps. The new third generation cellular systems will have maximum bandwidths of around 128 kbps or even 384 kbps. Since the charge for cellular communication is high, particularly when compared to even interstate land line phone calls, the cost for transferring data using these systems can be quite high. For example, the cost to transfer one mega-byte of data using the second generation digital wireless communication systems runs around $15.00 or higher. If a mobile user wants to obtain a large amount of content, the cost of doing so with cellular wireless communication can be quite high, making mobile data communication involving large amounts of data cost prohibitive to many potential users.

Fig. 1 provides a general illustration of the presently available wireless communication systems. They include regional area wireless networks 10, wide area wireless networks 12, metropolitan area networks 14, and local area networks 16. Regional area wireless networks 10 provide coverage over a large geographic region, such as the coverage provided by satellite based cellular communication networks and its

cost varies greatly. Wide area networks 12 are exemplified by the existing land based cellular phone systems mentioned above. They provide coverage over a relatively large geographic region, but to a lesser extent than regional area networks because the wide area networks utilized land based base station systems that individually have only a small geographic coverage. To obtain the wide area coverage, multiple base station systems must be spread throughout the coverage area with some degree of overlap in coverage. Thus, the geographic coverage provided by a given cellular phone system is often determined by population density and/or travel density in that locating base station systems in sparsely populated, lightly traveled geographic areas may not be cost justified. Metropolitan area networks 14, as the name implies, provide coverage only in metropolitan areas. The most well known type of metropolitan area network is Metricom's Richochet2 network architecture. Wireless local area networks 16 provide very limited geographic coverage, typically on the order of 100 yards or less. Because of this limited geographic coverage, wireless local area networks have not been used to any extent in mobile communications and their application has been pretty much limited to use in office environments and the like where the work stations that are connected to the wireless local area network are located in close proximity to each other. One such of wireless local area network is the 802.11 wireless LAN.

Initially, when the cellular systems first became popular, the wide area network AMPS network was used. More recently, cellular systems have added the second-generation digital networks to the wide area networks being used as well as the satellite based regional area networks and the metropolitan area networks. As these additional networks have been added to the networks available for mobile communication use,

cellular in particular, mobile communication devices such as newer generation cell phones have been provided the capability to switch between various networks. For example, a cellular phone can utilize the first generation AMPS network or the second generation digital networks (such as GPRS, GSM and CDMA), and even the satellite based networks.

When the mobile communication device switches among wireless networks, this is known as vertical handoff. A simple form of vertical hand-off would involve a cell phone having multi-network capability selecting which network to use based upon factors such as cost, availability and performance and switching to a second network if coverage from the first network is lost. Vertical handoff is more than just the ability to use more than one wireless network. In this regard, the cellular phone must maintain the same phone number even when it has switched networks. For example, a user having a cell phone that has both analog and digital capability might select the digital network if it was available because it has better quality than the analog network, but select the analog network if digital coverage was not available. (In today's environment, the analog network has broader coverage than digital coverage.)

More sophisticated mobile communication devices will perform the vertical handoff automatically. For example, if a cellular phone has tri-mode capability of using the analog network, digital network, and satellite network, the phone might select the network to use based in order of preference and availability. The user would have entered an order of preference into the phone telling it to use the analog network if its available, then the digital network and then the satellite network. Assuming that the phone first connected to the analog network, the phone would switch to the digital

network if the user moves out of the analog coverage area, and then to the satellite network if the user moves out of both the analog and digital coverage area. Typically, the phone decides to switch based upon whether it is in the coverage area of a given network usually determined by signal strength from the network's antennas. One of the problems that this technique has is that by the time a determination is made that the network being used should be switched, there may be a loss of service due to the time that it takes to make the switchover. Also, if the switch is from a more expensive network to a lesser expensive network, such as from the satellite network to either the digital or analog network, the switch from the satellite network may not be accomplished when the user first enters the coverage area for the analog or digital network, resulting the user paying longer than necessary for the more expensive satellite network.

Vertical handoff is a well-understood technology in the mobile computing field. In general, it is about how to automate the connection status and routing table updates on top of the mobile Internet Protocol (Mobile IP) technology. However, due to the unpredictable nature of wireless network boundaries, there is often an abrupt cut-off of service when the boundary is reached. Consequently, the overall direction of vertical hand-off research is generally focused on quick recovery schemes, such as preventative multicast to neighboring base stations.

Accordingly, it is an objective of the present invention to provide a predictive method of achieving seamless vertical handoff in a wireless communication system.

It is a further objective of the present invention to utilize the bandwidth available with local area networks for mobile communication, even though the geographic coverage of local area networks is limited.

Summary of the Invention

In order to achieve the forgoing objectives, a method is provided for selecting which of a plurality of wireless communication options will be used by a mobile communication device based on the location of the mobile communication device on a route, the route, and the availability for use of each of the plurality of wireless communication options along the route. In a further embodiment of the inventive method, information indicative of coverage areas for the wireless communication options available along the route are stored in a database by storing boundary locations of the coverage areas for the wireless communication options along the route where the boundary locations stored are boundary locations that are on streets of the route. In a further embodiment, updated information about the coverage areas is periodically obtained and the database updated accordingly.

In another embodiment of the invention, a uniform content layer application program interface is provided for application programs that use mobile communication provided by a mobile communication device. Information concerning any wireless communication options that are available for use by the mobile communication device as it traverses a route is stored in a database. The application program decide which wireless communication option to use based upon the information about the wireless communication options in the database.

In a further embodiment of the invention, a method of fueling a vehicle with information through a wireless communication device in the vehicle is provided. A predicted time when the vehicle will be able to communicate with an info-fueling station having a predictable geographic position is determined. A request for information from

the vehicle is sent through the wireless communication device to at least one wireless communication network. The information is routed from an information source in communication with the wireless communication network to the info-fueling station. The requested information is downloaded to the vehicle through the info-fueling station during the time that the wireless communication device in the vehicle is in communication range of the info-fueling station.

Brief Description of the Drawings

The present invention will become more fully understood from the detailed description and the accompanying drawings, in which:

Fig. 1 is a pictorial illustration of "prior art" wireless communication systems;

Fig. 2 is a systems interaction diagram of an embodiment of the present invention;

Fig. 3 is a pictorial illustration of wireless communication options used in the method of Fig. 2;

Fig. 4 is a pictorial representation a wireless coverage database record format in accordance with an embodiment of the present invention;

Fig. 5 is a block diagram of a route-dependent communication planning architecture according to an embodiment of the present invention;

Fig. 6 is a schematic of a data structure for monitoring and reporting wireless coverage along routes in accordance with an embodiment of the present invention;

Fig. 7 is a flow chart of a monitoring routine used in an embodiment of the present invention;

Fig. 8 is a system interaction diagram of a method of performing route dependent vertical handoff in accordance with an embodiment of the present invention;

Fig 9 is a map of the route traversed by a vehicle containing a wireless communication device with reference to Fig. 8; and

Fig 10 is an illustrative graph showing how an application may describe its preferred wireless communication requirements in accordance with an embodiment of the present invention.

Detailed Description of the Preferred Embodiments

Referring to Figs. 2 and 3, the route-based communication planning method of according to the present invention is described. (The elements of Fig. 1 that are common to Figs. 2 and 3 are identified with the same reference number.) This method is particularly advantageous for use with mobile wireless data communication applications, such as telematics applications, where data is being transmitted to and from the vehicle and will be described in that context, although the method is not limited to mobile wireless data communication applications.

A vehicle 18 has a mobile data communications device 20, illustratively, a computer having one or more wireless modems. This computer could be an off the shelf computer, such as a notebook computer, a personal digital assistant, or a computer built into the vehicle or another mobile device (*e.g.*, a cellular phone having data communication capability). The mobile communications device 20 has a communication availability monitor 34 which has a database of wireless communication network coverage information 22 (shown representatively in Fig. 4) and a communication

manager 36. Vehicle 18 also has a navigation system 26, such as that currently available in Mercedez-Benz vehicles. The navigation system 26 provides information describing a route 24 that the vehicle traverses and the location of the vehicle in the route, which it determines in a known fashion, such as from information obtained from a global positioning satellite 28.

As vehicle 18 traverses route 24, the mobile data communications device 20 is checking to determine what wireless communication networks and systems are available at particular points in the route, as described in more detail below. Based on the availability of the various wireless communication networks, the mobile communications device 20 determines which one it should use when it reaches each particular point and more specifically, if it should switch networks. If mobile communications device 20 determines that it should switch networks, such as from WAN 12 to MAN 14, it initiates the vertical handoff. Preferably, it does so in advance of reaching the predetermined point in the route, so that when the vehicle 18 reaches the predetermined point, the vertical hand-off occurs seamlessly and with minimum delay. Illustratively, the mobile communication device 20 knows how much time it takes to accomplish the vertical hand-off and, based on data such as the vehicle speed and the route the vehicle will take to reach the particular point, and initiates the request for the vertical handoff an appropriate amount of time in advance of the vehicle reaching the particular point so that the vertical handoff occurs seamlessly when the vehicle reaches the predetermined point.

More specifically, when vehicle 18 starts, communication availability monitor 34 obtains information about route 24, illustratively from an external source such as the vehicle's navigation system 26. It then creates a database of the coverage areas of the

wireless networks and systems that mobile communication device 20 can use as it traverses route 24. Communication availability monitor 34 at T0 informs communication manager 36 what wireless networks and systems are available, which in the example of Figs. 2 and 3, are WAN 12 and satellite network 10. Communication manager 36 then determines which wireless network to use, illustratively WAN 12 for reasons such as better cost or performance, and at T1 connects mobile communication device 20 to WAN 12.

As vehicle 18 traverses route 24, it reaches a point along the route that is a coverage boundary for MAN 14, indicated at T2-T4 (or just before the coverage boundary), where MAN 14 coverage is available. At T2, communication service availability monitor 34 informs communication manager 36 that MAN 14 coverage is now available. Communication manager 36 determines, based on factors such as cost and performance, that the network to which mobile data communication device 20 is connected should be switched from WAN 12 to MAN 12. At T3, communication manager 36 connects mobile data communication device 20 to MAN 14 and after the connection is established, disconnects mobile data communication device 20 from WAN 12 at T4.

Skipping to T14 (T5 – T13 are described below), when communication service availability monitor 34 determines that the vehicle will travel out of the coverage area for MAN 14 within a certain period of time, such as thirty seconds, it informs communication manager 36. At T15, communication manager 36 connects vehicle 18 to WAN 12, which communication manager determined was the best available choice, and at T16, disconnects vehicle 18 from MAN 12.

Referring to Fig. 5, an illustrative architecture 40 for the route dependent communication planning invention is shown. Architecture 40 includes wireless service availability monitor 34, communication manager 36 and communication protocol stacks 38, all of which are illustratively implemented in software as part of mobile communication device 20. Wireless service availability monitor 34 includes wireless coverage manager 42, location manager 44 and integrated position sensors 46. Integrated position sensors 46 are illustratively known types of position sensors that can determine the geographic location of an object, such as an inertial guidance system, a GPS system, and can also comprise an interface with the navigation system 26 of vehicle 18. Architecture 40 also includes navigation system 26, that is coupled to wireless coverage manager 42, and one or more applications 47 that communicate with communication manager 36 as described below.

Although shown separately from wireless coverage manager 42 in Fig. 5, location manager 44 and wireless coverage manager 42 logically interact to the point where they can both be considered part of wireless coverage manager 42. Location manager 44 keeps track of the current location of vehicle 18 and notifies wireless coverage manager 42 when vehicle 18 reaches a location registered by wireless coverage manager 42. Wireless coverage manager 42 maintains network coverage database 22 and issues commands to communication manager 36 to initiate route based vertical handoff. Integrated position sensors 46 obtain data indicative of the vehicle's geographic position, such as latitude and longitude, from sources such as the vehicle's navigation system 26 regarding the route 24 and the location of vehicle 18 on route 24.

As mentioned, wireless coverage manager 42 maintains network coverage database 22 (Fig. 4). Information regarding the coverage for each particular network is obtained from available sources, such as the network provider and signal strength monitoring by mobile communication device 20. Illustratively, this information is obtained by communication manager 36 and passed on to wireless coverage manager 42 for processing and eventual storage in network coverage database 22. From this information, the boundary locations of the network coverage on all the streets are determined and these boundary locations stored in network coverage database 22.

In an illustrative embodiment, the streets are divided into sections where a street section is a portion of a street in a digital map used in the navigational software used by the vehicle's navigational system 26. Each street section is illustratively identified with a unique integer, which allows easy sorting of the whole database by street. Network boundary locations are the locations on particular street sections where boundaries for the wireless networks lies. Latitude and longitude values, illustratively obtained by integrated position sensors 46, are stored to pinpoint each boundary location. A radius is also specified for each boundary location so that its location is precisely specified. An illustrative organization of database 22 is shown in Fig. 6.

Wireless coverage manager 42 also updates the network coverage database 22 as updated network coverage information is received, such as from communication manager 36. Wireless coverage manager 42 illustratively reacts to updated coverage information in one of two ways. If the update is for a location not presently in network coverage database 22, wireless coverage manager 42 processes and stores it in network coverage database 22 in the manner described above. If the update is for a location that is

presently in network coverage database 22, it compares the information for that location stored in network coverage database 22 with the update information (as processed), and if the update information is different, updates the information in network coverage database 22 for that location.

Preferably the running average method is used to make the update. The location value generated by the running average method lies somewhere between the old value and the update value. The exact position is determined by a parameter, illustratively determined heuristically, that shifts the location value a certain percentage toward the update location value. In this way, an abnormal update value would not destroy the integrity of the network coverage database. If the update value persists in subsequent updates, then the value stored in the network coverage database for that location will eventually align itself to the update value.

Wireless coverage manager 42 also predicts the network coverage for a particular route. Information regarding route 24 that vehicle 18 is taking can be read in from a file or, as discussed above, obtained from the vehicle's navigation system 26. Wireless coverage manager 42 then develops a list of wireless network and systems boundary locations along route 24 that vehicle 18 is traversing and registers this list with location manager 44, *e.g,* communicates the list to location manager 44 which stores it. Wireless coverage manager 42 also determines route turning points and registers these points with location manager 44. When wireless coverage manager 42 is notified by location manager 44 that a registered location is about to be reached, as described below, it checks to see if this registered location is a network boundary and if so, whether it is appropriate to switch networks. It may be that the preferred network is being used and the network

boundary about to be reached is for a different network. Also, it may be that even if the preferred network is not being used and the registered location about to be reached is a network boundary for the preferred location, the amount of time that the vehicle will be in a coverage area for the preferred network is so small that switching is not justified. If coverage manager determines that networks should be switched, it sends a command to communication manager 36 to initiate the vertical hand-off to switch networks.

Location manager 44 accepts the list of boundary locations along route 24 from wireless coverage manager 42 and stores it. Each location is specified in terms of the following information:

- Street section (same information that is stored in the network coverage data base 22 for the particular street section)
- Latitude, longitude (the location that location manager monitors for)
- Notification radius (specifies how far ahead of reaching the registered location either in distance or in time that location manager 44 notifies the registering component, usually, wireless coverage manager 42)
- Notification status (specifies whether this location should be continuously monitored or if it is to be checked one time only)
- Call back address (handler through which location manager 44 gives the notification)

Illustratively, the data base structure for the database where location manager 44 stores the registered location information is very similar to the structure of network coverage database 22.

Location manager 44 also obtains information regarding the street on which vehicle 18 is traveling from an external component, such as vehicle navigation system 26. Each time vehicle 18 turns onto a new street, location manager 44 accesses its database for the list of registered locations on the new street and uses this list as the monitoring list.

Fig. 7 is an illustrative monitoring routine used by location manager 44. At step 100, location manager 44 obtains the current location of vehicle 18 and its speed from integrated position sensors 46. At step 102, location manager 44 determines whether any of the locations in the monitoring list will be reached in the next time period, illustratively, one second. Location manager 44 makes this determination illustratively based on the speed of vehicle 18. In this regard, the speed information obtained by location manager 44 from integrated position sensors 46 is illustratively averaged with the prior speed information, using the running average method, and the averaged speed used to make the determination of whether a registered location will be reached in the next time period, illustratively, one second. This prevents the use of speed information that might not be representative of the speed of the vehicle over the next second, which might be the case in the event of quick braking or acceleration. If location manager 44 determines that a registered location will be reached in the next time period, it notifies the component that registered the location, usually wireless coverage manager 42, at step 104, and proceeds to step 106. If not, location manager proceeds to step 106. At step 106, location manager updates its monitoring list if appropriate, such as removing a registered location that was reached if it was registered for one time notification only. Location manager then waits for one time period at 108 and returns to step 100 and starts

the monitoring routine over. Once the vehicle travels within the radius for the registered location, location manager 44 notifies the registering component that the registered location has been reached.

Fig. 10 is a graph showing an example of how applications 47 can interact with communications manager 36 to describe its communication requirement. This figure shows time to obtain content versus acceptable cost. This curve could be implemented as part of an application 47, as part of communication manager 36 and accessed by each application 47 via communication manager 36, or as a separate database to which each application 47 has access. An application 47 illustratively decides to request all the content from the current day's Internet edition of a major newspapers. The application 47 then can use the curve of Fig. 10 to decide the amount of time to request that the content be obtained in. For example, the requesting application 47 can review the curve of Fig. 10 and determine that the content can be obtained in less than five seconds at a cost of $0.50 or obtained in less than five minutes at a cost of $0.01. Since a ten minutes difference in delivery time makes little difference when dealing with news content published daily, the application 47 requests communication manager 36 to obtain the content within ten minutes at the lowest possible cost. Communication manager 36 then utilizes this information in determining which wireless service to use to obtain the content and when to use it. This interaction process between applications 47 and communications manager 36 will be termed herein as the unified content access layer API (applications program interface).

In an illustrative embodiment, the curve, such as shown in Fig. 10, would not need to be defined in its totality, but could be approximated by a few points, such as the

highest cost/ shortest time, median cost, median time, and lowest cost/longest time. Also, in the example of Fig. 10, the factors considered are cost versus time, but it should be understood that these factors are illustrative only and the decision curve used by communication manager 36 can include other or alternative factors, such as power consumption, security, and others, and the methodology described will be equally applicable.

The key importance of Fig. 10 is that it shows a particular method to design and implement the API for unified content access layer. The unified content access layer is mainly composed of communication manager 36 and various other supporting components such as wireless service availability monitor 34. The general method to communicate in today's Internet is the TCP/IP socket based programming model in which an application interacts with the operating system's TCP/IP stack and open TCP channels for communication with other network computers. This model is fully supported by the unified content access layer. By allowing applications to describe their communication requirements such as cost and performance, the direct TCP/IP socket based communication method is even enhanced because wireless network options will be chosen accordingly to accommodate each application's needs. Furthermore, a general delayed communication transaction model will be provided to applications so that they can simply request the sending and receiving of some data objects. This model is similar to FTP or HTTP GET method, in which an application describes a data object it needs to receive or send using a URL (for example a web page address) to the communication manager along with its requirement as shown in Fig. 10. The communication manager is

in turn responsible for using the best wireless communication method at right place/time for the applications in the right order to attempt to satisfy all the applications' needs.

In particular, an application now has an API for the following features:

1. An application can describe its communication requirements in terms of duration, bandwidth, cost, etc. to the unified content access layer.
2. The unified content access layer can describe the available wireless options along the route and a general wireless communication quality prediction to the applications so that they would be able to decide when to use a particular wireless option.
3. An application can now describe a data object for sending/receiving and associated timing and cost requirements to the unified content access layer. The unified content access layer will find the best way to achieve the requests received from all the applications.

An example of the interaction of elements of architecture 40 is described with reference to Figs. 8 and 9. At T100, vehicle 18 (not shown in Figs. 9 and 10) starts and navigation system 26 determines the location of vehicle 18 on route 300, illustratively, the street location that vehicle 18 is at. At T101, navigation system 26 passes this information, such as vehicle 18 is on highway 82 at location (x,y), to wireless coverage manager 42. At T102, wireless coverage manager 42 looks up what wireless services are available at this location in network coverage database 22, which in the example shown in Figs. 9 and 10, is MAN and WAN, and passes this information to communications manager 36. At T103, communication manager 36 decides which wireless service to use, which in the example shown is MAN, based on factors such as cost and performance.

At T104, navigation system 26 figures out the details of route 300 and passes this information to wireless coverage manager 42, such as vehicle 18 will travel south on highway 82 for ten minutes, turn south onto highway 85 and travel south on highway 85 for fifteen minutes, turn south on highway 280 and travel south on highway 280 for twenty minutes, and so on. At T105, wireless coverage manager 42, using the details about route 300 passed to it by navigation system 26, accesses network coverage database 22 and develops a prediction of the wireless communication services availability for route 300, for example, as vehicle 18 travels route 300, it will have seventeen minutes of MAN coverage availability and thereafter will only have WAN coverage available. At T106, wireless coverage manager 42 requests location manager 44 to monitor for the MAN coverage boundary on highway 85.

At T107, navigation system 26 informs location manager 44 of the location of vehicle 18 on route 300 and its speed. At T108, location manager 44 determines that vehicle 18 is about to cross the MAN coverage boundary on highway 85 and informs wireless coverage manager 42 that vehicle 18 will cross the MAN coverage boundary on highway 85 in a certain time, such as ten seconds. At T109, wireless coverage manager 42 informs communication manager 36 that vehicle 18 will travel out of the MAN coverage area in the certain period of time, such as ten seconds, and of the wireless communication services that will be available when that occurs, which in the example shown is WAN coverage. At T110, communication manger 36 instructs communication protocol stacks 38 to switch to WAN before the MAN connection is disrupted.

A further embodiment of this invention utilizes the bandwidth available with wireless local area networks, such as the 802.11 wireless LAN, to burst data to mobile

communication device 20 in the vehicle 18. . This method will be referred to herein as "Drive-By InfoFueling." As has been mentioned previously, wireless LAN technology has generally not been used for mobile data communication due to its very limited geographic coverage. However, many data communications do not need to be communicated to the mobile communication device 20 in real time. Therefore, InfoFueling Stations 45, which are LAN wireless base stations, can be spaced along streets and be used to burst data to the mobile communication device 20 at high speeds using the bandwidth available with LAN wireless technology, which is currently around 11 megabits per second, when the vehicle enters the coverage area of a LAN wireless base station. An InfoFueling Station 45 would illustratively comprise a computer, such as an Internet server type of computer, a wireless LAN system, and be connected to the Internet via a high speed Internet connection, such as a DSL connection, cable connection, or T1 connection. In this regard, it is important to know which InfoFueling Station's coverage area that the vehicle will encounter next and the route-based communication planning method described above can be effectively utilized to provide this information.

With reference to Figs. 2 and 3, Drive-By InfoFueling will now be described As vehicle 18 traverses route 24, communication availability monitor 34 informs communication manager 36 at T5 that an Info-Fueling Station 45 will be reached in a certain period of time, such as five minutes. At T6, an application 47, such as a News Reader, sends a request to communication manager 36 that a large amount of content be downloaded from the content provider, such as all of the day's new stories from the Internet edition of a major newspaper, within a certain period of time, such as ten minutes

and at the lowest cost. At T7, T8 communications manager 36 requests through the current wireless network connection, MAN 14 in the example shown, that content/service provider 49 (which is illustratively the server handling the Internet edition of the major newspaper) forward this content to the InfoFueling station 45 that vehicle 18 is approaching. In this regard, when communication manager 36 requests the content, it accompanies the request with the identity (illustratively, the IP address) of the InfoFueling Station 45 to which the content is to be transferred, which is the Info-Fueling Station 45 that vehicle 18 is approaching as advised by coverage manager 42.

At T9, content/service provider transfers the content to the specified InfoFueling Station 45 and the content is cached at the specified InfoFueling Station 45. Communication availability monitor determines when vehicle 18 enters the coverage area of that InfoFueling Station 45 and when it does, informs communication manager 36 at T10 that vehicle 18 has entered this coverage area. Alternatively, mobile data communication device 20 could determine when vehicle 18 enters the coverage area for that InfoFueling Station 45 based upon the signal strength of that InfoFueling Station 45. In any event, at T11 communication manager 36 requests that the InfoFueling Station 45 download the cached content to vehicle 18, which InfoFueling Station 45 does at T12. At T13, downloading is complete and the communication manager 36 transfers the downloaded content back to the application 47 requested it.

In another embodiment of the above Drive-By InfoFueling invention, the wireless LAN base stations, InfoFueling Stations 45, can be mobile and moved to locations to optimize the performance of Drive-By InfoFueling. For example, during rush hour, additional InfoFueling Stations 45 can be moved into the most heavily traveled areas to

provide additional capacity, locate the InfoFueling Stations 45 closer together, and so forth.

Although the invention has been described in detail with reference to certain preferred embodiments and specific examples, variations and modification exist within the scope and spirit of the invention as described and as defined in the following claims.

Docket 2006-200

What is claimed is:

1. A method of selecting which of a plurality of wireless communication options will be used by a mobile communication device, comprising the step of selecting which wireless communication option to use based on a location of the mobile communication device on a route, the route, and the availability for use of each of the plurality of wireless communication options along the route.

2. The method of Claim 1, wherein one of the plurality of wireless communication options is not using any wireless communication.

3. In a mobile communication device, a method of selecting which of a plurality of wireless communication options will be used by the mobile communication device, comprising the steps of:

(a) storing in the mobile communication device route information that is indicative of the route that the mobile communication device will be traversing;

(b) storing in the mobile communication device information indicative of coverage areas for each of the plurality of wireless communication options along the route that the mobile communication device will be traversing;

(c) determining where on the route that the mobile communication device is at as it traverses the route;

(d) determining whether to switch from a first one of the wireless communication options presently being used to a second one of the wireless

communication options when the mobile communication device approaches a boundary of a coverage area of one of the wireless communication options; and

(e) switching from the first one of the wireless communication options to the second one of the wireless communication options when the mobile communication device crosses the boundary if the determination was made to switch to that second one of the wireless communication options.

4. The method of Claim 3, wherein the wireless communication options include a plurality of wireless networks.

5. The method of Claim 4, wherein the wireless communication options include at least one of the wireless networks having a plurality of service levels.

6. The method of Claim 4, wherein the wireless communication options include the option of using not using wireless communication.

7. A method of selecting which of a plurality of wireless communication options will be used by a, comprising the steps of:

(a) storing in a database information indicative of coverage areas for the wireless communication options along a route that the mobile communication device will be traversing;

(b) determining where on the route that the mobile communication device is at as it traverses the route;

(d) accessing the database to obtain information regarding the communication options available along the route and determining whether to switch from a first one of the wireless communication options presently being used to a second one of the wireless communication options when the mobile communication device approaches a boundary of a coverage area of one of the wireless networks based on the wireless communication options available once the boundary is crossed and those that will be available further along the route; and

(f) switching from the first one of the wireless communication options to the second one of the wireless communication options if the determination was made to switch to that second one of the wireless communication options.

8. The method of Claim 7 wherein the step of switching from the first one of the wireless communication options to the second one of the wireless communication options comprises establishing a connection with the second one of the wireless communication options and dropping a connection to the first one of the wireless communication options only after the connection with the second one of the wireless communication options has been established.

9. The method of Claim 7, wherein the step of storing in a database information indicative of coverage areas for the wireless communication options along a route that the mobile communication device will be traversing includes storing boundary locations of the coverage areas for the wireless communication options along the route

where the boundary locations stored are limited to boundary locations that are on streets of the route.

10. The method of Claim 9 and further including the step of obtaining updated information concerning the coverage areas of the wireless communication options and updating the database with the updated information.

11. The method of Claim 10 wherein the step of obtaining updated information concerning the coverage areas of the wireless communication options includes obtaining this information from providers of the wireless communication options.

12. The method of Claim 10, wherein the step of obtaining updated information concerning the coverage areas of the wireless communication options includes the mobile communication device monitoring signal strengths of the wireless communication options as it passes through the coverage areas for the wireless communication options and developing updated information concerning coverage areas for the wireless communication options based on the monitored signal strengths of the wireless communication options.

13. The method of Claim 12 wherein the step of updating the database with the updated information includes determining whether the updated information is for a location presently in the database,

(a) if the updated information is for a location not presently in the database, then storing the updated information in the database for the location;

(b) if the updated information is for a location presently in the database, comparing the updated information with the information stored in the database for the location and updating the stored information if updated information is different from the stored information.

14. The method of Claim 10 wherein the step of updating the database with the updated information includes determining whether the updated information is for a location for which information is presently stored in the database,

(a) if the updated information is for a location not presently in the database, then storing the updated information in the database for the location;

(b) if the updated information is for a location presently in the database, comparing the updated information with the information stored in the database for the location and updating the stored information if updated information is different from the stored information.

15. The method of claim 14, wherein the step of updating stored information comprises shifting the stored information toward the updated information by a parameter and replacing the stored information with the shifted stored information.

16. The method of claim 15 wherein the step of updating the stored information comprises doing so with a running average method wherein the stored

information is the running average of initial information and subsequent update information.

17. A method of storing data in a database that is indicative of coverage areas for wireless communication options along a route that a mobile communication device is traversing, comprising the steps of:

(a) storing boundary locations of the coverage areas for the wireless communication options along the route in the database where the boundary locations are boundary locations on streets of the route;

(b) periodically obtaining updated information concerning the coverage areas of the wireless communication options as the mobile communication device traverses the route; and

(c) updating the database with the updated information.

18. The method of Claim 17 wherein the step of updating the database with the updated information includes determining whether the updated information is for a location for which information is presently stored in the database,

(a) if the updated information is for a location not presently in the database, then storing the updated information in the database for the location;

(b) if the updated information is for a location presently in the database, comparing the updated information with the information stored in the database for the location and updating the stored information if updated information is different from the stored information.

19. The method of claim 18, wherein the step of updating stored information comprises shifting the stored information toward the updated information by a parameter and replacing the stored information with the shifted stored information.

20. The method of claim 18 wherein the step of updating the stored information comprises doing so with a running average method wherein the stored information is the running average of initial information and subsequent update information.

21. A method of determining which of a plurality of wireless communication options to use for data transmission with a mobile wireless communication device that is traversing a route, comprising the steps of determining where the mobile wireless communication device is on the route, determining which wireless communication option to use for the data communications and when to use it based upon the location of the mobile wireless communication device on the route and the availability of the wireless communication options at the location where the mobile wireless communication device is at on the route and locations on the route where the mobile wireless communication device will subsequently be at as it travels the route.

22. The method of claim 21, wherein the step of determining which wireless communication to use and when to use it includes making the determination based upon the cost to use each wireless communication option.

23. The method of claim 21, wherein the step of determining which wireless communication option to use and when to use it includes making the determination based upon the cost to and performance level of each wireless communication option.

24. A method of providing a uniform content access layer application program interface for application programs that use mobile communication provided by a mobile communication device, comprising the steps of:

(a) providing a database accessible by the application program;

(b) storing in the database information concerning any wireless communication options that are available for use by the mobile communication device as it traverses a route;

(c) the application program deciding its requirements for data transfer via wireless communication based on the information about the wireless communication options stored in the database.

25. The method of claim 24 wherein the information about the wireless communication options stored in the database includes information concerning cost and performance of the wireless communication options.

26. A method of providing a uniform content layer application program interface for application programs that use mobile communication provided by a mobile communication device, comprising the steps of:

(a) providing a database accessible by the application program; and

(b) storing in the database information concerning any wireless communication options that are available for use by the mobile communication device as it traverses a route.

27. The method of claim 26 wherein the information about the wireless communication options stored in the database includes information concerning cost and performance of the wireless communication options.

28. A method of wireless transmission of data to mobile data communication devices using wireless communication technology that has high bandwidth but low geographic coverage, comprising the steps of:

(a) providing multiple wireless communication base stations along roads, each base station having a high bandwidth and low geographic coverage;

(a) storing in the mobile data communication device route information that is indicative of the route that the mobile communication device will be traversing;

(b) storing in the mobile communication device information indicative of coverage areas for each base station located along the route that the mobile communication device will be traversing;

(c) determining which base station to use to send data to the mobile data communication device based on the location of the mobile data communication device on the route that it is travelling;

(d) transferring data to be sent to the mobile data communication device from a content provider to the base station that it was determined to use to send the data to the mobile data communication device; and

(e) the base station to which the data was transferred transmitting the data to the mobile data communication device when the mobile data communication device enter that base stations coverage area.

29. A method of fueling a vehicle with information through a wireless communication device in said vehicle, comprising the steps of:

(a) determining a predicted time when said vehicle will be able to communicate with an info-fueling station having a predictable geographic position;

(b) sending a request for information from said vehicle through said wireless communication device to at least one wireless communication network;

(c) routing said information from an information source in communication with said wireless communication network to said info-fueling station; and

(d) downloading said requested information to said vehicle through said info-fueling station during the time that said wireless communication device in said vehicle is in communication range of said info-fueling station.

30. The method according to Claim 29, wherein said info-fueling station has a fixed position relative to vehicles.

31. The method according to Claim 29, wherein said information request identifies said info-fueling station.

32. The method according to Claim 29, wherein said wireless communication network identifies said info-fueling station.

33. The method according to Claim 29, wherein said wireless communication device is coupled to an on-board communication network in said vehicle.

34. The method according to Claim 29, wherein said downloading of information commences once the detected signal strength of communication between said wireless communication device in said vehicle with said info-fueling station reaches a predetermined level.

35. The method according to Claim 29, wherein said wireless communication network also routes previously stored requests for information to said vehicle through said info-fueling station.

36. The method according to Claim 29, wherein said info-fueling station is mobile.

37. The method according to Claim 36, and further including the steps of moving each mobile info-fueling station to a location to optimize performance of info-fueling communication.

38. A method of wireless transmission of data to mobile data communication devices using wireless communication technology that has high bandwidth but low geographic coverage, comprising the steps of:

(b) providing multiple mobile wireless communication base stations on roads, each base station having a high bandwidth and low geographic coverage;

(a) storing in the mobile data communication device route information that is indicative of the route that the mobile communication device will be traversing;

(b) storing in the mobile communication device information indicative of coverage areas for each base station located along the route that the mobile communication device will be traversing;

(c) determining which base station to use to send data to the mobile data communication device based on the location of the mobile data communication device on the route that it is travelling;

(d) transferring data to be sent to the mobile data communication device from a content provider to the base station that it was determined to use to send the data to the mobile data communication device;

(e) the base station to which the data was transferred transmitting the data to the mobile data communication device when the mobile data communication device enter that base stations coverage area; and

(f) moving the base stations to locations to optimize communication between base stations and a plurality of mobile data communication devices.

Date: 2003-2-20

Abstract of the Disclosure

A method for selecting which of a plurality of wireless communication options will be used by a mobile communication device based on the location of the mobile communication device on a route, the route, and the availability for use of each of the plurality of wireless communication options along the route. Information indicative of coverage areas for the wireless communication options available along the route are stored in a database by storing boundary locations of the coverage areas for the wireless communication options along the route where the boundary locations stored are boundary locations that are on streets of the route.

A method of providing a uniform content layer application program interface for application programs that use mobile communication provided by a mobile communication device stores information concerning any wireless communication options that are available for use by the mobile communication device as it traverses a route is stored in a database. The application program decide which wireless communication option to use based upon the information about the wireless communication options in the database.

A method of fueling a vehicle with information through a wireless communication device determines a predicted time when the vehicle will be able to communicate with an info-fueling station having a predictable geographic position. A request for information from the vehicle is sent through the wireless communication device to at least one wireless communication network. The information is routed from an information source in communication with the wireless communication network to the info-fueling station and downloaded to the vehicle.

Attorney [redacted]et No. 705835US1RAF

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As below named inventor, I hereby declare that:

My residence, post office address and citizenship is as stated below next to my name.

I believe I am the original, first and sole inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled:

ROUTE-BASED COMMUNICATION PLANNING ARCHITECTURE AND METHOD FOR WIRELESS COMMUNICATION

the specification of which is attached hereto.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56(a).

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Power of Attorney: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:

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Citizenship: China

DOCKET: 20036.260

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Bib Data Sheet

CONFIRMATION NO. 9318

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09/718,007	11/21/2000 RULE	455	2681	705835US1RAF

APPLICANTS
Xi Jiang, Santa Clara, CA;

** CONTINUING DATA ********** None

** FOREIGN APPLICATIONS ********** None

IF REQUIRED, FOREIGN FILING LICENSE GRANTED
** 03/16/2001

		STATE OR COUNTRY	SHEETS DRAWING	TOTAL CLAIMS	INDEPENDENT CLAIMS
Foreign Priority claimed	☐ yes ☑ no	CA	8	38	10
35 USC 119 (a-d) conditions met	☐ yes ☑ no ☐ Met after Allowance				
Verified and Acknowledged	Examiner's Signature Initials				

ADDRESS
Crowell & Moring LLP
Intellectual Property Group
PO Box 14300
Washington ,DC 20044-2500

TITLE
Route-based communication planning architecture and method for wireless communication

FILING FEE RECEIVED		
1594	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

PATENT APPLICATION SERIAL NO. _____

U.S. DEPARTMENT OF COMMERCE
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FEE RECORD SHEET

11/27/2000 HLE333 00000012 031800 09718007

01 FC:101 710.00 CH
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PATENT APPLICATION FEE DETERMINATION RECORD
Effective October 1, 2000

Application or Docket Number

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS	38	
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	38 minus 20=	* 18
INDEPENDENT CLAIMS	10 minus 3 =	* 7
MULTIPLE DEPENDENT CLAIM PRESENT		☐

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

SMALL ENTITY TYPE ☐		OR	OTHER THAN SMALL ENTITY	
RATE	FEE		RATE	FEE
BASIC FEE	355.00	OR	BASIC FEE	710.00
X$ 9=		OR	X$18=	324
X40=		OR	X80=	560
+135=		OR	+270=	
TOTAL		OR	TOTAL	1594

CLAIMS AS AMENDED - PART II

AMENDMENT A	(Column 1)		(Column 2)	(Column 3)
	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA
Total	* 26	Minus	** 38	=
Independent	* 6	Minus	*** 10	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT B	(Column 1)		(Column 2)	(Column 3)
	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C	(Column 1)		(Column 2)	(Column 3)
	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. 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.

FORM PTO-875

Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE

2681 #2
B. Davis
11/02/01



Attorney Docket: 1844/50414MI
PATENT

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NOV 0 2 2001
Technology Center 2600

Applicant: XI JIANG

Serial No.: 09/718,007 Group Art Unit: 2681

Filed: NOVEMBER 21, 2000 Examiner:

Title: ROUTE-BASED COMMUNICATION PLANNING ARCHITECTURE AND METHOD FOR WIRELESS COMMUNICATION

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Sir:

The undersigned principal attorney of record hereby appoints, as associate attorneys, with full power to prosecute the above-identified patent application and to conduct all business at the U.S. Patent and Trademark Office, the following attorneys of the firm of Crowell & Moring LLP, Intellectual Property Group:

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The signed original notification of this paper, bearing the original signature, is being placed on file in the U.S. Patent and Trademark Office at the Office of Enrollment & Discipline for inspection.

Respectfully submitted,

Mark P. Calcaterra
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Dated: October 30, 2001

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JDS:pct

68 2681



Attorney Docket: 1844/50414MI
PATENT

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Technology Center 2600

Applicant: XI JIANG

Serial No.: 09/718,007 Group Art Unit:

Filed: NOVEMBER 21, 2000 Examiner:

Title: ROUTE-BASED COMMUNICATION PLANNING ARCHITECTURE AND METHOD FOR WIRELESS COMMUNICATION

INFORMATION DISCLOSURE STATEMENT
UNDER 37 CFR §§ 1.97 and 1.98

Commissioner for Patents
Washington, D.C. 20231

Sir:

In accordance with the duty of disclosure under 37 CFR §1.56, Applicant hereby notifies the U.S. Patent and Trademark Office of the documents which are listed on the attached Form PTO-1449 and/or listed herein and which the Examiner may deem relevant to patentability of the claims of the above-identified application.

The present Information Disclosure Statement is being filed before the mailing date of the first Office Action on the merits, and therefore no certification under 37 C.F.R. §1.97(e) or fee under 37 C.F.R. §1.17(p) is required.

The submission of the listed documents is not intended as an admission that any such document constitutes prior art against the claims of the present application. Applicant does not waive any right to take any action that would be appropriate to antedate or otherwise remove any listed document as a competent reference against the claims of the present application.

If necessary, the paper should be considered as a petition for consideration of the Information Disclosure Statement under 37 C.F.R. §1.97(d)(2) and that the petition fee set forth in 37 C.F.R. §1.17(i) in accordance with 37 C.F.R. §1.97(d)(3) should be charged to Deposit Account No. 05-1323 (Docket #1844/50414MI).

Respectfully submitted,

November 7, 2001

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Attorney Docket: 1844/50414MI
PATENT

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Applicant: XI JIANG

Serial No.: 09/718,007 Group Art Unit:

Filed: NOVEMBER 21, 2000 Examiner:

Title: ROUTE-BASED COMMUNICATION PLANNING ARCHITECTURE AND METHOD FOR WIRELESS COMMUNICATION

INFORMATION DISCLOSURE STATEMENT
UNDER 37 CFR §§ 1.97 and 1.98

Commissioner for Patents
Washington, D.C. 20231

Sir:

In accordance with the duty of disclosure under 37 CFR §1.56, Applicant hereby notifies the U.S. Patent and Trademark Office of the documents which are listed on the attached Form PTO-1449 and/or listed herein and which the Examiner may deem relevant to patentability of the claims of the above-identified application.

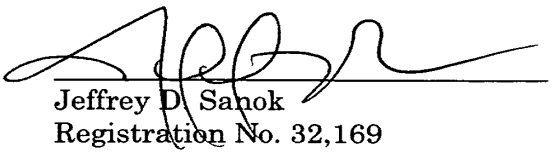
The present Information Disclosure Statement is being filed (1) no later than three months from the application's filing date or (2) before the mailing date of the first Office Action on the merits (whichever is later), and therefore no certification under 37 C.F.R. §1.97(e) or fee under 37 C.F.R. §1.17(p) is required.

The submission of the listed documents is not intended as an admission that any such document constitutes prior art against the claims of the present

application. Applicant does not waive any right to take any action that would be appropriate to antedate or otherwise remove any listed document as a competent reference against the claims of the present application.

Respectfully submitted,

March 13, 2003



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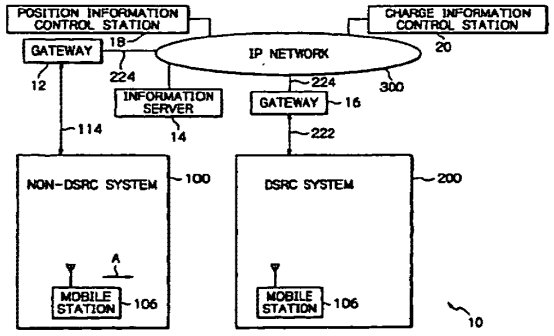
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(54) **Method and system for road vehicle communication**

(57) A road vehicle communication method allows bothway communication to be held between a mobile station (106), which sends a request for an information service and receives it, and a central base station (204) and local base stations (206-210) located at a roadside for sending the information service to the mobile station (106). The central base station (204) and the local base stations (206-210) use optical fibers in part of the transmission path thereof for the bothway communication and perform at least one of electric-to-optical conversion and optical-to-electric conversion. The mobile station (106) is caused to send the request for an information service beforehand. In response to the request, the local base station (206/208/210) covering the mobile station (106) expected to receive the information service is estimated. When the mobile station (106) lies in a service area (214/216/218) to which the local base station estimated is assigned, a control station (202) is caused to provide the mobile station (106) with information corresponding to the information service requested.

Fig. 1



EP 1 085 696 A1

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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a road vehicle communication method using light and radio and advantageously applicable to a reservation download type of asymmetric communication system. This type of communication system belongs to a family of Road Vehicle Communication (RVC) systems capable of providing automotive vehicles with information services by ROF (Radio On Fiber), which implements radio communication between the vehicles and roadsides by use of optical fibers.

Description of the Background Art

[0002] Wired services and wireless services are available with an asymmetric communication system. Wired services use, e.g., ADSL (Asymmetric Digital Subscriber Line) or CATV (Cable Television) Internet while wireless services use communication satellites. ADSL and CATV Internet are implemented by existing metallic telephone lines and exclusive coaxial cables for CATV, respectively. As for wireless services, telephone lines and satellites are assigned to up-going channels (requests for information services) and down-going channels (provision of information services), respectively.

[0003] A request for an information service, whether it be wired or wireless, and the provision of the same are effected substantially at the same time at the same location. Locations where information services are available are fixed. The maximum communication rate available on down-going channels is 1 Mbps (megabits per second).

[0004] There is an increasing demand for information services that users can receive at destinations or while in movement. To meet this demand and considering the fact that some information services deal with audio, video or similar mass information, environments that allow users to receive services rapidly without any stress are essential.

[0005] Wired services are, however, provided only at fixed locations. Likewise, wireless services are received from satellites via fixed antennas, so that communication terminals to receive the services via the antennas are also fixed in place. Further, such information service systems are not feasible for the transmission of mass information because the maximum communication rate is 1Mbps, as stated earlier.

[0006] Moreover, each information service is implemented as an exclusive system independent of the other systems. In addition, information service systems linked to other networks or media have not been reported yet.

SUMMARY OF THE INVENTION

[0007] It is therefore an object of the present invention to provide a road vehicle communication method capable of providing a mobile station with mass information rapidly when the mobile station reaches a destination or while it is running at high speed.

[0008] An RVC method of the present invention allows bothway communication to be held between a mobile station, which sends a request for an information service and receives it, and a central base station and local base stations located at a roadside for sending the information service to the mobile station. The central base station and the local base stations use optical fibers in part of the transmission path thereof for the bothway communication and perform at least one of electric-to-optical conversion and optical-to-electric conversion. The mobile station is caused to send the request for an information service beforehand. In response to the request, the local base station covering the mobile station expected to receive the information service is estimated. When the mobile station lies in a service area to which the local base station estimated is assigned, a control station is caused to provide the mobile station with information corresponding to the information service requested.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The objects and features of the present invention will become more apparent from the consideration of the following detailed description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a block diagram schematically showing an ROF road vehicle communication system with which a road vehicle communication method embodying the present invention is practicable;
FIG. 2 is a schematic block diagram showing a non-DSRC (Dedicated Short Range Communication) system included in the system of FIG. 1;
FIG. 3 is a schematic block diagram showing a DSRC system also included in the system of FIG. 1;
FIG. 4 is a schematic block diagram showing a specific configuration of a mobile station applicable to the system of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0010] Referring to FIG. 1 of the drawings, an asymmetric RVC system for practicing an RVC method embodying the present invention is shown and implemented as an ROF communication system. In FIG. 1, part of the RVC system not relevant to the understanding of the present invention is not shown. Signals are designated by reference numerals attached to connection lines on which they appear.

[0011] As shown in FIG. 1, the RVC system, gener-

ally 10, includes a non-DSRC system 100, a DSRC system 200, and an IP (Internet Protocol) network 300. A mobile station or automotive vehicle 106 sends a request for an information service via the non-DSRC system 100 and receives the information service via the DSRC system 200. Information to be provided exists on the IP network 300. DSRC refers to a beacon communication system, particularly exclusive road vehicle communication using local radio zones.

[0012] The non-DSRC system 100 implements short-range communication for a non-ITS (Intelligent Transport System) or advanced road communication system. FIG. 2 shows a specific configuration of the non-DSRC system 100. As shown, the non-DSRC system 100 includes a control station 102 and a base station 104 for mobile communication as well as the mobile station 106. The control station 102 assigns an address to the mobile station 106 (address assigning function) and guarantees mobile transmission of data (route controlling function). The term "mobile transmission of data" refers to control that maintains, e.g., an IP address assigned to the mobile station 106 even after the travel of the mobile station 106. This can be done with, e.g., a mobile IP or VIP (Visual Intelligent and Personal).

[0013] The base station 104 for mobile communication communicates by radio with a microcell 108 that defines a service area for providing information services. The mobile station 106 is a terminal unit capable of sending a request for an information service and receiving the information service. The mobile station 106 will be described more specifically later.

[0014] The control station 102, base station 104 and mobile station 106 and a relation therebetween will be described hereinafter, bottom-up. The mobile station 106 existing in the microcell 108 sends a request for an information service to the base station 104. In response, the base station 104 communicates with the control station 102 via a mobile communication network 110 and/or a wired communication network 112. The mobile communication network 110 and wired communication network 112 may be, e.g., a handy phone network and PSTN (Public Switched Telephone Network), respectively. The control station 102 is connected to a gateway 12 (see FIG. 1) via a PSTN 114.

[0015] In the illustrative embodiment, the gateway 12 is connected to the IP network 300 (see FIG. 1). The gateway 12 is capable of converting a protocol. Therefore, the request for an information service sent from the mobile station 106 is transferred to an information server 14 via the gateway 12 and IP network 300.

[0016] The DSRC system 200 is shown in FIG. 3 specifically. As shown, the DSRC system 200 includes a control station 202, a central base station 204, and a plurality of (three in the illustrative embodiment) local base stations 206, 208 and 210. The mobile station 106 is assumed to travel from the non-DSRC communication system 100, FIG. 1, to the DSRC communication system 200, as indicated by an arrow A in FIG. 1. The control station 202, like the control station 102 of the non-DSRC communication system 100, has an address assigning function and a route controlling function. The control station 202 additionally has a buffering function for temporarily holding information sent from the information server 14 and meant for the mobile station 106, and an authenticating function for authenticating the mobile station 106.

[0017] The integrating control station 204 includes a frequency converting circuit, a signal distributing and connecting circuit, and a radio/light converting circuit, although not shown specifically. The integrating control station 204 is connected to the local base stations 206 through 210 by optical fibers 212.

[0018] The local base stations 206 through 210 each include a light/radio converting circuit, a signal amplifying circuit, and a transmit/receive antenna, although not shown specifically. The local base stations 206 through 210 each communicate with the central base station 204 via the optical fibers 212 and communicate with the mobile station 106 by radio.

[0019] The local base stations 206 through 210 respectively cover service areas 214, 216 and 218 for providing the mobile station 106 with information services. The service areas 214 through 218 are microcells belonging to the DSRC system 200.

[0020] As also shown in FIG. 3, a monitor station 220 is connected to the central base station 204 and local base stations 206 through 210 by the optical fibers 212. The monitor station 220 measures the radio wave environments of the local base stations 206 through 210 with, e.g., sensors while monitoring the service areas 214 through 218 with, e.g., CCD (Charge Coupled Device) type cameras. Further, the monitor station 220 sends the resulting data to the control station 202 via the central base station 204 at a preselected period.

[0021] The control station 202 is connected to a gateway 16, PSTN 224 (see FIG. 1) via an ROF RVC network 222. The gateway 16 is connected to the IP network 300 and also has a protocol converting function.

[0022] The mobile station 106 sends a request for an information service in the service area 108 of the non-DSRC system 100 and then receives the information service in any one of the service areas 214 through 218 of the DSRC system 200. The mobile station 106 may alternatively send the above request while traveling in any one of the service areas 214 through 218.

[0023] Referring again to FIG. 1, the information server 14 stores music or similar audio data compressed by MP3 (MPEG (Moving Picture Experts Group)-1 Audio Layer 3) or similar compression scheme and video data compressed by MPEG-1, MPEG-2, MPEG-4 or similar compression scheme. The information server 14 provides the mobile station 106 with such data in accordance with the request received from the mobile station 106. While the information server 14 is shown as being connected to the IP network 300, it may alternatively be connected to the PSTN 114 or the RVC

network 222, if desired.

[0024] A position information control station 18 and a charge information control station 20 are also connected to the IP network 300. The position information control station 18 manages host identifier information particular to the mobile station 106, physical position information including GPS (Global Positioning System) information, and logical position information including IP address information. Further, the control station 18 relates map information and network construction information. In addition, the control station 18 estimates the destination of the mobile station 106 on the basis of the travel pattern and history of travel of the mobile station 106, information relating to a route that the mobile station 106 is expected to take, traffic information, and so forth.

[0025] The charge information control station 20 charges the mobile station 106 in accordance with the quantity and content of an information service provided by the information server 14.

[0026] Reference will be made to FIG. 4 for describing the mobile station 106 specifically. Assume that the mobile station 106 is located in the service area 214 covered by the local base station 206 of the DSRC communication system 200, as shown in FIG. 3. The service area 214 may, of course, be replaced with the other service area 216 or 218. As shown in FIG. 4, the mobile station 106 includes an ROF RVC unit 106a, a mass storage 106b, and a car navigation system 106c.

[0027] The ROF RVC unit 106a includes a transmit/receive antenna 106d and a signal amplifier, a signal distributor/coupler and a frequency converter that are not shown in FIG. 4. The ROF RVC unit 106a communicates with the local base station or roadside base station 206 assigned to the service area 214. In the case of a down-going channel, the ROF RVC unit 106a executes a procedure inverse to the procedure of the central base station 204. The ROF RVC unit 106a is capable of dealing with the millimeter-wave band.

[0028] The mass storage 106b is implemented by, e.g., a hard disk or a DVD-RAM (Digital Video Disk-Random Access Memory) and stores information received from the information server 14. The mass storage 106b is capable of sharing media with the storages of fixed terminal units connected to a wired network.

[0029] The car navigation system 106c is loaded with a DVD-ROM (Digital Video Disk-Read Only Memory) and capable of receiving a radio wave from a GPS satellite via an antenna 106e. The system 106c compares information stored in the DVD-ROM and position information derived from the radio wave coming in through the antenna 106e. The system 106c then displays the current position of the mobile station 106 and a route to a destination on a monitor, not shown, for guiding the occupant of the mobile station 106 to the destination. Further, the system 106c is capable of reading the information stored in the mass storage 106b or displaying the information directly on the monitor via the ROF RVC system 106a.

[0030] The car navigation system 106c includes an antenna 106e for receiving a radio wave 400 from a GPS satellite, a radio wave/optical beacon type of signal 402 from VICS (Vehicle Information and Communication System) and/or an FM (Frequency Modulation) multiplexed radio wave 404. The FM multiplexed radio wave 404 may be a D (Differential)-GPS signal to which a VICS signal and correction data are added in order to reduce position errors.

[0031] The car navigation system 106c may additionally include a transmit/receive antenna 106f assigned to a handy phone/PHS (Personal Handy-phone System) radio wave 406. To communicate with a handy phone/PHS via the antenna 106f, the system 106c uses existing or extra transmission/receipt circuitry. Alternatively, the antenna 106f may be included in the ROF RVC unit 106a, in which case extra handy phone/PHS transmission/receipt circuitry will be arranged in the ROF RVC unit 106a.

[0032] The local base station 206 is connected to the central base station 204 by the optical fibers 212, FIG. 3.

[0033] A specific operation of the ROF RVC system 10 will be described hereinafter. Assume that the mobile station 106 lies in the service area 108 covered by the base station 104 of the non-DSRC system 100 assigned to mobile communication, as shown in FIG. 2. In the service area 108, the mobile station 106 sets up a communication link to the base station 104 by use of the handy phone/PHS function available with the car navigation system 106c. If the mobile station 106 outputs any information service requested, the information server 14 outputs an ID (Identification) to the mobile station 106. The ID is for the sake of a reservation and information identifying the mobile station. This ID is for example, random numbers, car number ID + time information, a public key cryptogram, and so forth. The ID information is written into the mobile station 106. Also, in response, the base station 104 communicates with the control station 102 and requests it to assign an IP address to the mobile station 106. The IP address allows the position of connection of the mobile station 106 to the network to be unconditionally identified.

[0034] After the assignment of the IP address, the mobile station 106 communicates with the position information control station 18, which is connected to the IP network 300, via the non-DSRC system 100, PSTN 224 and gateway 12, as shown in FIG. 1. At this instant, the mobile station 106 sends to the position information control station 18 its own ID information, GPS position information and other physical position information, IP address information and other logical position information, history-of-travel information, and route-to-take information. The position information control station 18 registers such information particular to the mobile station 106.

[0035] Subsequently, the mobile station 106 sends

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a request for an information service to the information server 14, which exists on the IP network 300, via the mobile communication network 110, PSTN 112 and gateway 12. In response, the information server 14 inquires the position information control station 18 about the position of the mobile station 106 sent the request. On the receipt of the inquiry, the position information control station 18 estimates, based on the registered information relating to the mobile station 106, the DSRC system 200 to which the information server 14 should send information. The position information control station 106 then informs the information server 14 of information representative of the estimated DSRC system 200.

[0036] The information server 14 sends information read out to the DSRC system 200 designated by the information, which is received from the position information control station 18. Further, the information server 14 sends to the mobile station 106 information representative of the destination of the above information, i.e., the designated DSRC system 200. If desired, the mobile station 106 may estimate the destination of the information in place of the position information control station 18 on the basis of its own position information. In such an alternative case, when the mobile station 106 sends a request for an information service to the information server 14, the mobile station 106 adds to the request information indicative of a location (destination) where it is expected to receive the information service.

[0037] The information server 14 transfers, via the gateway 16, the information to the control station 202 of the DSRC system 200 that is the destination of the information. The control station 202 has a buffering function for temporarily holding data, as stated earlier. The control station 202 holds the information received from the information server 14 until the mobile station 106 enters any one of the service areas 214 through 218 of the DSRC system 200.

[0038] When the mobile station 106 enters any one of the service areas 214 through 218, the ROF RVC unit 106a thereof sets up a communication link to the control station 202 via one of the local base stations or roadside stations 206 through 210 belonging to the above service area, optical fibers 212, and central base station 204. At this time, the control station 202 assigns an IP address or an ID for information of reservation to the mobile station 106.

[0039] The mobile station 106 requests the control station 202 to send the reserved information service to the mobile station 106. In response, the control station 202 authenticates the mobile station 106 to which the IP address or the ID has been assigned. If the result of authentication is acceptable, the control station 202 transfers the information temporarily stored therein to the local base station 206, 208 or 210 via the central base station 204 and optical fibers 212. The local base station received the information transfers it to the mobile station 106 at a frequency lying in, e.g., the millimeter-wave band.

[0040] The mobile station 106 writes the received information in the mass storage 106b thereof and determines whether or not it has correctly received the entire information. If the answer of this decision is positive, the mobile station 106 sends its own host identifier information, end-of-receipt information and so forth to the charge information control station 20. In response, the charge information control station 20 charges the mobile station 106 for the information service.

[0041] As stated above, in the illustrative embodiment, the mobile station 106 can be provided with mass information at a time more rapidly than conventional at a destination or as soon as it enters a service area where information services are available. Because the ROF RVC communication system 10 implements service areas on a microcell basis, communication can be held even in dead areas. This successfully increases the number of users to be accommodated for a unit area. Moreover, by using a broad frequency band, it is possible to provide different kinds of services rapidly.

[0042] The illustrative embodiment has concentrated on communication between the local base stations 206 through 210 and the mobile station or on-board terminal unit 106. The on-board terminal unit 106 may, of course, be replaced with a handy portable terminal unit. In such a case, the local base stations 206 through 210 should preferably be located at, e.g., the wickets of railroad stations and the gates of event cites where traffic is heavy.

[0043] In summary, in accordance with the present invention, an RVC communication system allows a mobile station and a base station to hold bothway, asymmetric communication with each other through electric-to-optical and/or optical-to-electric conversion. The mobile station can therefore be provided with desired mass information, particularly audio and video information, in a short period of time. In addition, users can enjoy information services without any stress.

[0044] Further, because the RVC communication system using an ROF scheme implements service areas on a microcell basis and therefore allows communication to be held even in dead areas. This successfully increases the number of users to be accommodated for a unit area. Moreover, by using a broad frequency band, it is possible to provide different kinds of services rapidly.

[0045] The entire disclosure of Japanese patent application No. 264726/1999 filed September 20, 1999 including the specification, claims, accompanying drawings and abstract of the disclosure is incorporated herein by reference in its entirety.

[0046] While the present invention has been described with reference to the illustrative embodiment, it is not to be restricted by the embodiment. It is to be appreciated that those skilled in the art can change or modify the embodiment without departing from the scope and spirit of the present invention.

Claims

1. An RVC method for allowing bothway communication to be held between a mobile station (106), which sends a request for an information service and receives said information service, and an RVC system (200) at a roadside for sending said information service to said mobile station (106), wherein a central base station (204) and local base stations (206-210) use optical fibers (212) in a part of a transmission path for said bothway communication and perform at least one of electric-to-optical conversion and optical-to-electric conversion, CHARACTERIZED IN THAT said RVC method comprises the steps of:

   (a) causing the mobile station (106) to send the request for an information service beforehand;
   (b) estimating, in response to the request, one of said local base stations (206-210) covering the mobile station (106) expected to receive the information service; and
   (c) causing, when the mobile station (106) lies in a service area to which the local base station estimated is assigned, a control station (202) to provide the mobile station with information corresponding to the information service requested.

2. A method in accordance with claim 1, CHARACTERIZED IN THAT said step (a) comprises a step (d) of transforming information representative of the request to a protocol to be dealt with by a different network, connecting the mobile station (106) to said different network, and sending said information to a provider (14) capable of providing information stored therein, and wherein said step (c) comprises a step (e) of transforming information read out of said provider (14) to a protocol to be dealt with by said control station (202), and causing said local base station (206/208/210) and the mobile station (106) sent the request to hold road vehicle communication by radio.

3. A method in accordance with claim 2, CHARACTERIZED IN THAT the different network comprises Internet (300) using an IP.

4. A method in accordance with claim 2, CHARACTERIZED IN THAT the information read out of the provider (14) is transformed to a protocol to be dealt with by a network connected to the different network, and wherein a PSTN (224) is connected between said different network and the road vehicle communication.

5. A method in accordance with claim 1, CHARACTERIZED IN THAT said step (a) comprises the step of:

   (d) causing, when the mobile station does not lie in the service area, said mobile station (106) to send the request via an existing mobile communication system; and
   (e) causing, when the mobile station lies in the service area when sending the request, said mobile station to send said request via an RVC system (200) using radio and available between the local base station and said mobile station (106).

6. A method in accordance with claim 5, CHARACTERIZED IN THAT the existing mobile communication system uses at least one of existing telephone lines and exclusive lines.

7. A method in accordance with claim 2, CHARACTERIZED IN THAT the provider (14) provides the mobile station (106) with at least one of audio information and video information.

8. A method in accordance with claim 7, CHARACTERIZED IN THAT the provider (14) is connectable to any one of the different network, the existing mobile communication system, and the RVC system (200) using the optical fibers (212).

9. A method in accordance with claim 1, further comprising a step (d) of confirming, after said step (c), a delivery of the information service to the mobile station (106), and charging said mobile station (106) for said information service on the basis of at least one of a quantity and a content of said information service.

10. A method in accordance with claim 8, CHARACTERIZED IN THAT the existing mobile communication system and the RVC system each include a procedure for assigning, at a time of connection of the mobile station (106) and the different network, an identifier that unconditionally identifies a connection position of the mobile station (106) to said existing mobile communication system or said RVC system (200) to said mobile station (106), and a procedure for controlling mobile transmission of a route on which the information is to be provided.

11. A method in accordance with claim 1, CHARACTERIZED IN THAT said step (b) comprises a step (d) of relating, when estimating the local base station (206/208/210), physical position information and logical position information of the mobile station (106) under control and map information and network information prepared beforehand, and estimating a destination of the mobile station (106) by compounding at least one of related information,

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information representative of a movement pattern and a history of movement of said mobile station, information representative of an expected route, and traffic information.

12. A method in accordance with claim 1, CHARACTERIZED IN THAT said steps (a) through (c) each comprise a step (d) of measuring a radio wave condition of the local base stations (206-210), which performs radio communication with the mobile station (106) in a limited region covered by the local base station (206-210), monitoring the service area (214-218) covered by said local base stations (206-210), and repeatedly sending, at a preselected period, measured data and monitored data to said control station (202) governing said central base station (204) and said local base stations (206-210).

13. A method in accordance with claim 1, CHARACTERIZED IN THAT the mobile station (106) includes a car navigation system (106c) and holds road vehicle communication with the local base stations (206-210) in interlocked relation to or by using a function available with said car navigation system (106c).

14. A method in accordance with claim 13, CHARACTERIZED IN THAT said method is capable of communicating with a plurality of systems different from the road vehicle communication as well as with said road vehicle communication.

15. A method in accordance with claim 14, CHARACTERIZED IN THAT the plurality of systems use at least one of an existing mobile communication system, GPS, VICS and an FM multiplexing system.

16. A method in accordance with claim 1, CHARACTERIZED IN THAT said step (c) comprises a step (d) of preparing a mass storage (106b) in the mobile station (106) for storing mass information provided by the provider, and reading said information out of said mass storage (106b).

17. A method in accordance with claim 16, CHARACTERIZED IN THAT said mass storage (106b) is capable of sharing media with storages included in fixed terminal units, which are connected to a wired network.

18. An RVC method for allowing bothway communication to be held between a mobile station (106), which sends a request for an information service and receives said information service, and an RVC system (200) at a roadside for sending said information service to said mobile station (106), wherein a central base station (204) and local base stations (206-210) perform at least one of electric-to-optical conversion and optical-to-electric conversion with information provided at a time of provision of said information service and effect asymmetric communication via optical fibers (212), which constitute a part of a transmission path, for thereby dealing with a greater amount of information when said information service is provided than when said request is sent, CHARACTERIZED IN THAT said RVC method comprises the steps of:

(a) causing the mobile station (106) to send the request for an information service beforehand;
(b) estimating, in response to the request, one of said local base stations (206-210) covering the mobile station (106) expected to receive the information service; and
(c) causing, when the mobile station (106) lies in a service area to which the local base station estimated is assigned, a control station (202) to provide the mobile station (106) with information corresponding to the information service requested.

19. An RVC method for allowing bothway communication to be held between a mobile station (106), which sends a request for an information service and receives said information service, and an RVC system (200) at a roadside for sending said information service to said mobile station (106), said method using the RVC system (200) allowing a central base station (204) and local base stations (206-210), which effect said bothway communication by at least one of electric-to-optical conversion and optical-to-electric conversion via optical fibers constituting a part of a communication path for said bothway communication, and said mobile station (106) to hold radio communication with each other, CHARACTERIZED IN THAT said RVC method comprises the steps of:

(a) causing the mobile station (106), which lies in a service area covered by said local base stations (206-210) of the RVC system (200), to send the request for an information service via the local base station (206/208/210), said central base station (204), and a control station (202) beforehand;
(b) estimating, in response to the request, the local base station (206/208/210) covering the mobile station expected to receive the information service; and
(c) causing, when the mobile station (106) lies in a service area to which the local base station estimated is assigned, a control station (202) to provide the mobile station (106) with information corresponding to the information service requested.

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20. An RVC method for allowing optical-radio combined, bothway communication to be held between a mobile station (106), which sends a request for an information service and receives said information service, and a base station (206/208/210) at a roadside for sending said information service to said mobile station (106), said RVC method comprising the steps of:

    (a) causing the mobile station (106) to send the request for an information service to said base station (206/208/210); and
    (b) providing said base station (206/208/210) with the information service associated with the request previously in response to the mobile station (106) lying in a service area covered by said base station (206/208/210).

21. An RVC method in accordance with claim 20, wherein in said step of sending the request for the information service an existing mobile communication system is used for sending the request for the information service when said mobile station (106) is outside the service area (214-218), an RVC system (200) employing radio transmission and an optical fiber (212) being used for sending the request for the information service when said mobile station (106) stays in the service area (214-218).

22. An RVC method in accordance with claim 21, wherein said existing mobile communication system includes an existing telephone switching system and/or a dedicated line.

23. An RVC method in accordance with claim 20, wherein the information service is presented from a node storing and presenting information including music data and/or image data.

24. An RVC method in accordance with claim 23, wherein said node is allowed to be connected to any one selected from a group consisting of an Internet (300), a mobile communication system and an RVC system (200) employing a radio transmission and an optical fiber (212).

25. An RVC method in accordance with claim 20, further comprising the step of charging a fee on the basis of an amount and/or a content of the information service provided.

26. An RVC method in accordance with claim 21, wherein said mobile communication system and said RVC communication system (200) each comprise a function of assigning said mobile station (106) with a network connection point identification and a path control function having a mobile transparency such as MobileIP and VIP.

27. An RVC method in accordance with claim 20, further comprising the steps of:

    managing physical and logical position information of said mobile station (106);
    associating the physical and logical position information with map information and network structure information; and
    estimating a location to which the information service is to be provided on the basis of the physical and logical position information, map information and network structure information as well as information on usual behavior and history of movement of said mobile station (106), a scheduled path along which said mobile station (106) is to move, and traffic information.

28. An RVC method in accordance with claim 20, further comprising the steps of:

    sensing a condition of radio waves around a local base station (206-210) in the RVC communication system (200);
    monitoring the local base station (206-210) and a service area (214-218) covered by the local base station (206-210); and
    informing periodically a control station (202) of information on results of said steps of sensing and monitoring from a condition monitor station (220).

29. An RVC method in accordance with claim 20, further comprising the step of causing said mobile station (106) to communicate with a roadside base station (206/208/210) employing radio transmission and an optical fiber (212) to be operative with a car navigation system (106c).

30. An RVC method in accordance with claim 29, further comprising the step of communicating with a communication system such as a mobile communication system, a GPS system, a VICS system and an FM multiplex system, following communication with the roadside base station (206).

31. An RVC method in accordance with claim 29, wherein said mobile station (106) comprises a large-capacity storage (106b) for storing information.

32. An RVC method in accordance with claim 31, wherein said large-capacity storage (106b) is compatible in media with a storage included in a fixed terminal unit accommodated in a wired network.

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33. An RVC method for allowing optical-radio combined, bothway communication to be held between a mobile station (106), which sends a request for an information service and receives said information service, and a base station (206/208/210) at a roadside for sending said information service to said mobile station (106), said RVC method comprising the steps of:

    (a) transmitting a request of the information service with low speed transferring means; and
    (b) transmitting said information service with high speed transferring means,
    whereby asymmetric communication is established.

34. An RVC method in accordance with claim 33, wherein in said step of sending the request for the information service an existing mobile communication system is used for sending the request for the information service when said mobile station(106) is outside the service area (214-218), an RVC system (200) employing radio transmission and an optical fiber (212) being used for sending the request for the information service when said mobile station (106) stays in the service area (214-218).

35. An RVC method in accordance with claim 34, wherein said existing mobile communication system includes an existing telephone switching system and/or a dedicated line.

36. An RVC method in accordance with claim 33, wherein the information service is presented from a node storing and presenting information including music data and/or image data.

37. An RVC method in accordance with claim 36, wherein said node is allowed to be connected to any one selected from a group consisting of an Internet (300), a mobile communication system and an RVC system (200) employing a radio transmission and an optical fiber (212).

38. An RVC method in accordance with claim 33, further comprising the step of charging a fee on the basis of an amount and/or a content of the information service provided.

39. An RVC method in accordance with claim 34, wherein said mobile communication system and said RVC communication system (200) each comprise a function of assigning said mobile station (106) with a network connection point identification and a path control function having a mobile transparency such as MobileIP and VIP.

40. An RVC method in accordance with claim 33, further comprising the steps of:

    managing physical and logical position information of said mobile station (106);
    associating the physical and logical position information with map information and network structure information; and
    estimating a location to which the information service is to be provided on the basis of the physical and logical position information, map information and network structure information as well as information on usual behavior and history of movement of said mobile station (106), a scheduled path along which said mobile station (106) is to move, and traffic information.

41. An RVC method in accordance with claim 33, further comprising the steps of:

    sensing a condition of radio waves around a local base station (206-210) in the RVC communication system (200;
    monitoring the local base station (206-210) and a service area (214-218) covered by the local base station (206-210); and
    informing periodically a control station (202) of information on results of said steps of sensing and monitoring from a condition monitor station (220).

42. An RVC method in accordance with claim 33, further comprising the step of causing said mobile station (106) to communicate with a roadside base station (206/208/210) employing radio transmission and an optical fiber (212) to be operative with a car navigation system (106c).

43. An RVC method in accordance with claim 42, further comprising the step of communicating with a communication system such as a mobile communication system, a GPS system, a VICS system and an FM multiplex system, following communication with the roadside base station (206).

44. An RVC method in accordance with claim 42, wherein said mobile station comprises a large-capacity storage (106b) for storing information.

45. An RVC method in accordance with claim 44, wherein said large-capacity storage (106b) is compatible in media with a storage included in a fixed terminal unit accommodated in a wired network.

46. An RVC method for allowing optical-radio combined, bothway communication to be held between a mobile station (106) , which sends a request for

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an information service and receives said information service, and a base station (206/208/210) at a roadside for sending said information service to said mobile station (106), said RVC method comprising the step of sending the request for an information service using an RVC system (200) employing radio transmission and an optical fiber (212) in a service area covered by said base station providing the information service associated with the request.

47. An RVC method in accordance with claim 46, wherein said RVC system (200) employing the radio transmission and the optical fiber (212) is interconnected to another communication network (300) through a gateway (16) or router including a protocol conversion function.

48. An RVC method in accordance with claim 47, wherein said other communication network (300) is an Internet based upon an IP protocol.

49. An RVC method in accordance with claim 47, wherein said other communication network (300) is further interconnected through a gateway (12) or router including a protocol conversion function to a public switched network.

50. An RVC method in accordance with claim 46, wherein in said step of sending the request for the information service an existing mobile communication system is used for sending the request for the information service when said mobile station (106) is outside the service area (214-218).

51. An RVC method in accordance with claim 50, wherein said existing mobile communication system includes an existing telephone switching system and/or a dedicated line.

52. An RVC method in accordance with claim 46, wherein the information service is presented from a node storing and presenting information including music data and/or image data.

53. An RVC method in accordance with claim 52, wherein said node is allowed to be connected to any one selected from a group consisting of an Internet (300), a mobile communication system and an RVC system (200) employing a radio transmission and an optical fiber (212).

54. An RVC method in accordance with claim 46, further comprising the step of charging a fee on the basis of an amount and/or a content of the information service provided.

55. An RVC method in accordance with claim 50, wherein said mobile communication system and said RVC communication system (200) each comprise a function of assigning said mobile station (106) with a network connection point identification and a path control function having a mobile transparency such as MobileIP and VIP.

56. An RVC method in accordance with claim 46, further comprising the steps of:

managing physical and logical position information of said mobile station (106);
associating the physical and logical position information with map information and network structure information; and
estimating a location to which the information service is to be provided on the basis of the physical and logical position information, map information and network structure information as well as information on usual behavior and history of movement of said mobile station (106), a scheduled path along which said mobile station (106) is to move, and traffic information.

57. An RVC method in accordance with claim 46, further comprising the steps of:

sensing a condition of radio waves around a local base station (206-210) in the RVC communication system (200);
monitoring the local base station (206-210) and a service area (214-218) covered by the local base station (206-210); and
informing periodically a control station (202) of information on results of said steps of sensing and monitoring from a condition monitor station (220).

58. An RVC method in accordance with claim 46, further comprising the step of causing said mobile station (106) to communicate with a roadside base station (206/208/210) employing radio transmission and an optical fiber (212) to be operative with a car navigation system (106c).

59. An RVC method in accordance with claim 58, further comprising the step of communicating with a communication system such as a mobile communication system, a GPS system, a VICS system and an FM multiplex system, following communication with the roadside base station (206).

60. An RVC method in accordance with claim 58, wherein said mobile station (106) comprises a large-capacity storage (106b) for storing information.

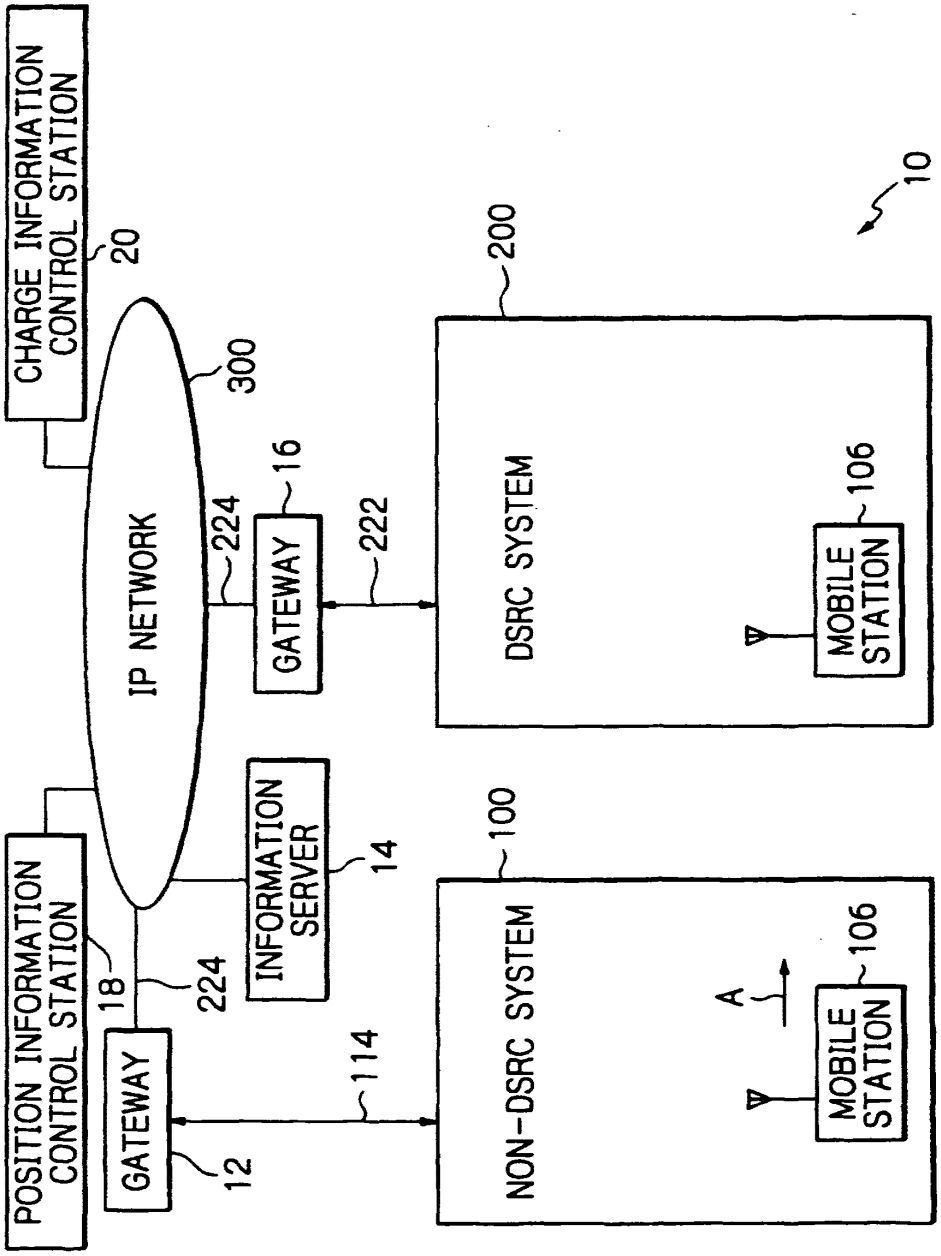
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61. An RVC method in accordance with claim 60, wherein said large-capacity storage (106b) is compatible in media with a storage included in a fixed terminal unit accommodated in a wired network.

62. Apparatus configured to perform a method as claimed in any preceding claim.

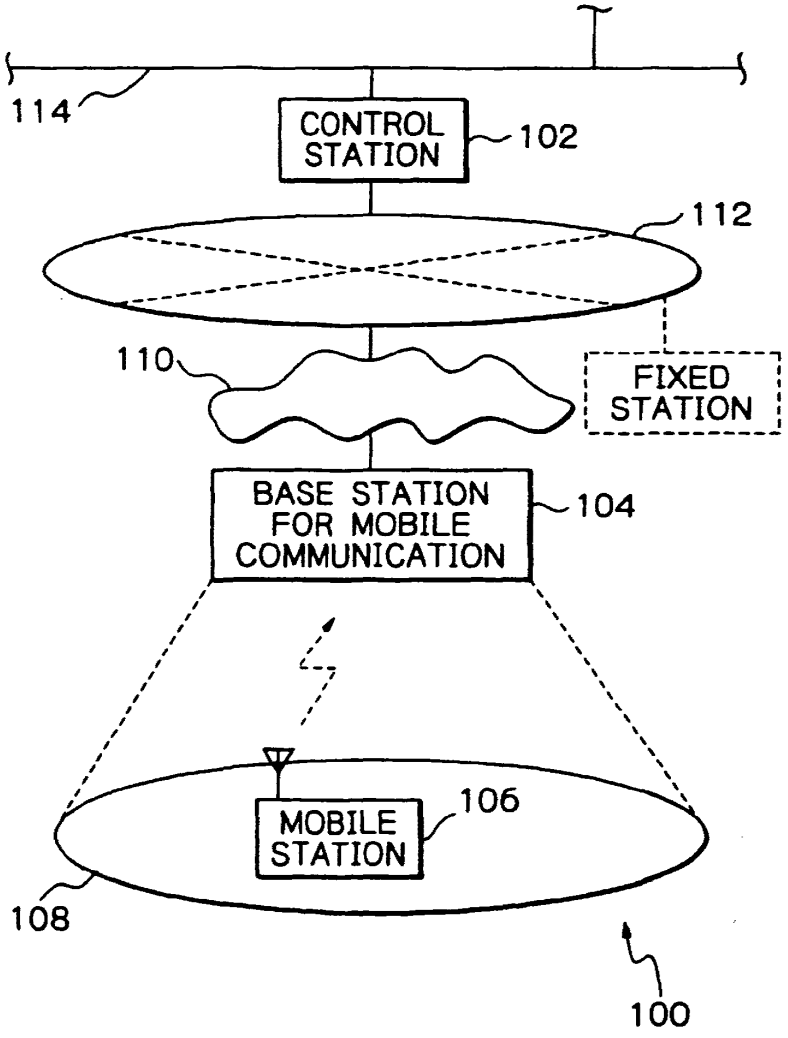
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Fig. 1



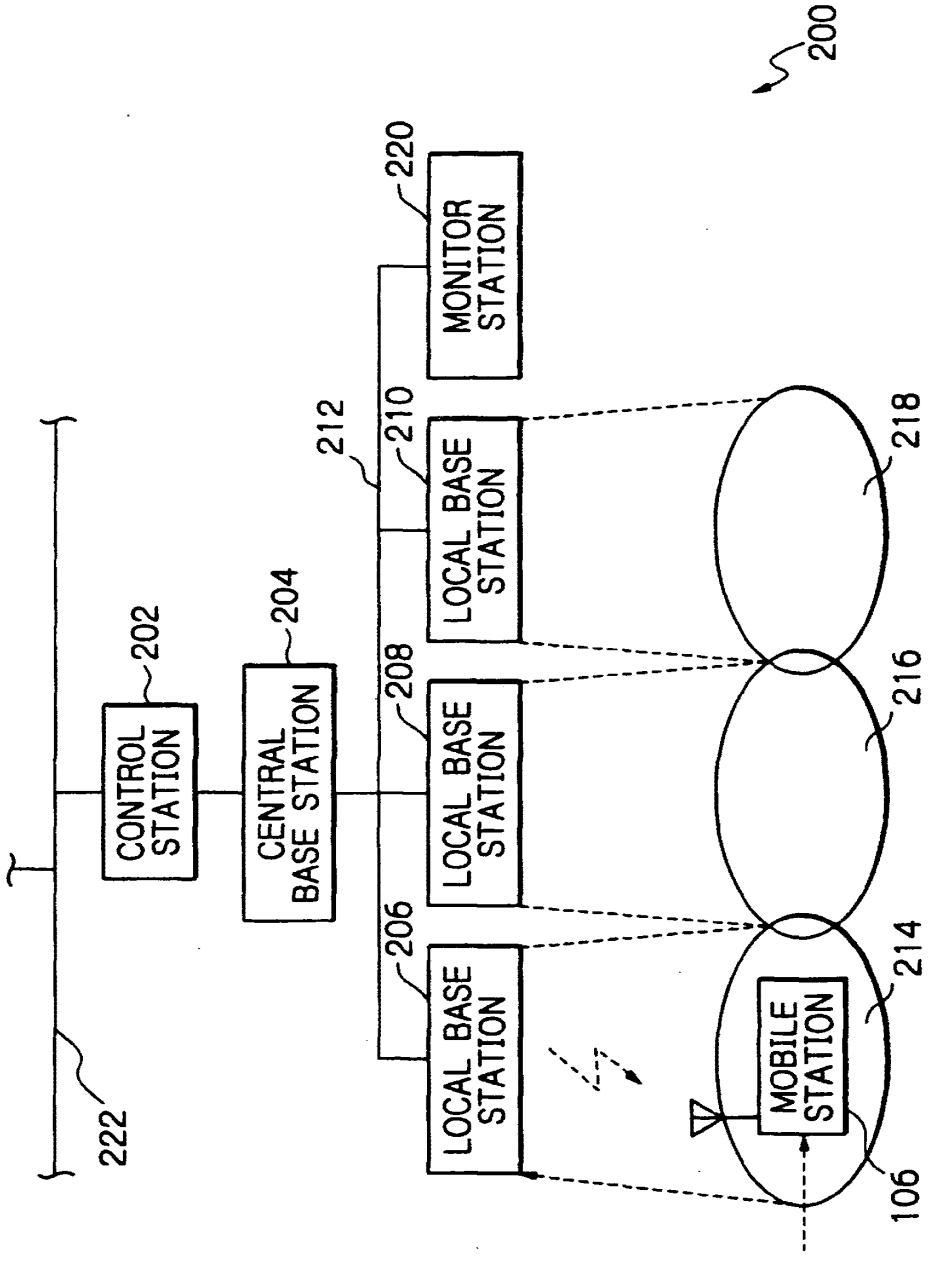
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Fig. 2



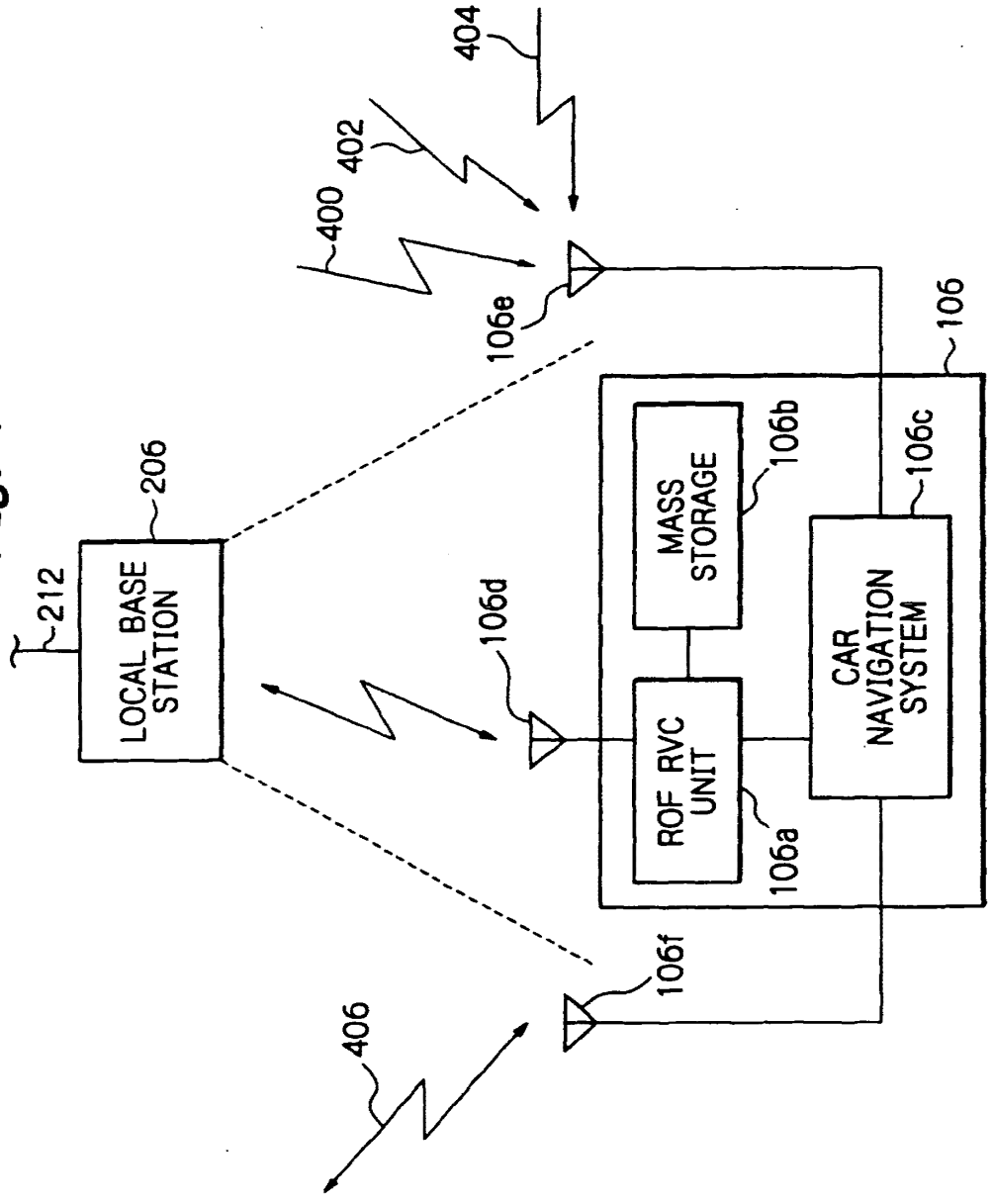
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Fig. 3



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Fig. 4



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European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 30 8146

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 5 572 221 A (MARLEVI ALEXANDER ET AL) 5 November 1996 (1996-11-05) * column 2, line 59 - column 3, line 13 * * column 5, line 49 - line 60 * * column 6, line 59 - column 7, line 29 * * column 14, line 33 - line 40 * * column 15, line 20 - line 28 * * figures 3,4 *	1,5,11, 12, 18-20, 27,28, 33,40	H04L12/28
X	EP 0 673 177 A (OKI ELECTRIC IND CO LTD) 20 September 1995 (1995-09-20) * column 3, line 29 - column 4, line 51 * * column 10, line 33 - line 52 * * column 38, line 26 - column 39, line 50 * * figures 1,2,16,28 *	1,5-7, 13,14, 18,19, 33,40	
A	EP 0 883 266 A (TOKYO SHIBAURA ELECTRIC CO) 9 December 1998 (1998-12-09) * column 5, line 11 - line 47 * * column 7, line 39 - column 8, line 34 * * column 12, line 10 - line 39 * * column 14, line 34 - column 15, line 10 * * column 21, line 25 - line 46 * * figure 5 *	1,2,9, 10,16, 18-20, 33, 36-39, 46-50, 54,55	TECHNICAL FIELDS SEARCHED (Int.Cl.7) H04Q H04L

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	10 January 2001	Barel, C

CATEGORY OF CITED DOCUMENTS

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European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 30 8146

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	US 5 548 806 A (MIZUNO TOSHIO ET AL) 20 August 1996 (1996-08-20) * column 11, line 5 - line 47 * * figure 7 * -----	1,8,18, 19,29, 34,46	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	10 January 2001	Barel, C

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& : member of the same patent family, corresponding document

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 00 30 8146

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10-01-2001

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5572221 A	05-11-1996	AU 694575 B	23-07-1998
		AU 3818995 A	23-05-1996
		CN 1170493 A	14-01-1998
		EP 0788720 A	13-08-1997
		FI 971778 A	26-06-1997
		JP 10513016 T	08-12-1998
		RU 2141738 C	20-11-1999
		WO 9613951 A	09-05-1996
		US 5825759 A	20-10-1998
EP 0673177 A	20-09-1995	JP 1309427 A	13-12-1989
		JP 2032009 C	19-03-1996
		JP 7067186 B	19-07-1995
		JP 1311628 A	15-12-1989
		JP 2032011 C	19-03-1996
		JP 7067187 B	19-07-1995
		JP 1311629 A	15-12-1989
		JP 2670085 B	29-10-1997
		JP 1311630 A	15-12-1989
		JP 2670086 B	29-10-1997
		JP 1311631 A	15-12-1989
		JP 2670087 B	29-10-1997
		JP 1311632 A	15-12-1989
		JP 1969279 C	18-09-1995
		JP 6103947 B	14-12-1994
		JP 1311633 A	15-12-1989
		JP 1969280 C	18-09-1995
		JP 6103948 B	14-12-1994
		JP 1311634 A	15-12-1989
		JP 1969281 C	18-09-1995
		JP 6103949 B	14-12-1994
		JP 1311635 A	15-12-1989
		JP 6103946 B	14-12-1994
		JP 1311636 A	15-12-1989
		JP 1969282 C	18-09-1995
		JP 6103847 B	14-12-1994
		DE 68925706 D	28-03-1996
		DE 68925706 T	17-10-1996
		EP 0345601 A	13-12-1989
		US 5058201 A	15-10-1991
EP 0883266 A	09-12-1998	JP 11266278 A	28-09-1999
US 5548806 A	20-08-1996	JP 2669288 B	27-10-1997
		JP 6224828 A	12-08-1994
		JP 2789987 B	27-08-1998

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

BNSDOCID: <EP___1085696A1_I_>

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 00 30 8146

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

10-01-2001

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5548806 A		JP 6237208 A	23-08-1994

EPO FORM P0459

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(54) **Mobilfunksystem.**

(57) Für die Positionsbestimmung eines Fahrzeuges - (F) mit einem Mobilfunkgerät (MB) und für dessen Zuordnung zu einer Funkzelle bzw. einem bestimmten Funkkonzentrator (FuKo) wird ein im Fahrzeug als Teil eines Zielführungssystems angeordnetes Navigationsgerät (N) verwendet. Das Navigationsgerät (N) erhält jeweils beim Passieren einer Bake - (BK) genaue Standortdaten und aktualisiert diese während der Fahrt mit Hilfe einer Koppelnavigationseinrichtung (KON). Das Mobilfunkgerät (MB) übernimmt die im Navigationsgerät (N) ermittelten Positionsdaten und überträgt sie an die Funkkonzentratoren (FuKo) bzw. ermittelt selbständig, in welcher Funkzelle sich das Fahrzeug befindet. Damit entfällt eine eigene Positionsbestimmung über die Funkkonzentratoren.

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Rank Xerox

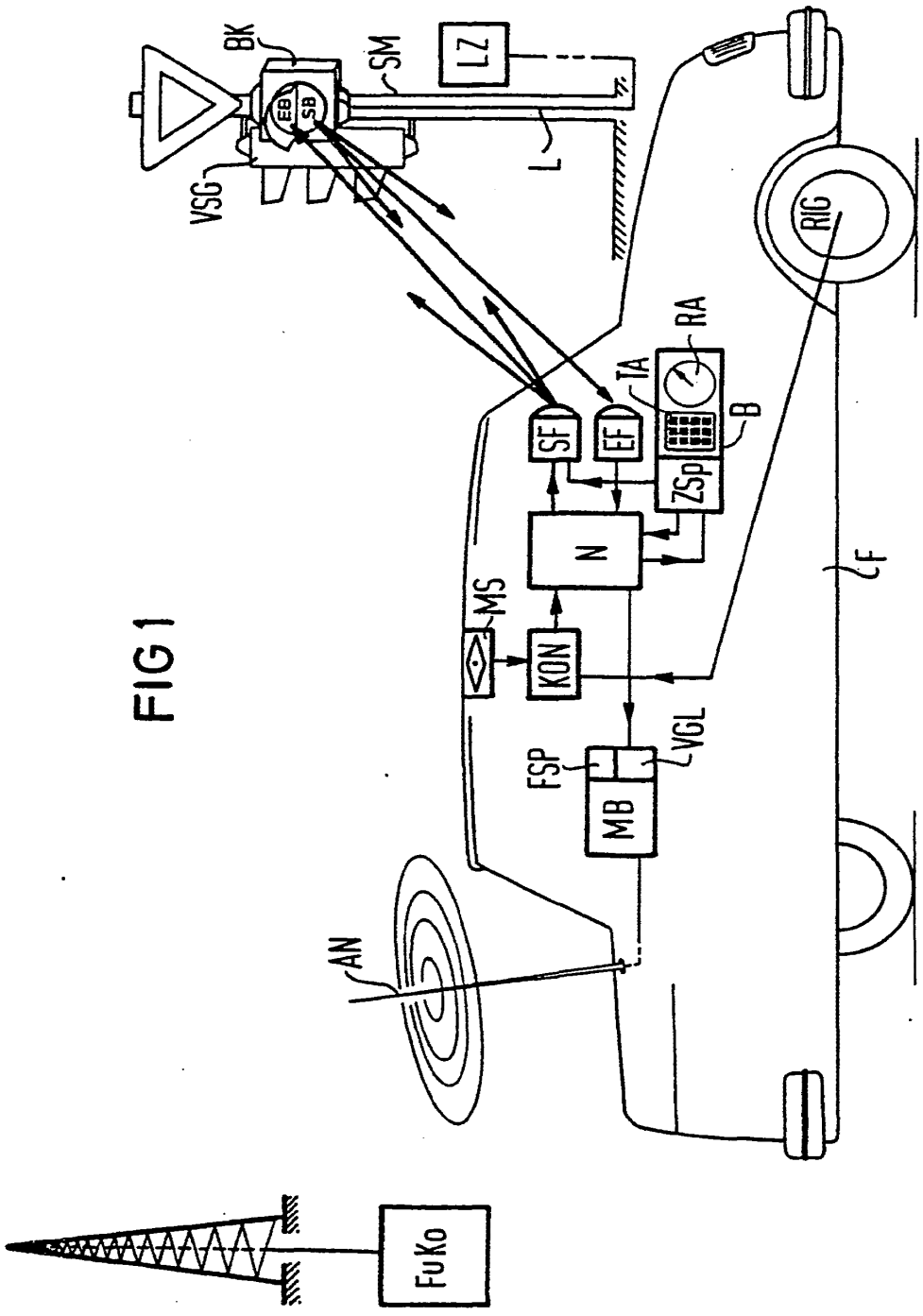


FIG 1

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Mobilfunksystem

Die Erfindung betrifft ein Mobilfunksystem zur Herstellung von Fernsprechverbindungen von und zu Fahrzeugen über Funkstrecken zwischen fahrzeugseitigen Mobilfunkgeräten und ortsfesten Funkkonzentratoren, wobei das vom System erfaßte geografische Gebiet in eine Vielzahl von sich teilweise überlappenden Funkzellen unterteilt und jeder Funkzelle ein Funkkonzentrator fest zugeordnet ist und wobei jeweils Ortungseinrichtungen vorgesehen sind, um die dem Fahrzeugstandort entsprechende Funkzelle zu identifizieren und das Mobilfunkgerät dem dieser Funkzelle entsprechenden Funkkonzentrator zuzuordnen.

Das System der Funkzellen in Mobilfunksystemen dient dazu, die nur begrenzt zur Verfügung stehenden Funkkanäle vielfach verwendbar zu machen. Dabei wird die Sendeleistung der Mobilfunkgeräte in den Fahrzeugen und der Funkkonzentratoren so niedrig gewählt, daß sie im wesentlichen nur innerhalb einer Funkzelle empfangen werden kann. In einem gewissen räumlichen Abstand können dann dieselben Kanäle wiederum verwendet werden. Soll die Gesamtzahl der Teilnehmer an dem Mobilfunksystem erhöht werden, ohne daß zusätzliche Funkfrequenzen verfügbar sind, so muß die Zahl der Funkzellen erhöht und deren Größe damit verkleinert werden, wobei gleichzeitig auch die Sendeleistung herabgesetzt wird.

Ein Problem bei Mobilfunksystemen ist die Zuordnung der Fahrzeugpositionen zu den jeweils zuständigen Funkzellen bzw. den zugehörigen Funkkonzentratoren. Bei herkömmlichen Systemen (IEEE Transactions on Vehicular Technology, Febr. 1977, Seiten 43 bis 46) wird zu diesem Zweck eine Fahrzeugortung mittels Feldstärkemessung oder mittels Laufzeitmessung durchgeführt. Dabei werden jeweils Signale zwischen den Funkkonzentratoren und den in ihrer Reichweite befindlichen Fahrzeugen ausgetauscht, wobei durch Bestimmung der Feldstärke oder durch Messung der Laufzeiten festgestellt wird, welcher Funkkonzentrator dem Fahrzeug am nächsten liegt bzw. die besten Empfangsbedingungen besitzt. Derartige Meßverfahren sind zwar brauchbar, solange die Funkzellen eine relativ große Ausdehnung haben, so daß Signalverfälschungen, beispielsweise Laufzeitverfälschungen durch Reflexionen an Gebäuden und dergl., nicht ins Gewicht fallen. Müssen jedoch die Durchmesser der Funkzellen aus den obengenannten Gründen auf einen oder wenige Kilometer verkleinert werden, so steigen die Anforderungen an die Funkortung. Im bebauten Gebiet wird die Ortungsgenauigkeit wegen der bereits erwähnten gestörten Ausbreitung der Funkwellen prinzipiell begrenzt, da hohe Gebäude die direkte Funkübertragung abschirmen. Ein Funkkontakt kommt dabei nur über Umwege durch zahlreiche Reflexionen zustande, wobei diese Umwege durchaus einige Kilometer betragen können und damit in der Größenordnung der Funkzellendurchmesser liegen können. Wenn dieser Fall eintritt, dann sind die Ortungsfehler für das System nicht mehr tragbar.

Aufgabe der Erfindung ist es, ein Mobilfunksystem der eingangs genannten Art zu schaffen, bei dem die Ortung der Fahrzeuge und damit deren Zuordnung zu bestimmten Funkzellen und Funkkonzentratoren auf einfache Weise und mit hoher Genauigkeit ermöglicht ist, so daß die Zuverlässigkeit des Systems erhöht wird.

Erfindungsgemäß wird diese Aufgabe dadurch gelöst, daß in den Fahrzeugen jeweils ein Navigationsgerät vorgesehen ist, welches beim Passieren ortsfester Baken Daten über deren Standort empfängt und diese während der Fahrt mittels einer fahrzeugeigenen Koppelnavigationseinrichtung aktualisiert, daß die jeweils in dem Navigationsgerät ermittelten Standortdaten dem Mobilfunkgerät des Fahrzeuges übermittelt und durch Vergleich mit den Ortsdaten der einzelnen Funkzellen zur Bestimmung der zugehörigen Funkzelle bzw. des zugehörigen Funkkonzentrators ausgewertet werden.

Die Erfindung arbeitet also mit einem bakengestützen Koppelnavigationssystem, mit welchem eine sehr genaue Standortbestimmung der Fahrzeuge ständig während der Fahrt durchführbar ist. Der Aufbau eines derartigen Ortungssystems allein als Ergänzung für das Mobilfunksystem wäre zwar verhältnismäßig aufwendig. Die Kosten für eine solche Ortung im Mobilfunksystem werden aber dann minimal, wenn ein Navigationssystem der geschilderten Art ohnehin als Teil eines Verkehrsleitsystems für den Individualverkehr vorhanden ist, wobei die Infrastruktur für die Leitbaken im Rahmen des Verkehrsleitsystems aufgebaut ist und die einzelnen Fahrzeuge mit einem Navigationsgerät ausgerüstet sind. Ein derartiges Zielführungssystem ist beispielsweise in den EP-PSen 00 21 060 und 00 25 193 beschrieben.

Wird ein derartiges Verkehrsleitsystem für den Bereich des Mobilfunksystems flächendeckend eingeführt, um eine wirksame Verkehrsleitung, eine bessere Nutzung der Verkehrsflächen, eine Senkung des Treibstoffverbrauches, der Umweltbelastung und des Unfallrisikos zu erreichen, so ist damit zu rechnen, daß etwa zwischen 25 % und 50 % aller Fahrzeuge mit den Einrichtungen für die

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Nutzung des Leitsystems ausgestattet werden. Erfahrungsgemäß ist dann damit zu rechnen, daß auf jeden Fall Fahrer mit gehobenen Ansprüchen ihre Fahrzeuge mit den Einrichtungen für dieses System ausrüsten und damit über ein Navigationsgerät der obengenannten Art verfügen. Damit kann man aber davon ausgehen, daß alle Anwärter auf ein Autotelefon, die man mit großer Sicherheit dieser Gruppe zurechnen kann, über die entsprechenden Einrichtungen zur Koppelnavigation verfügen. Macht man nun also diese Positionsbestimmung erfindungsgemäß dem Mobilfunksystem nutzbar, indem die fahrzeugseitigen Mobilfunkgeräte die ermittelten Positionskoordinaten übernehmen, so kann die herkömmliche Positionsbestimmung bei den Funkkonzentratoren entfallen, wodurch das Mobilfunksystem vereinfacht, in seiner Zuverlässigkeit erhöht und in seiner Infrastruktur verbilligt wird.

In einer einfachen Ausführungsform der Erfindung werden die im Fahrzeug durch das Navigationsgerät ermittelten Positionsdaten einfach dem Mobilfunkgerät übergeben und von diesem an die erreichbaren Funkkonzentratoren übertragen, wobei die Zuordnung zu den Funkzellen in den Funkkonzentratoren errechnet wird. Noch vorteilhafter ist es allerdings, wenn im Mobilfunkgerät des Fahrzeuges die Daten der Funkzellen nach Lage und Abmessungen gespeichert werden, so daß die Mobilfunkgeräte selbständig durch Vergleich der Funkzellendaten mit den Positionsdaten des Fahrzeugs berechnen können, in welcher Funkzelle sie sich gerade befinden. Sie können sich dann auf den entsprechenden Funkkanal schalten und bei den jeweiligen Funkkonzentratoren an-bzw. abmelden. Die Speicherung der Funkzellendaten erfolgt je nach der Form dieser Funkzellen, beispielsweise durch Speicherung der Koordinaten der Eckpunkte von Rechtecken oder durch Speicherung der Mittelpunktkoordinaten und der Radien von Kreisen.

Im allgemeinen würde es allerdings zuviel Speicherplatz beanspruchen, die Daten für sämtliche Funkzellen des gesamten Systemgebiets in jedem Mobilfunkgerät zu speichern. Vorteilhaft ist es deshalb, wenn die jeweiligen Baken beim Passieren eines Fahrzeugs neben den Standortkoordinaten auch die Lagekoordinaten für die Funkzellen eines gewissen Umgebungsbereiches mit übertragen, so daß diese jeweils dem Mobilfunkgerät zugeführt und in diesem gespeichert werden können.

Soweit der Fahrzeugführer zum Zweck der individuellen Verkehrsleitung sein Reiseziel in einen Zielspeicher des Fahrzeugs eingegeben hat, kann diese Information zusätzlich für das Mobilfunksystem ausgenutzt werden. Aufgrund der Kenntnis der empfohlenen Fahrtroute kann den betreffenden Funkkonzentratoren ein Wechsel in eine benachbarte Funkzelle bereits vorangekündigt werden. Auf diese Weise ist es auch möglich, in Überlappungszonen ein Telefongespräch von Anfang über die Funkzelle zu führen, in die das Fahrzeug einfährt. Auf diese Weise wird die Notwendigkeit, während eines Gesprächs einen Kanalwechsel vorzunehmen, auch bei Funkzellen kleiner Abmessungen nur selten vorliegen.

Die Erfindung wird nachfolgend an Ausführungsbeispielen anhand der Zeichnung näher erläutert. Es zeigt

Fig. 1 ein Fahrzeug in schematischer Darstellung mit einer Bake und einem Funkkonzentrator sowie den in einem Blockschaltbild dargestellten Einrichtungen für die Zuordnung von Ortung und Mobilfunksystem,

Fig. 2 die schematische Darstellunge einiger Funkzellen mit Funkkonzentratoren und zugeordneten Fahrzeugen.

Fig. 1 zeigt in schematischer Darstellung die gerätetechnische Ausgestaltung der erfindungsgemäßen Kombination eines Mobilfunksystems mit einem Navigationssystem. Ein Fahrzeug F enthält ein Mobilfunkgerät MB, welches über eine Antenne AN in bekannter Weise mit einem ortsfesten Funkkonzentrator FuKo, der in Sendereichweite steht, in Verbindung tritt und auf Bedarf eine Fernsprechverbindung über diesen Funkkonzentrator aufbaut. Um die Zuordnung des Fahrzeugs zu einer bestimmten Funkzelle und zu einem zugehörigen Funkkonzentrator zu ermitteln, ist das Mobilfunkgerät MB mit einem Navigationsgerät N verbunden, welches im Fahrzeug ständig dessen aktuellen Standort feststellt. Zu diesem Zweck enthält das Fahrzeug auch noch eine Koppelnavigationseinrichtung KON, welches die Meßwerte einer Magnetfeldsonde MS und eines Radimpulsgebers RIG verarbeitet und den daraus jeweils errechneten Wegvektor an das Navigationsgerät gibt. Um eine Fehlersummierung des Koppelnavigationssystems zu vermeiden, sind über das Straßennetz verteilt, vorzugsweise an wichtigen Kreuzungen, Baken BK aufgestellt, welche jeweils unter anderem genaue Standortmeldungen mit ihren eigenen Positionskoordinaten aussenden, so daß jedes passierende Fahrzeug diese Koordinaten empfangen und zur Korrektur seines Navigationsgerätes N verwerten kann.

Die Informationsübertragung zwischen den Baken BK und den Fahrzeugen F erfolgt z. B. über Infrarotgeräte, wobei in jeder Bake jeweils ein Infrarotsender SB und ein Infrarotempfänger EB, in den einzelnen Fahrzeugen jeweils ein Infrarotsender SF

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und ein Infrarotempfänger EF angeordnet sind. Die Infrarotgeräte der Baken können beispielsweise an Signalmasten SM der Straßenkreuzungen zusätzlich zu den Verkehrssignalgebern VSG angeordnet sein. Die Bake BK steht über eine Leitung L mit einer Leitzentrale LZ in Verbindung und erhält von dort auch Leitinformationen. Da die Bake BK ebenso wie das Navigationsgerät N des Fahrzeugs Teil eines Zielführungs-bzw. Leitsystems für Fahrzeuge sind, werden zwischen der jeweiligen Bake BK und dem jeweils passierenden Fahrzeug F nicht nur die erwähnten Standortdaten, sondern zusätzliche Leitinformationen ausgetauscht, beispielsweise ein in einem Zielspeicher ZSp des Fahrzeugs eingegebener Zielwunsch des Fahrzeugs vom Fahrzeug F zur Bake BK bzw. Fahrtrichtungsempfehlungen und andere Informationen von der Bake BK zum Fahrzeug F. In dem Bediengerät B des Fahrzeugs sind neben dem bereits erwähnten Zielspeicher ZSp eine Eingabetastatur TA sowie eine Richtungsanzeige RA vorgesehen. Dies ist jedoch nicht Gegenstand der vorliegenden Anmeldung, so daß hierauf nicht weiter eingegangen wird.

Der im Navigationsgerät N des Fahrzeugs jeweils errechnete aktuelle Standort wird, vorzugsweise in Form von Koordinaten, dem Mobilfunkgerät MB zugeführt und dort in einer Vergleichseinrichtung VGL mit Funkzellendaten verglichen, die beispielsweise in einem Funkzellenspeicher FSp gespeichert sind. Entsprechend dem Vergleichsergebnis stellt das Mobilfunkgerät fest, in welcher Funkzelle sich das Fahrzeug befindet und mit welchem Funkkonzentrator dementsprechend eine gewünschte Fernsprechverbindung aufgebaut werden soll. Die im Funkzellenspeicher FSp gespeicherten Daten für die verschiedenen Funkzellen werden ebenfalls jeweils beim Passieren einer Bake BK von dieser an das Fahrzeug übertragen und dem Mobilfunkgerät MB zur Aktualisierung des Speichers FSp übertragen. Dabei genügt es, wenn jeweils für die Funkzellen im Umgebungsbereich der Bake die Daten übertragen und gespeichert werden.

Wenn im Zielspeicher ZSp des Fahrzeugs ein Zielwunsch eingegeben ist, kann dieser bzw. eine dem Zielwunsch entsprechende, von der Bake empfangene Leitempfehlung, ebenfalls dem Mobilfunkgerät mitgeteilt werden. Aufgrund solcher Zieldaten kann das Mobilfunkgerät MB dem Funkkonzentrator bereits einen Wechsel von einer Funkzelle zu einer anderen ankündigen. Andererseits ist es möglich, bereits beim Aufbau einer Funk-Fernsprechverbindung die Zieldaten zu berücksichtigen und von zwei in Betracht kommenden Funkkonzentratoren denjenigen auswählen, in dessen Be reich bzw. in dessen Funkzelle sich das Fahrzeug im weiteren Verlauf befinden wird.

In Fig. 2 sind schematisch verschiedene Funkzellen Z1 bis Zn dargestellt, deren Größe z. B. der Besiedelungsdichte oder der Verkehrsdichte angepaßt ist. Sie werden jeweils durch ihre Mittelpunkt-Koordinaten $(x_1; y_1)$, $(x_2; y_2)$ bis $(x_n ; y_n$ und ihre Radien r_1, r_2 bis $r_n$beschrieben. Jeder Funkzelle ist ein Funkkonzentrator zugeordnet, z. B. der Funkkonzentrator FuKo1 der Funkzelle Z1. Die Bake BK überträgt diese Zellenbezeichnungen und -koordinaten sowie ihre eigenen Koordinaten - $(x_B ; y_B)$ an alle passierenden Fahrzeuge, in Fig. 2 z. B. an das Fahrzeug F1. Das Navigationsgerät N (Fig. 1) bestimt während der weiteren Fahrt laufend die Position des jeweiligen Fahrzeugs und teilt diese dem Mobilfunkgerät MB mit. Dieses kann durch einfache Berechnung feststellen, in welcher Funkzelle sich das Fahrzeug befindet.

Das Fahrzeug F2 bewegt sich bei dem Beispiel in Fig. 2 in einer Überlappungszone der Funkzellen Z1 und Z3 in Richtung zum Zentrum von Z3. Es ist also sinnvoll, ein beginnendes Gespräch von vornherein über die Funkzelle Z3 und deren Funkkonzentrator FuKo abzuwickeln, weil dann nicht sobald auf einen anderen Kanal umgeschaltet werden muß.

Durch die Übertragung der Funkkreis-Koordinaten über Baken gewinnt man außerdem eine größere Freizügigkeit bezüglich des Aufstellungsortes der Funkkonzentrator-Antennen. Bei einer Ortung der Fahrzeuge über Laufzeitmessung müßten sie im Zentrum ihrer Funkzellen angeordnet sein. Dort kann jedoch eine Montage unter Umständen auf Schwierigkeiten stoßen, weil beispielsweise keine geeigneten Gebäude bzw. Gelände zur Verfügung stehen. Erfolgt die Positionsbestimmung jedoch erfindungsgemäß über Baken, so können die Funkkonzentratoren exzentrisch in den Funkzellen angeordnet werden, wie am Beispiel des Funkkonzentrators FuKo2 in der Funkzelle Z2 dargestellt. Auch eine versorgung von mehreren Funkzellen von einer einzigen Stelle aus, beispielsweise über Richantennen ist möglich. Ein solches Beispiel stellt der Funkkonzentrator FuKo3-4-n dar.

Ansprüche

1. Mobilfunksystem zur Herstellung von Fernsprechverbindungen von und zu Fahrzeugen (F) über Funkstrecken zwischen fahrzeugseitigen Mobilfunkgeräten (MB) und ortsfesten Funkkonzentratoren (FuKo), wobei das vom System erfaßte

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geografische Gebiet in eine Vielzahl von sich teilweise überlappenden Funkzellen (Z1 bis Zn) unterteilt und jeder Funkzelle ein Funkkonzentrator (FuKo) fest zugeordnet ist und

wobei jeweils Ortungseinrichtungen vorgesehen sind, um die dem Fahrzeugstandort entsprechende Funkzelle (Z1 bis Zn) zu identifizieren und das Mobilfunkgerät (MB) dem dieser Funkzelle entsprechenden Funkkonzentrator zuzuordnen,

dadurch gekennzeichnet,

daß in den Fahrzeugen (F) jeweils ein Navigationsgerät (N) vorgesehen ist, welches beim Passieren ortsfester Baken (BK) Daten über deren Standort empfängt und diese während der Fahrt mittels einer fahrzeugeigenen Koppelnavigationseinrichtung (KON) aktualisiert,

daß die jeweils in dem Navigationsgerät (N) ermittelten Standortdaten dem Mobilfunkgerät (MB) des Fahrzeuges (F) übermittelt und durch Vergleich mit den Ortsdaten der einzelnen Funkzellen (Z1 bis Zn) zur Bestimmung der zugehörigen Funkzelle bzw. des zugehörigen Funkkonzentrators (FuKo) ausgewertet werden.

2. Mobilfunksystem nach Anspruch 1, **dadurch gekennzeichnet,** daß in dem jeweiligen Mobilfunkgerät (MB) ein Speicher (FSp) zur Speicherung der Ortsdaten für mehrere Funkzellen vorgesehen ist.

3. Mobilfunksystem nach Anspruch 2, **dadurch gekennzeichnet,** daß von den Baken (BK) jeweils die Ortsdaten für eine oder mehrere Funkzellen (Z1 bis Zn) an die passierenden Fahrzeuge (F) übermittelt werden.

4. Mobilfunksystem nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet,** daß die in den Fahrzeugen (F) ermittelten Standortdaten über das Mobilfunkgerät (MB) an die erreichbaren Funkkonzentratoren (FuKo) übertragen und dort zur Zuordnung des Fahrzeuges (F) zu einer Funkzelle (Z1 bis Zn) ausgewertet werden.

5. Mobilfunksystem nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet,** daß der Inhalt von in den Fahrzeugen jeweils vorgesehenen Zielspeichern (ZSp) bzw. von den Baken (BK) empfangene Leitempfehlungen an das Mobilfunkgerät (MB) übermittelt werden und daß die Zuordnung zu einem Funkkonzentrator (FuKo) unter Berücksichtigung dieser Zieldaten vorgenommen wird.

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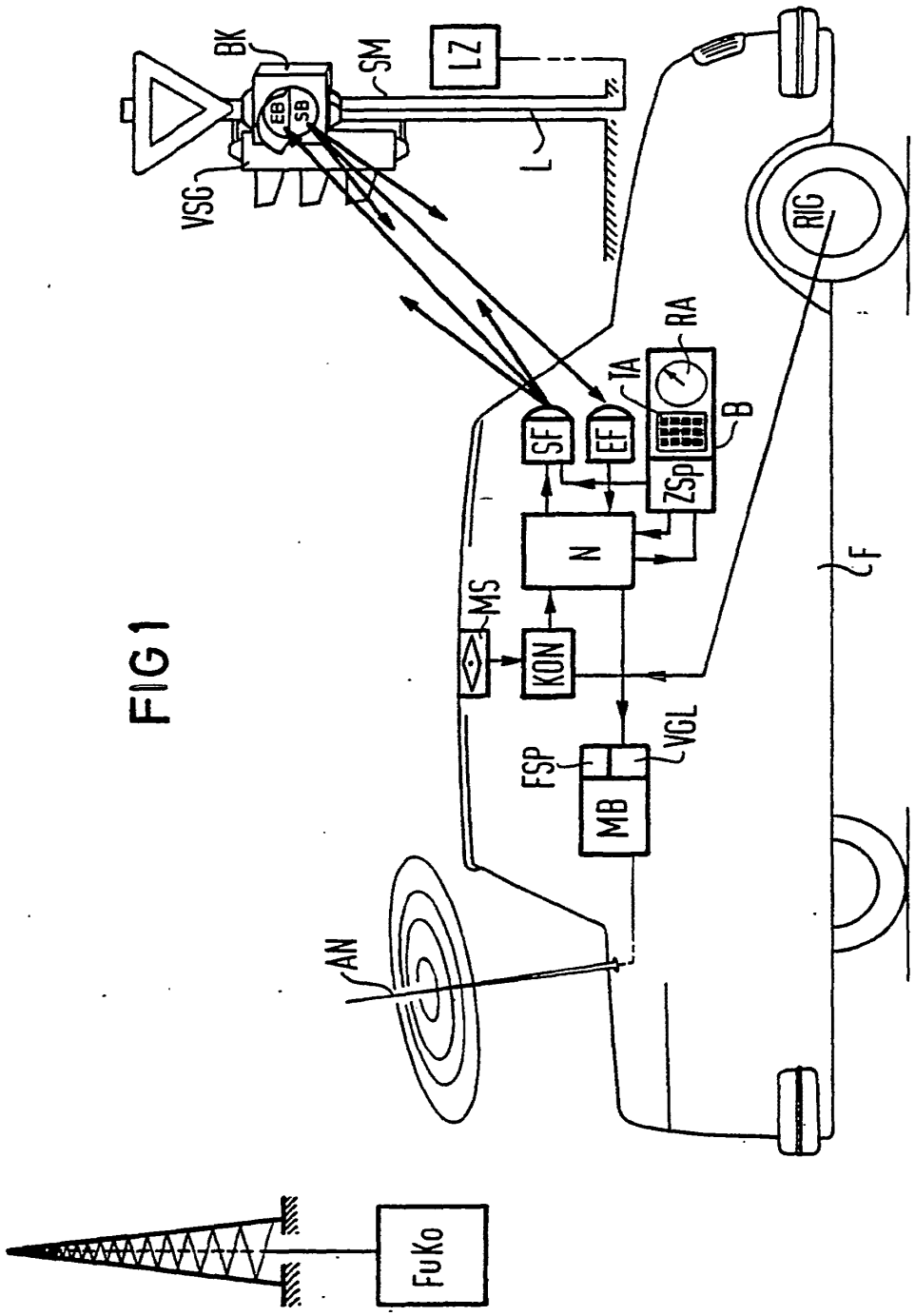
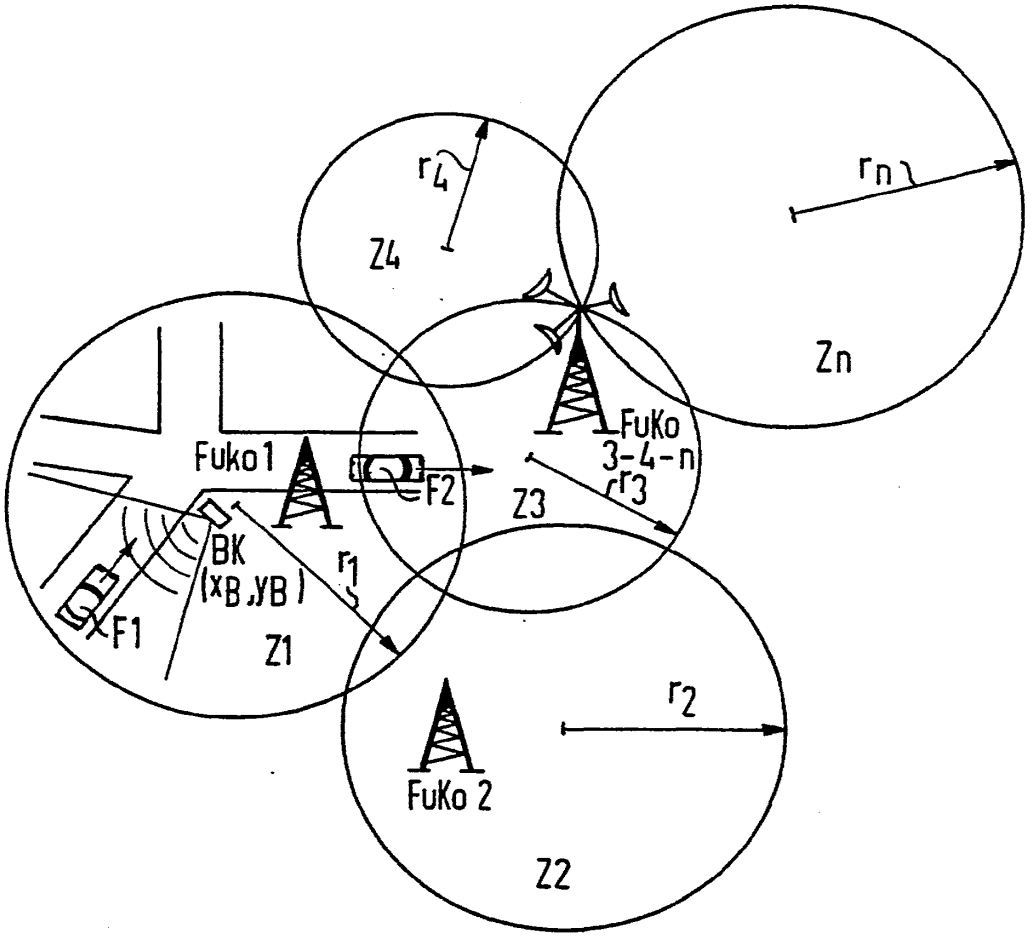

BK
SM
LZ
EB
SB
VSG
L
RIG
RA
IA
B
SF
EF
ZSp
N
MS
KON
VGL
FSP
MB
AN
FuKo
F

FIG 1

FIG 2



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EP 86 10 5205

EINSCHLÄGIGE DOKUMENTE

Kategorie	Kennzeichnung des Dokuments mit Angabe, soweit erforderlich, der maßgeblichen Teile	Betrifft Anspruch	KLASSIFIKATION DER ANMELDUNG (Int. Cl.4)
Y,D	EP-A-0 021 060 (SIEMENS) * Seite 4, Zeilen 6-29; Seite 5, Zeilen 17-30; Seite 8, Zeile 25 - Seite 10, Zeile 16 *	1	H 04 Q 7/04
A,D		3-5	

Y	PATENTS ABSTRACTS OF JAPAN, Band 6, Nr. 259 (E-149)[1137], 17. Dezember 1982, Seite 1 E 149; & JP - A - 57 154 952 (MATSUSHITA DENKI SANGYO K.K.) 24-09-1982 * Zusammenfassung *	1	

A	PATENTS ABSTRACTS OF JAPAN, Band 6, Nr. 254 (E-148)[1132], 14. Dezember 1982, Seite 15 E 148; & JP - A - 57 152 241 (FUJITSU TEN K.K.) 20-09-1982 * Zusammenfassung *	1,4	RECHERCHIERTE SACHGEBIETE (Int. Cl.4)
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A	DE-A-3 335 128 (SIEMENS)		

Der vorliegende Recherchenbericht wurde für alle Patentansprüche erstellt.

Recherchenort	Abschlußdatum der Recherche	Prüfer
DEN HAAG	18-07-1986	GERLING J.C.J.

KATEGORIE DER GENANNTEN DOKUMENTE

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Mobile radio system.

Patent Number: EP0199266
Publication date: 1986-10-29

Inventor(s): VON TOMKEWITSCH ROMUALD DIPL-I
Applicant(s): SIEMENS AG (DE)

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Abstract

1. Mobile radio system or producing telephone connections from and to vehicles (F) via radio links between vehicle-side mobile radio sets (MB) and stationary base stations (FuKo), the geographical area covered by the system being subdivided into a multiplicity of partially overlapping radio zones (Z1 to Zn) and each radio zone having a base station (FuKo) permanently assigned to it and in each case locating devices being provided in order to identify the radio zone (Z1 to Zn) corresponding to the location of the vehicle and to assign the mobile radio set (MB) to the base station corresponding to this radio zone, characterized in that in the vehicles (F) in each case a navigation unit (N) is provided which determines the location data of the vehicle by means of a vehicle-own dead-reckoning navigation system (KON), these data being corrected on passing stationary beacons with the beacon location data received thereby, and in that the mobile radio system is configured in such a way that the location data in each case determined in the navigation unit (N) are transmitted to the mobile radio set (MB) of the vehicle (F) and in that the mobile radio set (MB) evaluates these location data by comparison with the local data of the individual radio zones (Z1 to Zn) to determine the associated radio zone or the associated base station (FuKo).

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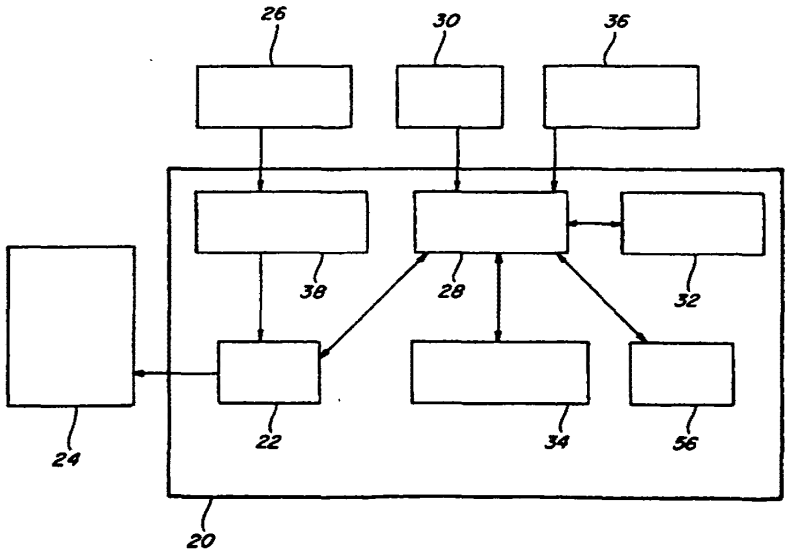
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(54) Title: METHOD AND APPARATUS FOR INCORPORATING ENVIRONMENTAL INFORMATION FOR MOBILE COMMUNICATIONS



(57) Abstract

An apparatus and method for communicating between a first communication node and a second communication node in an area having a plurality of communications nodes are disclosed which comprises generating a propagation model of signals from selected communication nodes in the area. The communication nodes may be fixed or mobile. The propagation model is based on an environmental map that includes the topography of the terrain and structures in the area. The propagation model is generated at selected intervals to provide updated information for predicting the quality of communication at a location at a future time.

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Description

METHOD AND APPARATUS FOR INCORPORATING ENVIRONMENTAL INFORMATION FOR MOBILE COMMUNICATIONS

Technical Field

The present invention relates generally to a method and apparatus for predicting loss of signal quality in a mobile communications system and, more particularly, to a method and apparatus for predicting loss of signal quality in response to knowledge of the environment in which the mobile communications system is used and also to adapting the routing, network selection, or other behavior in response to the prediction to improve the signal quality.

Background

As mobile machines capable of operating manually, partially or fully autonomously at work sites are developed, a large amount of up-to-date information is required to coordinate particular tasks and to provide adequate time for the machines to plan their movements. In some situations, multiple pieces of equipment must work cooperatively with one another and information regarding the activity and movement of each machine and other objects in the environment must be communicated. As the work site becomes more complex and more machines are used, an efficient means for receiving and transmitting data among the machines is required. Further, the information that must be communicated is diverse in nature. For example, the system must support prioritized data, giving precedence to data pertaining to mission-critical operations. Some of the operations

may be highly interactive, requiring very low system latencies. There is also large variation in bandwidth requirements, from a few bytes per second to hundreds of thousands of bytes per second or more.

Currently, wireless mobile communications systems are configured to switch between routes or networks in response to detection of loss of signal quality. For example, cellular systems switch base stations when the signal level drops below a specified level, such as when a mobile node moves from one base station area to another. In some cases the drop in signal level occurs sufficiently fast that the connection is lost before hand off to another base station can be completed. For example, a communication system for heavy mobile machinery that is operating partially or fully autonomously cannot afford to lose valuable data during this fade out period; quality communications must be maintained at all times. It is therefore desirable to have a mobile communication system with means for preventing degradation of communication signals and loss of information.
In order to make most efficient use of the bandwidth available, the communication system would ideally have the capability to choose among several overlapping wireless networks for the networks most suited for a particular application. To prevent loss of communication signals, it is also desired to switch base stations or networks immediately before the mobile node moves from one network to another. This requires the ability to predict handoffs before they are forced and inform the network when it is discovered that a handoff

is imminent. The ability to predict handoffs must be reliable in a work environment having a large amount of interference due to complex terrain including hills, trenches, pits, and tunnels, and where the machinery is spread over large distances. Radio frequency (RF) wave propagation in regions having irregular terrain and buildings, such as deep trenches, steep hills, and high walls, require factors such as the reflection, diffraction, multi-path, and scattering effects to be taken into account. The signal strength of the RF signals can fluctuate greatly with small movements in such regions. The reliability of the system must be balanced with speed, since a wireless network can typically be made more reliable by adding error checking and correction, at the expense of lower throughput and higher latency.

In traditional hierarchical data networks, such as the Internet, routing protocols are tied to the logical location of the nodes in the network. When a packet is transmitted, it contains the address of the destination host computer in its header. Intermediate nodes that exist in the path between the source and destination examine the address of the destination and make decisions about how to route the packet based upon the network component of this destination address. This allows the intermediate nodes to forward the packet to the network on which the destination host resides without knowing the exact location of the destination host. As the packet travels along the path, the intermediate nodes that are closer to the destination have information about the exact location of the

destination and forward the packet accordingly. One advantage of this type of scheme is that a host only needs to know the location of a few networks of nodes instead of the location of every node in the network.

This traditional network assumes that hosts will be stationary. With lightweight and battery powered mobile computers using wireless technology, users may move around while maintaining connectivity. When nodes move away from their "home" network, however, the scheme breaks down. For example, when a mobile computer with an address that belongs to network A moves to network B, the packets that are destined for the mobile computer will still be delivered to network A, as indicated by the network component of the address. All packets that were destined to the mobile computer will be lost while the mobile computer is away from its home network. The limitations of the traditional routing scheme restrict the mobility of these computers by confining them to a single network.

Accordingly, the present invention is directed to overcoming one or more of the problems as set forth above.

Disclosure of the Invention

In one embodiment of the present invention, a method for communicating between a first communication node and a second communication node in an area having a plurality of communication nodes includes generating a propagation model of signals from selected communication nodes in the area. The communication nodes may be fixed or mobile. The propagation model is based on an

environmental map that includes the topography of terrain and structures in the area. The propagation model is generated at selected intervals to provide updated information for predicting the quality of communication at a location at a future time. Additionally, the present invention predicts the future location of a mobile communication node based on the speed and direction of travel of the mobile communication nodes. The previous quality of communication at the predicted location of a communication node is also used. The communication signals are then routed through the network in a manner that provides the desired or best available predicted quality of communication.

Brief Description of Drawings

Fig. 1 is a functional block diagram showing a basic Mobile IP configuration;

Fig. 2 is a functional block diagram showing a basic Mobile IP configuration with packet tunneling;

Fig. 3 is a functional block diagram showing packet routing without Route Optimization;

Fig. 4 is a functional block diagram showing packet routing with Route Optimization;

Fig. 5 is an overview diagram showing an example of coverage of local area and wide area wireless networks;

Fig. 6 is a functional block diagram of the present switching system architecture;

Fig. 7 is a diagram of the state machine that the Model Daemon uses to make switching decisions;

Fig. 8 is a flowchart showing an example of position-based prediction;

Fig. 9 is an overview diagram of a terrain map;

Fig. 10 is a diagram of the state machine for the present switching system;

Fig. 11 is a view of a graphical user interface for the present switching system; and

Fig. 12 is a view of a work site wherein the present invention may be utilized.

Best Mode for Carrying Out the Invention

Overview

The present wireless mobile communication system provides a method and apparatus for communicating between two or more communication nodes in an area having a plurality of communication nodes and one or more communication network technologies. The communication nodes may be mobile or stationary. An intelligent switching system incorporates position information and calculations of RF wave propagation for selected communication networks. At selected time intervals, an environmental map which includes the topography of terrain and structures in the area, as well as the locations and properties of potential sources of electromagnetic interference, is used to create a RF propagation and communications model for signals generated by selected communication nodes and networks in the area. The RF propagation and communications model offers the predicted signal quality at any given location. With these inputs, each

communication node in the present network can predict where it will be in the future, whether that location will be reachable via a particular wireless network, and the quality of the signal at that location. The network can then prepare to handoff between base stations or networks having the desired signal quality, thus minimizing the delay and the overhead incurred. In order to support mobile nodes, a communication protocol, such as the standard Internet protocol known as Mobile IP, is used which allows nodes to change their location in the network without changing their address. When a mobile node moves from one network to another, the home agent is the only node in the network which keeps track of the location of the mobile node and routes packets to this location. The present system also allows direct peer-to-peer communication. When two nodes are within the range of each other's wireless coverage, they can communicate directly without the aid of any central router. When two nodes are beyond the range of each other's wireless coverage, they may be able to communicate by using other mobile nodes between them to forward their packets, thus dynamically using these intermediate nodes as routers and forming an ad hoc network. By providing this capability, the present system is able to support a large number of mobile nodes. The present system further provides support for a variety of network traffic types, including data-intensive file transfers, time-critical emergency data, real time audio data, constant bandwidth data, and periodic position data. The type of service required for the traffic is also considered to meet the special

needs of various communication nodes and facilitating the interaction of different user applications.

Mobile IP

The Mobile IP (Internet Protocol) standard was developed to provide for the mobility of hosts on the Internet. The implementation of Mobile IP, as discussed herein, is based on the IP version 4 (IPv4) protocol standard. Mobile IPv4 allows for the transparent routing of IPv4 packets to mobile nodes in the Internet. There is also a newer version of IP which is known as IP version 6 (IPv6) for which there is also a Mobile IP extension which is known as Mobile IPv6. Both Mobile IPv4 and Mobile IPv6 may be used in the present apparatus.

In traditional IP routing, if a node has moved to another network, packets destined for it will no longer be deliverable. For a node to be able to communicate on a new network, it must change its IP address. This makes it impossible to maintain connections when the node changes locations. Mobile IP is a routing scheme that does not require a mobile node to change its IP address when it moves. Instead, each mobile node is identified by a single IP address, regardless of its current point of attachment to the network.

An understanding of Mobile IP requires familiarity with the following concepts:

Mobile node: A node that moves from one network to another. The mobile node implements Mobile IP in order to maintain communication with other nodes.

Correspondent node: A node with which a mobile node is communicating. A correspondent node could be either a stationary node or another mobile node.

Home address: The IP address that is assigned to the mobile node and which remains unchanged, regardless of whether the node is attached to the network.

Home network: Each mobile node has a home network. This is the network to which traditional IP routing would deliver packets addressed with its home address when a mobile node is attached to its home network. Traditional IP routing could deliver packets to the mobile node using its home address.

Foreign network: Any network other than the mobile node's home network.

Home agent: A Mobile IP agent located on the mobile node's home network. The home agent keeps track of the location of the mobile node and forwards packets to the mobile node when it is away from home.

Foreign agent: A Mobile IP agent located on a foreign network. Foreign agents may help a mobile node register with its home agent and may also help deliver forwarded packets to a mobile node.

Care-of address: An IP address on the foreign network to which the home agent forwards packets. The care-of address could be either the IP address of a foreign agent, or a local address obtained on the foreign network. A protocol such as Dynamic Host Configuration Protocol (DHCP) may be used for this. The former type of care-of address is referred to as a

foreign agent care-of address and the latter type of care-of address is referred to as a co-located care-of address.

Packet interception: This is the process by which the home agent receives packets destined for one of its mobile nodes. This may be implemented in Mobile IP by the use of "proxy" Address Resolution Protocol (ARP) at the home agent. With proxy ARP, the home agent answers address resolution requests for the mobile node's IP address from other nodes on the home network, giving the home agent's link-layer address as if it were the mobile node's address. The node requesting the address then uses the home agent's link-layer address to deliver packets to the mobile node, allowing the home agent to receive the packets and to forward them to the current location of the mobile node.

Binding cache: Correspondent nodes may maintain a cache of care-of addresses for mobile nodes in order to determine where to send packets destined for a mobile node.

Binding update: A message used to update a correspondent node's binding cache.

Registration lifetime: The duration for which a mobile node's registration on a foreign network is valid. It is also the duration for which a binding update is valid.

Fig. 1 illustrates the terms defined above. M is a mobile node. Node S is communicating with M, so S is a correspondent node. R2 is M's home agent. When M moves to the foreign network, R4 serves as its foreign

agent. In this case, R4's address is used as M's care-of address.

Mobile IP offers a set of services to provide nodes with mobility. This section describes each of these services.

Agent Discovery: Home agents and foreign agents may advertise their availability on each link on which they provide services. In addition, a newly connected mobile node can send an explicit solicitation on a link to learn if any prospective agents are present. Foreign agents will respond to a solicitation by advertising their location. Mobile IP agent discovery is implemented as an extension to the ICMP (Internet Control Message Protocol) Router Discovery protocol. The Agent Discovery protocol extends the messages (Router Advertisement and Router Solicitation) used in the Router Discovery protocol. The messages used in Agent Discovery are thus called Agent Advertisement and Agent Solicitation.

Registration: When a mobile node is away from home, it informs its home agent of its current location using a process called registration. Depending on its method of attachment, the node will register either directly with its home agent or through a foreign agent that forwards the registration to the home agent. Registrations are valid for a fixed amount of time, or registration lifetime. If the mobile node is using a co-located care-of address, the presence of a foreign agent is not necessary and the mobile node can register directly. When the mobile node returns to its home

network, it "deregisters" with its home agent to stop packet forwarding.

Tunneling: The service provided by the home agent to forward packets to the mobile node is called "tunneling". When tunneling packets, the home agent will encapsulate the original packet by placing another IP header on the front of the existing packet. This "outer" IP header has a source address that is the IP address of the encapsulating host and has a destination address that is the care-of address of the mobile host. If the care-of address is the foreign agent, the foreign agent will receive the packet, decapsulate it, and deliver it locally to the mobile node. If a co-located care-of address is used, the mobile node will receive the packet and decapsulate this packet by itself.

Fig. 2 illustrates the process of encapsulation when a foreign agent is used. During operation home agent R2 and foreign agent R4 advertise their presence using agent advertisement messages. Mobile node M is originally connected to its home network, so it operates without mobility services at this time. Mobile node M moves to a foreign network. When the mobile node detects that it is on a foreign network (because it receives the advertisements of the foreign agent), it obtains a care-of address. The care-of address is obtained from the foreign agent advertisement message sent by R4. If no node such as R4 is available to provide foreign agent services, and if the mobile node has the capability, it may attempt to obtain a co-located care-of address using a service such as DHCP.

Mobile node M registers its new care-of address with the home agent R2 through exchange of registration request and reply messages. If R4's address is used as the care-of address, the registration request and reply are sent to the foreign agent R4 which then forwards the packets appropriately. If a co-located care-of address is used, a foreign agent is not involved. When the correspondent node sends packets to M, the packets are routed to M's home network. The home agent R2 intercepts those packets and tunnels them to M's care-of address. If R4's address is the care-of address, R4 decapsulates the packets and delivers them to M locally. If a co-located address is used, the tunneled packets would be received and decapsulted by M itself. In the reverse direction, packets sent by M to S are delivered to their destination using traditional IP routing mechanisms, regardless of the location of M.

Security in Mobile IP is essential due to the fact that it concerns the ability to change the routing of packets destined to any host to be delivered to anywhere else in the Internet. Attacks on registration requests or replies could cause packets destined to the mobile node to be undeliverable or delivered to the incorrect destination. For example, another host could attempt to masquerade as a mobile node and convince a home agent to deliver packets to it. Therefore, authentication is performed by the mobile node and the home agent on all registration request and replay messages. To authenticate with its home agent, the mobile node shares a security parameter index (SPI) and a secret key with its home agent. One of several

available algorithms may be used for authentication, such as keyed Message Digest version 5 (MD5) with a key size of 16 bytes. To prevent replay of any registration messages, time stamps or nonces are used to uniquely identify each registration request and reply.

Mobile IP With Route Optimization

Basic Mobile IP allows a mobile node to move away from its home network by providing a home agent to intercept packets destined for the mobile node's home address. In a typical situation, as shown in Fig. 3, the mobile node M, depicted here is away from its home network and is conversing with a correspondent node S, located on the foreign network to which the mobile node is currently connected. When mobile node M sends a packet to correspondent node S, the packet will be routed directly to mobile node M using traditional IP routing. When correspondent node S sends a packet to mobile node M, however, the packet will first be routed back to the mobile node M's home network. The mobile node M's home agent R2 will intercept this packet and tunnel it to the mobile node's current foreign agent R1. When the foreign agent R1 receives the encapsulated packet, it is decapsulated and then sent to mobile node M.

Alternatively, the packets may be routed more optimally by sending the packets directly to each other over the local network as shown in Fig. 4. Route Optimization for Mobile IP optimizes the path that packets travel from correspondent nodes S to mobile nodes M. Any type of optimization of the routing of

packets from correspondent nodes S to mobile nodes M requires the correspondent nodes S to keep information about the current location of the mobile nodes M. Each correspondent node S that supports Route Optimization must maintain a cache of care-of addresses, called a binding cache. When a correspondent node S sends a packet, it checks its binding cache for an entry corresponding to the destination address of the packet. If a matching entry is found, then the correspondent node S itself will encapsulate the packet with the care-of address specified in the binding cache entry, tunneling the packet directly to the care-of address instead of sending it to the mobile node M's home network.

If a binding cache entry is not found, then the packet is sent using traditional IP routing which, as before, causes the packet to be sent back to mobile node M's home network. When the home agent R2 intercepts the packet, it assumes the source host does not have a binding cache entry for the mobile node M. The home agent R2 will respond by sending an authenticated binding update to the correspondent node S to inform it of mobile node M's current care-of address before tunneling the packet to mobile node M's current location. The home agent R2 will set the lifetime of the binding update to the amount of time remaining for the registration of that particular mobile node M. When the original source receives and authenticates the binding update, it adds the binding update to the binding cache for future use. Binding updates expire

after the amount of time that is specified by home agent R2.

In order for a correspondent node S to use Route Optimization, a software process must be operating to receive and process binding updates. If the host does not use the Route Optimization software, then packets are routed in the same way as in basic Mobile IP. Because some correspondent nodes S will not have this Route Optimization software, home agents R2 must have an algorithm to limit the rate at which they send out binding updates to each correspond host S, since otherwise, a home agent R2 might flood the network with binding updates to a correspondent node S that ignores them.

Intelligent Switching System

The present network system incorporates multiple technologies to offer the best qualities from each network, including a wide area wireless network that provides low-speed coverage over a site and one or more local area wireless networks as shown in Fig. 5, each providing high speed coverage over a portion of the site. As mobile nodes move through the network, they are continuously within the range of the wide-area network and will move into and out of areas of local area coverage. The network technology to use in a particular situation is selected based upon the needs of each specific application. A single, composite network made up of sub-networks using different technologies thus provides a total solution. The flow of data in this network takes the most efficient route from the source

to the destination, depending on the characteristics of the technologies of the particular sub-networks. For example, if a high speed local area communication link is available between two nodes that want to exchange communication, then that communication path could be used, as opposed to a slower, wide-area link that might also be available. If no other means of communication between two nodes is available, a wide area network could be available by default.

In a preferred embodiment, Mobile IP is used to switch between networks as described hereinabove. The Mobile IP scheme has the advantage that it requires no changes to the routers or non-mobile nodes in the network. The protocol, however, does not specify when to change sub-network connections.

The present system provides the basic Mobile IP protocol with instruction about which network connection to establish while requiring minimal change to the standard Mobile IP protocol. In the present system, no input from a human operator is required since some mobile nodes may not carry operators and if they do, the operator should be able to focus attention on operating the equipment, not on trying to determine if a network handoff should occur. Additionally, one of the inputs into the process of deciding when to switch networks is an estimate of the quality of the wireless communication signal from a correspondent on the local area network. The current levels of signal strength and noise or interference could be used to predict future values or recorded for later use. In addition to being able to estimate this signal quality value, a threshold

value is established for a particular local area network technology. This value is the minimum satisfactory signal quality value for the hardware and is obtained either directly from the hardware or from the hardware's specifications. Another useful input to the decision process is knowledge of the current locations of the mobile nodes. This type of input may be combined with knowledge of the locations of wireless local area network transmitters to estimate values of signal quality.

In order to provide realistic models of RF propagation, the present system includes a description of the actual terrain surrounding the mobile node. Using the RF propagation model, the switching system attempts to predict when handoffs will be required in order to minimize the time that a mobile node might be disconnected from the network. The switching system predicts a future value of the signal quality for communications on the local area network connection. This signal quality value is then compared to the specified threshold. If the predicted value exceeds the threshold, the switching system tells Mobile IP to attempt to communicate using its local-area network interface; otherwise, the switching system tells Mobile IP to communicate using the wide-area network connection.

Switching System Architecture

The components of a preferred embodiment of the present system are shown in Fig. 6. Model Core 20 contains a set of components such as Model Daemon 22,

position-based prediction mechanism 28, environment/terrain map 32, RF propagation and communications model 34, non-position-based prediction mechanism 38, and mobility model 56, that provide the central functions of the switching system. The switching system has a modular design so that improvements in the supporting technologies may be incorporated. Model Daemon 22 is a state machine that keeps track of the current state of the mobile node and makes switching decisions based upon this state and inputs from two other sources which are a position-based prediction mechanism 28 and a non-position based prediction mechanism. Model Daemon 22 also sends commands to the Mobile IP software 24, the component of Mobile IP that allows mobile nodes to inform their home agents R2 of their current location.

Fig. 7 shows the state machine that Model Daemon 22 uses to make its switching decisions. When Model Daemon 22 begins execution, it starts in the WAN state (where "WAN" refers to the network interface that Mobile IP is commanded to use, in this case, the wide-area network interface). The wide area network was chosen for the initial state for the present system because of the assumption that the wide area network will always be available. From this state, a number of things can happen. First, if nothing else occurs, Model Daemon 22 will send an "update" command to the Mobile IP software on this node. Update commands are sent periodically to ensure that the Model Daemon 22 and mobile node M remain synchronized.

The only way for Model Daemon 22 to leave the WAN state is if Model Daemon 22 decides that the empirically collected signal strength values (i.e., those read directly from the local-area network interface hardware) suggest that a stable connection to the local area network (LAN) can be made. In a preferred embodiment, this occurs when the Model Daemon 22 reads several consecutive values of signal strength or hardware signal quality input 26 from the LAN hardware that are above the LAN signal strength threshold.

Once the Model Daemon 22 has entered the LAN state, it can only leave if one of the prediction systems described below predict a future value of signal strength that is below the LAN threshold. If this occurs, a command to switch to the WAN interface is sent to the Mobile IP software on this node, and Model Daemon 22 enters the WAN state again. Model Daemon 22 sends "update" commands while in the LAN state to insure that the Model Daemon 22 and Mobile IP software remain synchronized.

The decision to switch from the LAN interface to the WAN interface is made based upon predicted information, while the decision to switch from WAN to LAN is made based upon empirically measured data. This distinction is made in order to minimize the possibility that a mobile node could be instructed to use the local area network interface when that network is not actually available. The result of this is that the rules for changing state make it easier to enter the WAN state,

since the wide area network connection is assumed to always be available.

Another important point is that Model Daemon 22 has no concept of home or foreign. It only knows about network interfaces. The decision of whether the mobile node M should be home or foreign is left up to the Mobile IP software or routing protocols 24 (Fig. 6) and is not affected by the presence of the Model Daemon 22.

Referring again to Fig. 6, a position-based prediction mechanism 28 accepts as an input the current position of the mobile node from position acquisition system 30, translates this information into coordinates on the environment/terrain map 32, and predicts the motion of mobile node M to a new point. The position-based prediction mechanism 28 also provides the coordinates as inputs to the RF propagation and communications model 34 that calculates future signal strength values at one or more locations at the site using equations for RF wave propagation.

Hardware for reliably acquiring position information, such as differential global positioning systems (DGPS), is readily available commercially. The present switching system has a default position prediction system such as the environment/terrain update system 36 that operates correctly even if the position information is not available. To this end, the present system includes the non-position-based prediction mechanism 38 that keeps track of empirically collected signal strength values and extrapolates a set of data points to come up with a future value.

The extrapolation performed by non-position-based prediction mechanism 38 can be as complex as necessary, taking into account many historical values or just a few, and combining them in a polynomial or fitting them to a curve. An example of a simple implementation includes defining a line using the two most recently collected signal strength values. A third point is extrapolated along this line, becoming the predicted signal strength value. A more useful mechanism would be able to predict further in the future than just the next point in time. To this extent, a more complex model can be used that fits a curve through a series of points, taking into account the past behavior of the system.

The position-based prediction mechanism 28 is part of Model Core 20, and uses information from a number of sources including the environment/terrain map 32, position acquisition system 30, the RF propagation and communications model 34, the environment/terrain update system 36, and the mobility model 56 to provide a predicted value of the future signal strength to Model Daemon 22. Fig. 8 shows a flowchart of the decision process for predicting a signal strength value. When the position-based prediction mechanism 28 is invoked at block 40, it first attempts to collect input on the current state of the mobile node. The current strength of local area network communication is acquired from Model Daemon 22, which previously read the data from the local area network hardware. The current position of the mobile node is gathered from whatever position system is available as shown at block 42. Once these

inputs have been collected, the present system checks to see if the environment/terrain map 32 for the current location of the mobile node is available at block 44. If no environment/terrain map 32 is available for this point, a return error is generated at block 46 and the position-based prediction mechanism 28 cannot be used. Model Daemon 22 will default to using the value from the non-position-based prediction mechanism 38.

If the environment/terrain map 32 for this point is available, then the present switching system attempts to predict a future position of the mobile node at block 48. The future position of the mobile node is resolved to a specific entry in the environment/terrain map 32. The data stored in that location, specifically the historical signal strength value and the time it was collected, is retrieved. Once the historical value has been retrieved, the system stores the current signal strength value along with the current collection time in the environment/terrain map 32 at the position specified by the current location. The amount of time that has elapsed since the collection time is calculated and compared against the age threshold associated with the current terrain map at decision block 50. If the elapsed time is less than the threshold, then the historical value is used as the predicted value at block 52. Otherwise, a calculation must be performed using RF propagation and communications model 34 to predict a future signal strength value at block 54. The predicted signal strength value can then be returned to Model Daemon 22 to be used as input into its threshold comparisons, as described above.

Model Daemon 22 can learn about its environment from places that it has been to before by using the historical signal strength values. When a mobile node is using its local area network connection, it can record a collection of signal strength values as historical values in its environment/terrain map 32. If the mobile node leaves the area to perform a task, and returns at a later time to roughly the same place that it occupied previously, it could use the historical signal strength value as the predicted signal strength value, making the RF propagation calculations unnecessary.

The historical values may be aged in situations where the terrain in some areas of local area network coverage change faster than other areas. The model allows each area of local area network coverage to have its own age threshold. For purposes of example only, the terrain near a site operations center is likely to be fairly static, since operations typically do not take place near the site operations center. If this is the case, the age threshold for the site operations center can be relatively long, such as a week or so. The age threshold of a work area might only be valid for a relatively short period of time where the terrain changes more rapidly. If a mobile node returns to a location that it has been to within the limit of time set by the age threshold, then Model Daemon 22 can use the historical value as the predicted value. Otherwise, Model Daemon 22 must calculate an entirely new value. A more complicated aging system could be devised which would slowly age the historical values in

the manner of a half-life, possibly combining them in a weighted polynomial with a value predicted by the RF propagation and communications model 34.

In a preferred embodiment of the present system, the position acquisition system 30 is a differential global positioning system (DGPS) system, although another technology could be substituted. The desirable resolution (size in meters of each grid) of the environment/terrain map 32 is a parameter for the present switching system. One constraint on this resolution is that it cannot be finer than the accuracy of the DGPS equipment. Smaller grid resolution also requires more storage space for the environment/terrain map 32 and more computationally intensive RF propagation model calculations. A larger grid size will allow faster calculations and less storage space, but will represent the terrain with less accuracy, generally leading to less accurate RF propagation calculations. The resolution of the "grid" of the terrain map should not exceed the resolution of the position information. The position information may be represented in units of degrees of latitude and longitude, or in Cartesian coordinates having a reference frame fixed in space. Additionally, it should be noted that the model is not limited to use on a map with a fixed grid. For example, maps having irregular mesh descriptions of the terrain are possible.

The environment/terrain map 32 can be thought of as a grid that has been placed on the ground over areas where local area network coverage exists, or where wide area network coverage exists, or, in general, the

environment/terrain map 32 could exist for all areas, regardless of network coverage. At each square in the grid is a storage location which holds three values. The first is an elevation value corresponding to the altitude of the terrain at that point above sea level (or some other reference point). The second value is a signal strength value. As a mobile node traverses the actual terrain, Model Daemon 22 tracks its position across the environment/terrain map 32 and records the empirically collected values of signal strength into these storage locations. The third value stored is the time at which the most recent signal strength value was collected.

An initial terrain data file or mobility model 56 (in Fig. 6) contains the elevation information for the terrain of the local-area network in question. The file also specifies the Cartesian coordinates of the center of the environment/terrain map 32, as an x and y offset in the desired units of measurement from a fixed reference location, the "size" of the terrain map in terms of range and resolution in meters, and the age threshold, mentioned earlier. Fig. 9 depicts some of these concepts. The fixed reference location 58 is the origin of the Cartesian coordinate system. Overlaying an outline 60 representing the range of the local area network is an imaginary grid 62 representing terrain map 32. The center of the wireless local area network is located at the center of the terrain map grid 62, and the grid extends beyond the edges of the coverage of the wireless local area network as represented by outline 60. The initial terrain data file 56 containing the

elevation information for this local area network coverage region specifies the center of the terrain map 32 with respect to fixed reference point 64. With knowledge of its current position relative to the fixed reference point 64, a mobile node can determine which, if any, of its available terrain maps 32 are appropriate for use at a particular position.

The environment/terrain update system 36 for calculating a future position of the mobile node several seconds in the future provides Model Daemon 22 with sufficient warning to send switch commands before network connectivity is lost completely. In the present system, various position prediction methods may be used ranging from using the two most recently collected positions of the mobile node and projecting the path of the mobile node along a straight line running through these two points to more complex position prediction systems that fit a parametric curve, such as a Bezier curve, through a series of recently collected positions. A more complicated prediction system could make intelligent predictions of motion based upon the surrounding terrain or knowledge of commonly followed routes through the terrain (i.e., roads) and the dynamic characteristics of the unit.

In the current system, the RF propagation and communications model 34 produces an estimate of the signal strength of local area communications that a mobile node would receive based upon a predicted position of the mobile node, the position of a transmitter (usually a local area network access point or base station), the terrain between the two, and the

radio frequency used by the transmission equipment. A preferred embodiment of RF propagation and communications model 34 models the effects of natural terrain on electromagnetic wave propagation in real-time. This model utilizes a two-dimensional path loss model based on information stored in the environment/terrain map 32. The two-dimensional model treats terrain as if it exists within a vertical plane between an RF transmitter and receiver. RF transmissions can go over or under the terrain, but they cannot leave the plane to go around terrain features. In order to construct the two-dimensional model, a vertical plane is intersected between the x, y, and z coordinates of transmitting and receiving antennas in the environment/terrain map 32. Two calculations are then performed on this slice of terrain. First, a free space estimate of the RF wave propagation from the transmitter to the receiver is calculated using the following equation:

$$P_r = P_t G_t G_r \lambda^2 / ((4\pi)^2 d^2 L)$$

where:

P_t = the transmitted power

G_t = the gain of the transmitting antenna

G_r = the gain of the receiving antenna

λ = transmitted wavelength

d = the distance between the antennas

L = a system loss factor

This calculation estimates the received power of the transmissions as if the two antennas were in a free space, with no obstructions of any kind. Next, a

plane earth calculation is performed. In a plane earth estimate of RF propagation, another path from the transmitter to the receiver is taken into consideration, the reflected path from the transmitter to the ground to the receiver, using the following equation:

$$P_r = P_t G_t G_r h_t^2 h_r^2 / d^4$$

where:

P_t = the transmitted power

G_t = the gain of the transmitting antenna

G_r = the gain of the receiving antenna

h_t = the transmitter height

h_r = the receiver height

d = the distance between the antennas

Once both of the calculations have been performed, the lesser of the two (representing the "worst case" received power) is used as the basis for the next steps in the modeling calculations. Some of the power of RF waves is carried by secondary waves that do not travel on the direct path from the transmitter to the receiver. These secondary waves reach the receiver after being diffracted by point-sources existing between the transmitter and receiver and carry an important component of the total transmitted power. Even if a direct line of sight exists between the transmitter and receiver, these secondary waves may still be blocked, reducing the total received power. A Fresnel zone refers to a category of these secondary waves based upon the path that the waves travel. Adequate Fresnel zone clearance means that there is no significant loss of power because enough of these secondary waves are able

to reach the receiver. Fresnel zone clearance is calculated as known in the art depending on which of the following criteria is met:

1. A line of sight exists between the transmitter and the receiver and there is adequate Fresnel zone clearance. In this case, the base value calculated before is used as the received power.

2. A line of sight exists between the transmitter and the receiver but there is not adequate Fresnel zone clearance. The received power is reduced further from the base power by the loss of secondary waves.

3. No line of sight exists between the transmitter and receiver. In this case, only some of the secondary waves are able to reach the receiver.

The result of these calculations are then passed back to the position-based prediction mechanism 28. A method for calculating a three-dimensional RF propagation model may be used as an alternative to the two-dimensional model. The three-dimensional model will typically require greater data processing resources. Those skilled in the art will recognize that any other RF propagation model could be used as well as the above described model.

Quality of Service Characteristics

The present network is primarily concerned with two main quality of service (QOS) parameters: throughput, which is the average amount of data delivered per time unit, usually measured in bits/second or packets/second, and delay, which is the average

length of time for a packet to travel from source to destination. The present network makes use of the highest bandwidth path from the source to the destination through the use of Route Optimization and the intelligent switching system. When a high speed, wireless, local area network link is available, it will typically be used instead of the wide area link.

Fig. 10 shows a state diagram 68 for the present switching system wherein a mobile node can only attach to its home network when it is using its local area network interface. The present system begins with the Connection Lost state which clears some internal variables, disables the local area network interface, and enables the wide area network interface. Control then passes to the Purge Routes state, which clears the routing information stored by the mobile node. In the Acquire state, the mobile node attempts to register with its home agent by sending registration requests on all available network interfaces. Control is then automatically transferred to the Care-of Wait state, where the mobile node waits for a response from its registration requests. If the attempts to register fail, the mobile node will re-send the registration requests, remaining in the Care-of Wait state. If re-sending is not allowed, the mobile node will return to the Acquire state and generate new registration requests. If the registration request is successful, the mobile node enters the Care-of Registered state, which corresponds to the Mobile IP notion of being attached to a foreign network. The mobile node can remain in this state indefinitely, as long as re-

registration attempts on the same interface that was used previously are successful. Registration attempts can only be made using an interface that is enabled and the mobile node can then be instructed to communicate with a specific interface. If these registration attempts fail, the mobile node returns to the Connection Lost state, and the process begins again.

In addition to the failed registration attempt, the mobile node may leave the Care-of Registered state if a switch command is received from the Model Daemon 22 instructing the mobile node to switch from its local area network (LAN) interface to its wide-area network (WAN) interface. In this case, the mobile node enters the Connection Lost state. If the switch command is to change from the wide-area network interface to the local area network interface, the system must first enable the local area network interface and disable the wide-area network interface. At this point, the system cannot enter the Connection Lost state, because this would change the enable/disabled state of the network interfaces again. Instead, the Connection Lost state is skipped and the Purge Routes state is entered directly. Then, once in the Acquire state using the local-area network interface, the system will either enter the At Home state (if the mobile node is attached to the home network) or eventually the Care-of Registered state (if the mobile node is attached to a foreign network).

At many different places in the state diagram 68 the mobile node attempts to detect if its home agent is present on the directly connected sub-networks. If a

home agent is detected (because the mobile node receives home agent advertisement messages), the mobile node immediately enters the At Home state. Once in the At Home state, the mobile node will remain there until it receives a command to switch to the wide area network interface, at which point it will enter the Connection Lost state.

A graphical user interface (GUI) may be provided with the present system in order to monitor the state of the mobile node, as shown in Fig. 11. The switching system GUI consists of a representation of the terrain map 32 and a display of state information. The terrain map is displayed in a grid having the desired dimensions, with the local area network transmitter defining the center of the local area network for the terrain map designated in black at the center of the grid. The height of the terrain may be indicated by colors on the map or other means such as topological elevation lines. The current coordinates of the mobile node, in this case a service truck, relative to the fixed reference, are displayed to the right of the map, and the mobile node's position is shown by the white square on the map. The GUI also displays information about which interface the mobile node is currently using (the LAN or WAN interface) and about the quality of the DGPS information (ON or OFF). Further information on the GUI shows that the mobile node (i.e., the service truck) is at a work area, with coordinates of (-68, -248, 0). Further, the mobile node is using its LAN interface and its DGPS equipment is functioning correctly.

Wireless Local Area Network

The present system requires a local area network in order to provide mobile nodes with the ability to communicate at high speeds to nearby fixed computers or other nearby mobile nodes. One such local area network is WaveLAN, which is a product developed by Lucent Technologies. The modular architecture of the present system can accommodate any local area network technology desired, however. The bandwidth of the local area network used with the present invention must be high enough to support such traffic as isochronous voice data, and burst, high volume traffic such as file transfer and image data. The local area network must also provide access to signal strength measurements for use in the switching system. This signal strength data is a measure of the received power of packets transmitted by another wireless host.
The local area network must also allow peer-to-peer communication.

Wireless Wide Area Network

Another important piece of the present network architecture is the wireless wide area network technology, as it provides communication coverage throughout the entire area operation and constitutes the default communication path for the different entities of the system. Any wide area network technology used with the present network architecture must provide certain capabilities in order to efficiently support the traffic characteristics of the present network architecture.

One capability is that the wireless wide area network should be chosen to provide coverage of the entire work site. Preferably, this coverage should not restrict the network to line-of-sight placement of transmitters. The network must also provide point-to-multipoint or broadcast capabilities. Further, support for packetized data is necessary in order to carry the IP traffic of the network. Additionally, although guaranteeing wide area coverage often compromises the ability to provide high bandwidth, a fair trade off is recommended since this feature will highly impact the performance of the overall system. An example of a suitable wide area network is the RFM96 Radio Modems, manufactured by Pacific Crest Corporation. The Pacific Crest are configured to transmit with a power of 2 watts, giving them enough range to completely cover a large area without line of sight placement of antennas. Another alternative for a wide area network is the use of low earth orbit satellites, which are currently under development.

Use With Ad Hoc Networking

In addition to the use of prediction and the RF propagation model with Mobile IP, the present invention can also be used in a similar fashion in ad hoc networks. An ad hoc network is a collection of wireless mobile hosts forming a temporary network without the aid of any established infrastructure or centralized administration. In such an environment, it may be necessary for one mobile host to enlist the air of other hosts in forwarding a packet to its

destination, due to the limited range of each mobile host's wireless transmissions.

Industrial Applicability

The present invention is applicable in situations where several entities, such as autonomous or semi-autonomous machines, and operators must coordinate actions to accomplish tasks as efficiently as possible. For example, a single site operations center may direct the effort of the machinery for an entire site, collecting information about the status of the machinery, and the status of the task to be accomplished. In addition, there is a need for communication between machines and operators to allow close cooperation between them. Information must also be communicated to service and maintenance personnel to alert them to problems that may slow down or halt performance of the machinery. The present invention accommodates a wide range of different types of messages including alert messages, network management messages to allow communication between nodes, detailed information about the location of all machinery and the current state of the task or tasks being performed, audio transmissions, diagnostic and service manual information, and image data to allow machines to cooperate with one another and to aid in the diagnosis of faults. The present invention provides the ability for machines to roam between different wireless network technologies using the Mobile IP protocol with Route Optimization, peer-to-peer communication, and an intelligent switching system.

Fig. 12 shows an example of components that are included at a work site 70, a service truck 72 for servicing the machinery at work site 70, and a site office 74. In this example, a service technician has the ability to take service laptop 76 from the network at site office 74 and attach it to the mobile network on the service truck 72 where it registers with mobile router 78. When a mobile node, such as excavator 80 begins operation, it sends a packet containing a status message to service truck 72. The packet originates from excavator 80 and is sent over wireless local area network 82 to router 84 at work site 70. The work site router 84 is implemented on a host computer system having data input/output capability and executing software to handle IP data packets, determine the destination address, and forward the packet over wireless wide area network 86 to the default home agent for excavator 80, which is router 88. Router 88 at site office 74 receives the packet, determines its destination address, and forwards the packet to local area network (LAN) 90. Before the packet is sent out over LAN 90, router 88 encapsulates the packet with the service laptop's 76 care-of address as the destination address, and forwards the packet over local area network 82.

Home agent router 88 determines the source of the original packet (the excavator 80) and sends a binding update to excavator 80, informing it of the current care-of address of service laptop 76, which is the mobile router's 78 address. Before the encapsulated packet can be sent out over the local area network 90 to

the service laptop's 76 foreign agent 78, the home agent router 88 intercepts the packet again. This time, the home agent encapsulates the packet with the mobile router's 78 care-of address as the destination address, and forwards the packet over the wide area network 86. The home agent again determines that the excavator 80 is the original source of the packet and sends a binding update to it, telling it the current care-of address of the mobile router 78. The router 84 at work site 70 receives the packet from the wide area network 86 and forwards the packet over wireless local area network 82. The mobile router 78 receives the packet from wireless local area network 82 and removes the first encapsulation. The mobile router 78 attempts to forward this inner packet to the correct location. The destination address of this inner packet is the mobile router's 78 own address, so it instead processes the inner packet itself by removing the inner encapsulation and forwarding the packet to service laptop 78.

The service laptop 76 receives the packet and replies to the excavator. The packet is first sent to the mobile router 78, since it is the service laptop's 76 default router. Using the wireless local area network's 82 peer-to-peer communication capabilities, the mobile router 78 forwards the packet directly to excavator 80 using wireless local area network 82.

The excavator 80 receives the packet. Excavator 80 also receives the two binding updates from the home agent 88. The excavator 80 uses the binding updates to add entries to its binding cache. Once the excavator has binding cache entries for the service

laptop 76 and the mobile router 78, it can send packets using Route Optimization until the binding cache entries expire. The excavator 80 first checks its binding cache, then the packet is encapsulated using the service laptop's 76 care-of address as the destination address, which is the mobile router's 78 address. The excavator 80 again finds an entry in its binding cache, this time for mobile router 78. The packet is encapsulated a second time using the mobile router's 78 care-of address as the destination address. The packet is then sent over the wireless local area network 82. Using the local area network's 82 peer-to-peer capabilities, the packet is delivered directly to the mobile router 78. Mobile router 78 receives the packet using wireless local area network 82 and removes the first encapsulation. The mobile router 78 attempts to forward this inner packet to the correct location. The destination address of this inner packet is the mobile router's 78 own address, so it instead processes the inner packet itself by removing the inner encapsulation and forwarding the packet to service laptop 76. Service laptop 76 receives the packet and replies to the excavator 89. The packet is first sent to the mobile router 78, since it is the service laptop's default router. Using the local area network's 82 peer-to-peer capabilities, the mobile router 78 forwards the packet directly to excavator 80 using wireless local area network 82. The excavator 80 receives the packet.

Since the excavator has binding updates for the service laptop 76 and the mobile router 78, the packets are no longer routed over the wide area network

86. This utilizes network resources efficiently and minimizes the use of the low speed wide area network. Note that in the foregoing example, the Route Optimization software on the excavator 80 must perform double encapsulation in order to send packets directly to the service laptop 76.

The example discussed above included only one work site, however, the present invention may be implemented to cover multiple work sites and multiple machines at each work site.

Other aspects, objects and advantages of the present invention can be obtained from a study of the drawings, the disclosure and the appended claims.

Claims

1. A method for communicating between a first communication node and a second communication node in an area having a plurality of communication nodes, the method comprising the steps of:

(a) generating, at selected time intervals, a propagation model of signals generated by selected communication nodes in the area based on an environmental map, the environmental map including the topography of terrain and structures in the area; and

(b) predicting quality of communication at a location at a future time based on the propagation model.

2. The method, as set forth in claim 1, further comprising the step of (c) predicting quality of communication at a future time based on a predicted location of the communication nodes as a function of the speed and direction of travel of the communication nodes.

3. The method, as set forth in claim 1, further comprising the step of (d) predicting quality of communication at a location at a future time based on the previous quality of communication at a predicted location of a communication node.

4. The method, as set forth in claim 1, further comprising the step of (e) selecting a means of

communication having the desired predicted quality of communication.

5. The method, as set forth in claim 1, further comprising the step of (c) predicting quality of communication at a future time based on a predicted location of the communication nodes as a function of the speed and direction of travel of the communication nodes, and (d) the previous quality of communication at a predicted location of a communication node.

6. The method, as set forth in claim 1, further comprising the steps of (c) predicting quality of communication at a future time based on a predicted location of the communication nodes as a function of the speed and direction of travel of the communication nodes, and (e) selecting a means of communication having the desired predicted quality of communication.

7. The method, as set forth in claim 1, further comprising the steps of (d) predicting quality of communication at a future time based on the previous quality of communication at a predicted location of a communication node, and (e) selecting a means of communication having the desired predicted quality of communication.

8. A method for communicating between a first communication node and a second communication node in an area having a plurality of communication nodes, the method comprising the steps of:

(a) generating, at selected time intervals, a propagation model of signals generated by selected communication nodes in the area based on an environmental map, the environmental map including the topography of terrain and structures in the area; and

(b) predicting quality of communication at a location at a future time based on the propagation model,

(c) a predicted location of the communication nodes as a function of the speed and direction of travel of the communication nodes, and

(d) the previous quality of communication at a predicted location of a communication node; and

(e) selecting a means of communication having the desired predicted quality of communication.

9. A method for communicating between a first communication node and a second communication node in an area having a plurality of communication nodes, the method comprising the steps of:

(a) generating, at selected time intervals, a propagation model of signals generated by selected communication nodes in the area based on an environmental map, the environmental map including the topography of terrain and structures in the area; and

(c) predicting quality of communication at a future time based on a predicted location of the communication nodes as a function of the speed and direction of travel of the communication nodes.

10. The method, as set forth in claim 9, further comprising the step of (d) predicting quality of communication at a future time based on the previous quality of communication at a predicted location of a communication node.

11. The method, as set forth in claim 9, further comprising the step of (e) selecting a means of communication having the desired predicted quality of communication.

12. The method, as set forth in claim 9, further comprising the steps of:

(c) predicting quality of communication at a future time based on a predicted location of the communication nodes as a function of the speed and direction of travel of the communication nodes, and

(d) the previous quality of communication at a predicted location of a communication node; and

(e) selecting a means of communication having the desired predicted quality of communication.

13. A method for communicating between a first communication node and a second communication node in an area having a plurality of communication nodes, the method comprising the steps of:

(a) generating, at selected time intervals, a propagation model of signals generated by selected communication nodes in the area based on an environmental map, the environmental map including the topography of terrain and structures in the area; and

(d) predicting quality of communication at a future time based on the previous quality of communication at a predicted location of a communication node.

14. The method, as set forth in claim 13, further comprising the step of

(e) selecting a means of communication having the desired predicted quality of communication based on the propagation model.

15. A method for communicating between a first communication node and a second communication node in an area having a plurality of communication nodes, the method comprising the steps of:

(a) generating, at selected time intervals, a propagation model of signals generated by selected communication nodes in the area based on an environmental map, the environmental map including the topography of terrain and structures in the area; and

(e) selecting a means of communication having the desired predicted quality of communication.

16. An apparatus for communicating between a first communication node and a second communication node in an area having a plurality of communication nodes, the apparatus comprising:

a data processor operable to continuously calculate a propagation model of signals generated by selected communication nodes in the area based on a continuously updated environmental map, the environmental map including the topography of terrain and structures in the area, and to predict the quality of communication at a location at a future time based on the propagation model.

17. The apparatus, as set forth in claim 16, wherein the data processor is further operable to predict quality of communication at a future time based on a predicted location of the communication nodes as a function of the speed and direction of travel of the communication nodes.

18. The apparatus, as set forth in claim 16, wherein the data processor is further operable to predict quality of communication at a location at a future time based on the previous quality of communication at a predicted location of a communication node.

19. The apparatus, as set forth in claim 16, wherein the data processor is further operable to select a means of communication having the desired predicted quality of communication.

20. The apparatus, as set forth in claim 16, wherein the data processor is further operable to predict quality of communication at a future time based on a predicted location of the communication nodes as a function of the speed and direction of travel of the communication nodes, and the previous quality of communication at a predicted location of a communication node.

21. The apparatus, as set forth in claim 16, wherein the data processor is further operable to predict quality of communication at a future time based on a predicted location of the communication nodes as a function of the speed and direction of travel of the communication nodes, and select a means of communication having the desired predicted quality of communication.

22. The apparatus, as set forth in claim 16, wherein the data processor is further operable to predict quality of communication at a future time based on the previous quality of communication at a predicted location of a communication node, and select a means of communication having the desired predicted quality of communication.

23. A method for communicating between a first communication node and a second communication node in an area having a plurality of communication nodes, the method comprising the steps of:

continuously generating a propagation model of signals generated by selected communication nodes in the

area based on an environmental map, the environmental map including the topography of terrain and structures in the area;

predicting quality of communication at a location at a future time based on the propagation model, a predicted location of the communication nodes as a function of the speed and direction of travel of communication at a predicted location of a communication node; and

selecting a path of communication among the communication nodes having the best available predicted quality of communication.

24. The method as set forth in claim 23, further comprising the step of:

(f) modifying a packet of data being communicated from a first communication node to a second communication node to indicate the selected path of communication.

25. The method, as set forth in claim 23, wherein one communication node is a wide area network, and another communication node is a local area network.

26. A method for communicating between a first communication node and a second communication node in an area having a plurality of communication nodes, the method comprising the steps of:

continuously calculate a propagation model of signals generated by selected communication nodes in the area based on a continuously updated environmental map,

the environmental map including the topography of terrain and structures in the area; and

predicting the quality of communication at a location at a future time based on the propagation model.

27. An apparatus for communicating between a first communication node and a second communication node in an area having a plurality of communication nodes, the apparatus comprising a data processor operable to continuously generate a propagation model of signals generated by selected communication nodes in the area based on an environmental map, the environmental map including the topography of terrain and structures in the area, to predict the quality of communication at a location at a future time based on the propagation model, a predicted location of the communication nodes as a function of the speed and direction of travel of communication at a predicted location of a communication node, to select a path of communication among the communication nodes having the best available predicted quality of communication, and to modify a packet of data being communicated from a first communication node to a second communication node to indicate the selected path of communication.

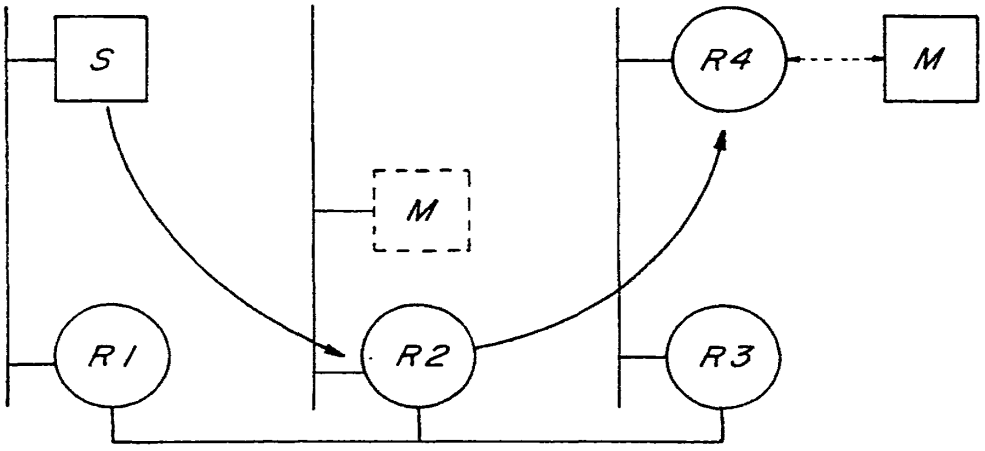


Fig. 1

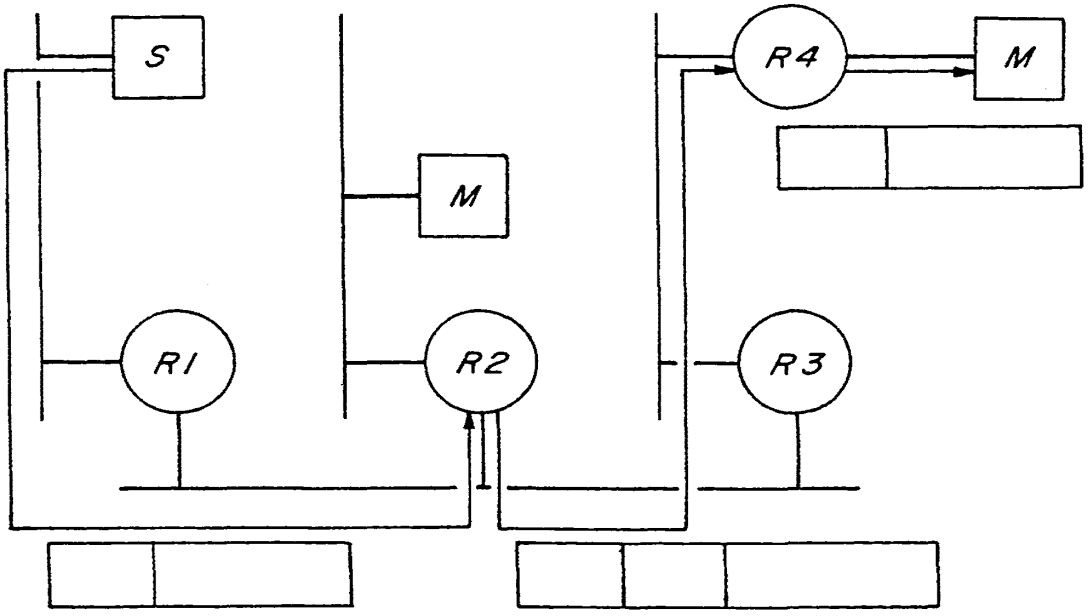


Fig. 2

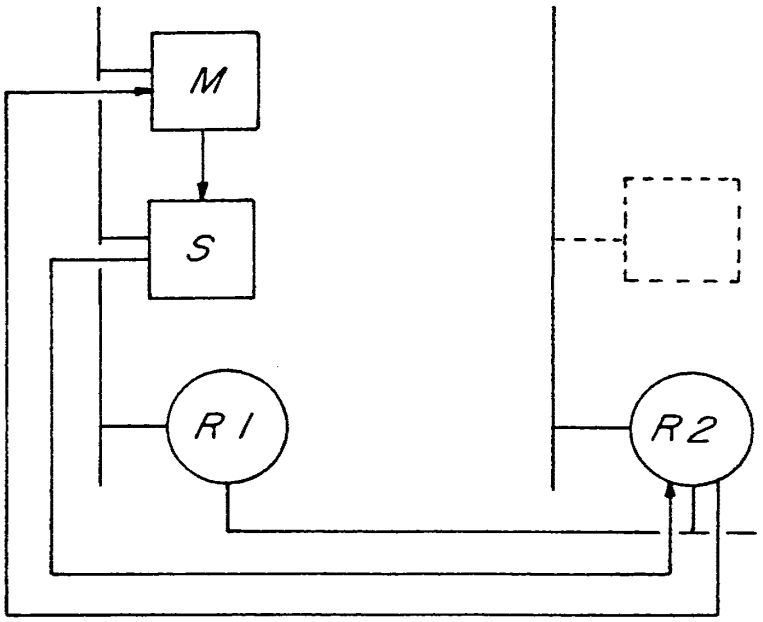


Fig. 3

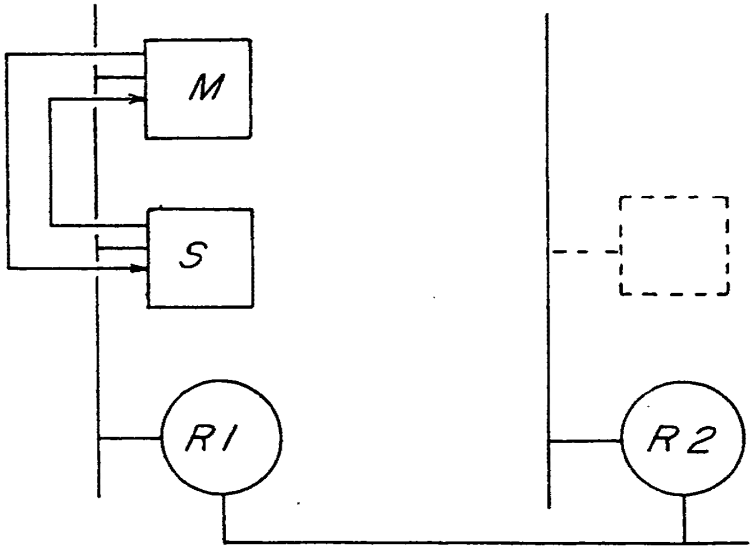


Fig. 4

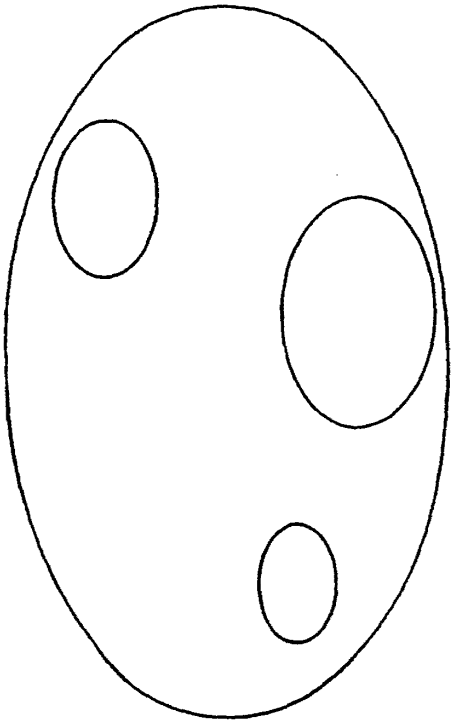


Fig. 5

BNSDOCID: <WO___9959363A1_I_>

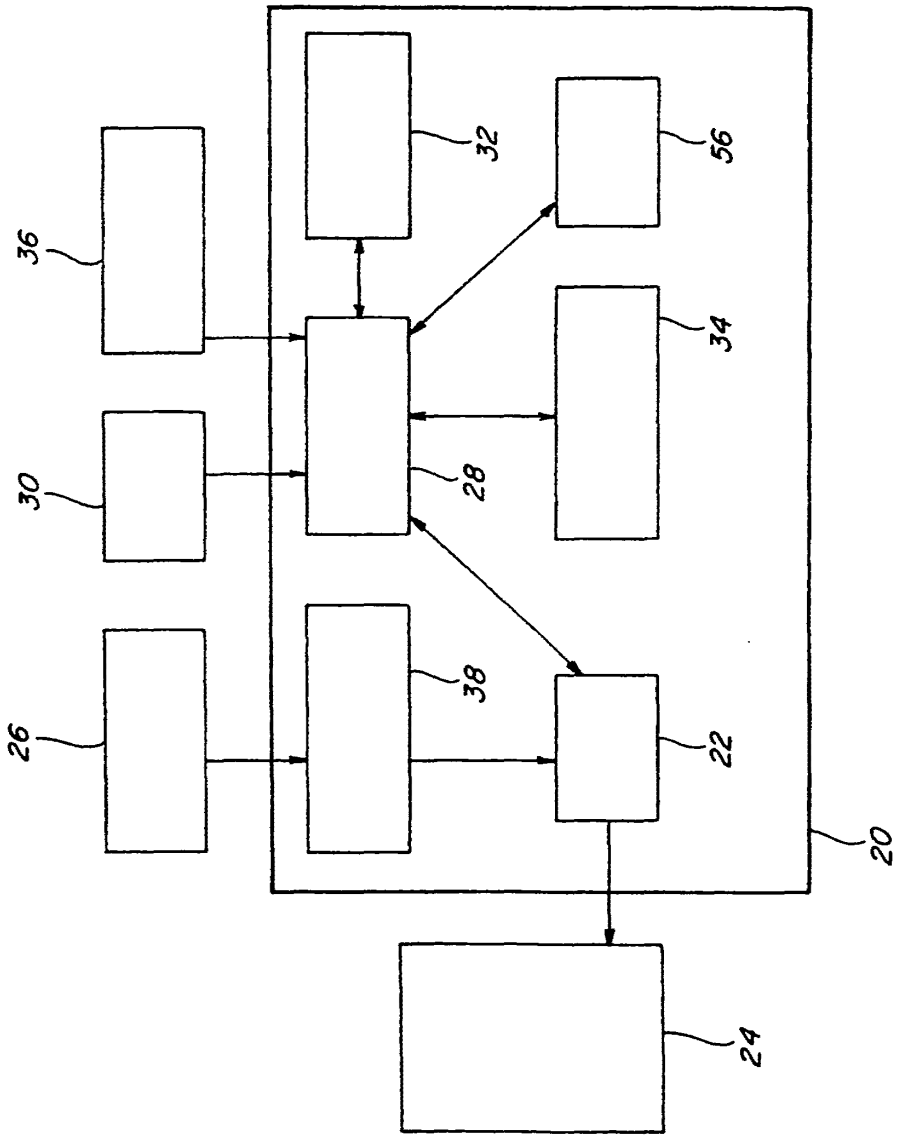


Fig. 6

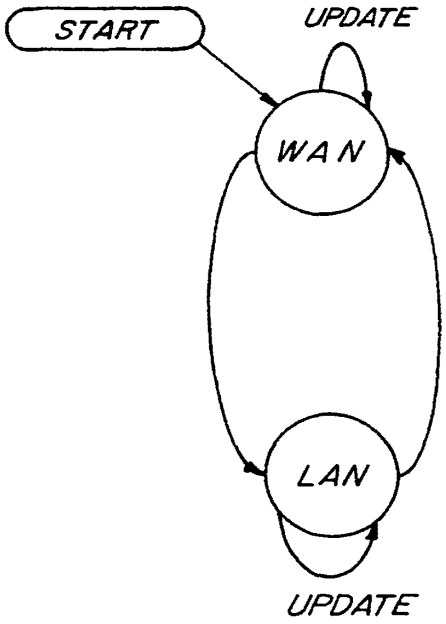


Fig. 7

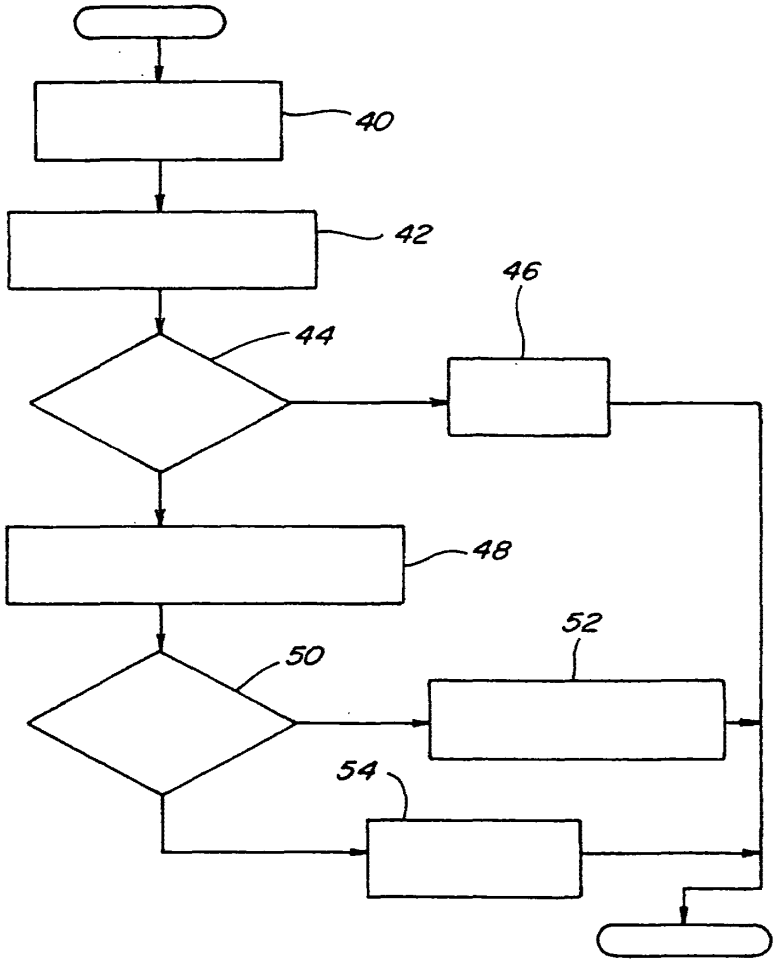


Fig. 8

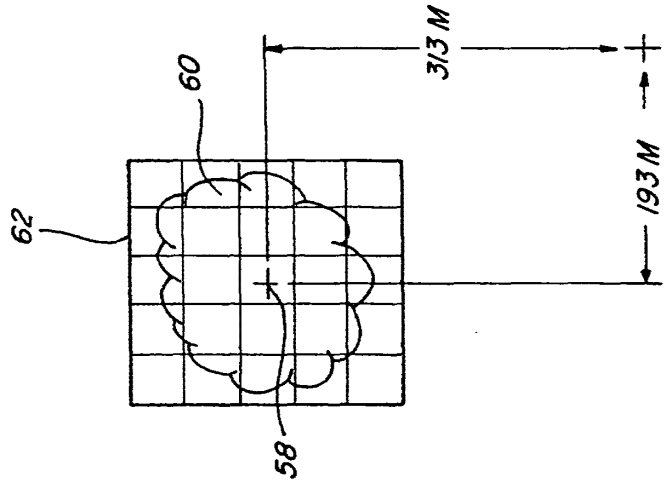


Fig. 9

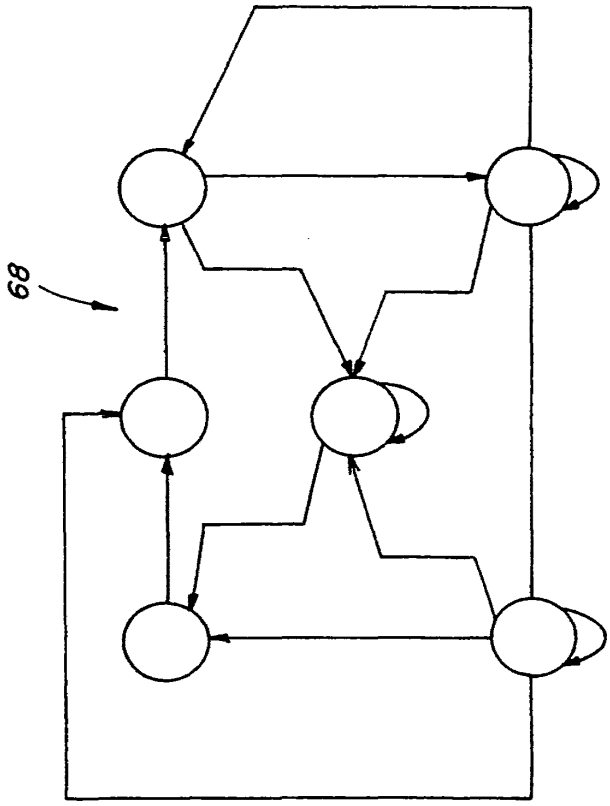


Fig. 10

BNSDOCID: <WO___9959363A1_I_>

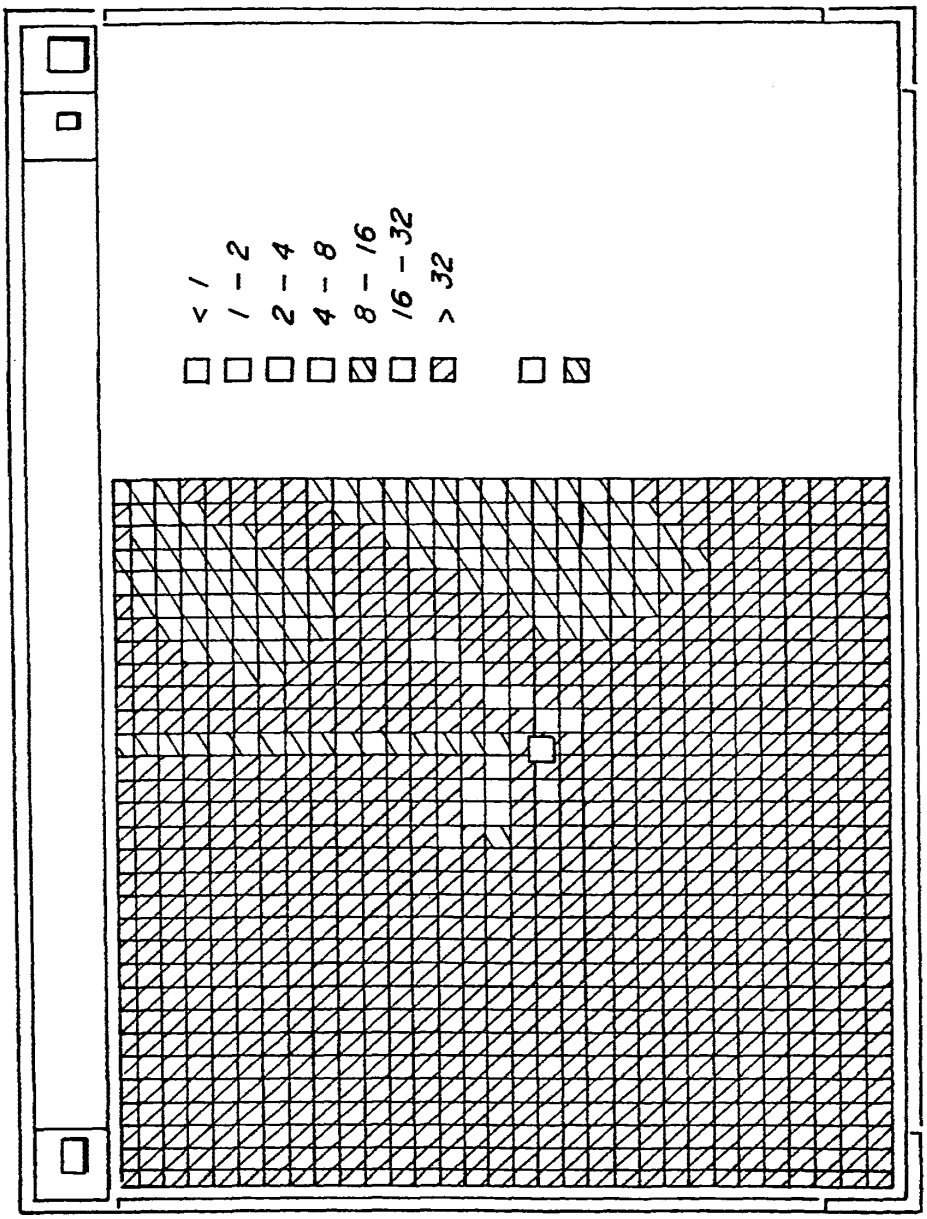


Fig. 11

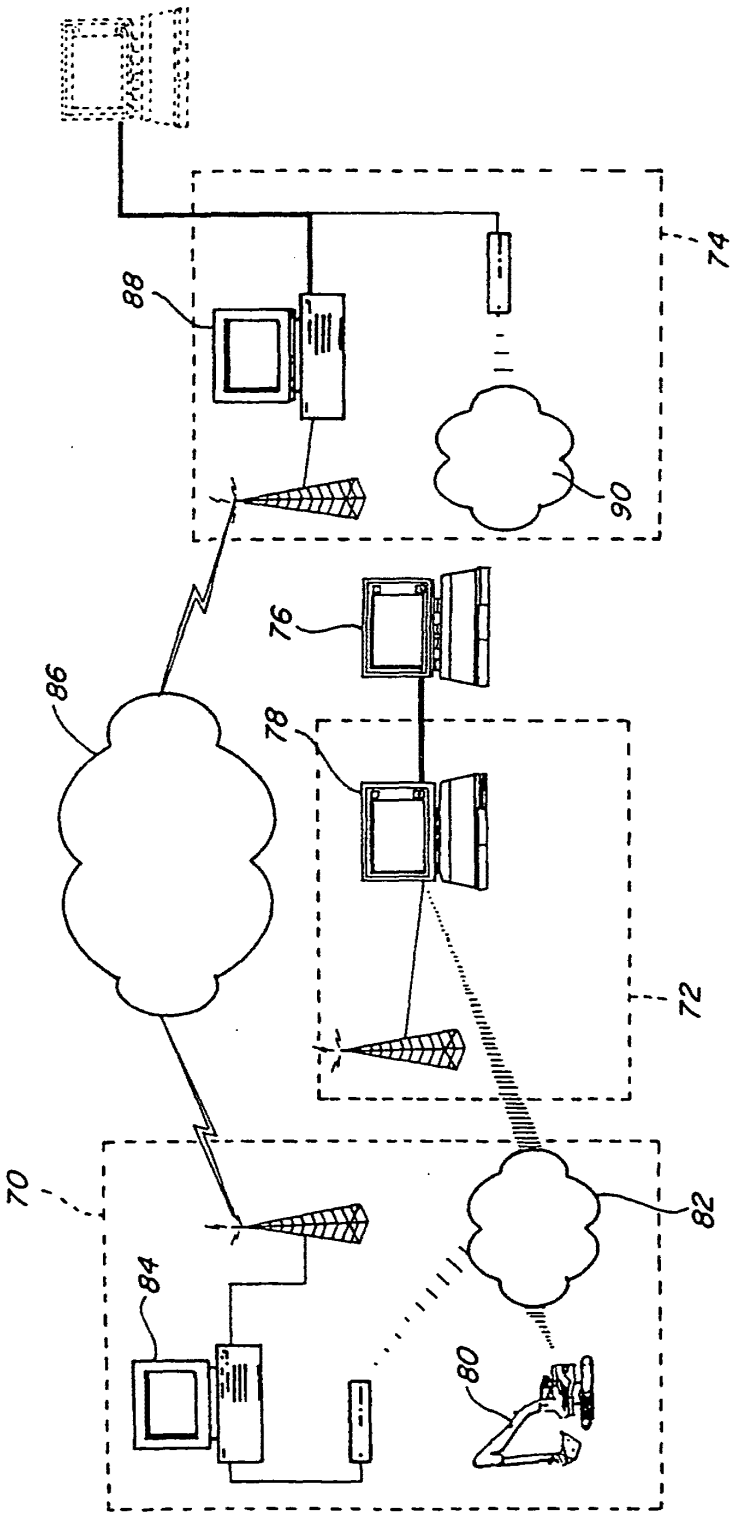


Fig. 12

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 99/10231

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04Q7/36

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04Q

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	JUNIUS M: ""INTELLIGENTES" RADIO RESOURCE MANAGEMENT MUSTERERKENNUNG MIT GSM -FUNKMESSDATEN UND ANWENDUNG" ITG-FACHBERICHTE, vol. 124, 27 September 1993 (1993-09-27), pages 487-501, XP002006361 ISSN: 0932-6022 page 490, line 8 -page 494, line 7 page 499, line 18 -page 500, line 24 figures 1-3	1-27
A	US 5 561 841 A (NOKIA TELECOMMUNICATION OY) 1 October 1996 (1996-10-01)	
A	WO 96 13951 A (ERICSSON TELEFON AB L M) 9 May 1996 (1996-05-09)	

☐ 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)

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

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

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

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

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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
11 October 1999	15/10/1999

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

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

INTERNATIONAL SEARCH REPORT

ormation on patent family members

International Application No
PCT/US 99/10231

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5561841 A	01-10-1996	FI 920291 A	24-07-1993
		AU 670424 B	18-07-1996
		AU 3354493 A	01-09-1993
		EP 0623272 A	09-11-1994
		WO 9315591 A	05-08-1993
		JP 7503345 T	06-04-1995
		NO 942760 A	23-09-1994
WO 9613951 A	09-05-1996	US 5572221 A	05-11-1996
		AU 694575 B	23-07-1998
		AU 3818995 A	23-05-1996
		CN 1170493 A	14-01-1998
		EP 0788720 A	13-08-1997
		FI 971778 A	26-06-1997
		JP 10513016 T	08-12-1998
		US 5825759 A	20-10-1998

Form PCT/ISA/210 (patent family annex) (July 1992)

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/718,007	11/21/2000	Xi Jiang	705835US1RAF	9318

7590 09/08/2003

Crowell & Moring LLP
Intellectual Property Group
PO Box 14300
Washington, DC 20044-2500

EXAMINER
D AGOSTA, STEPHEN M

ART UNIT	PAPER NUMBER
2683	

DATE MAILED: 09/08/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 07-01)

Office Action Summary	Application No.	Applicant(s)	
	09/718,007	JIANG, XI	
	Examiner	Art Unit	
	Stephen M. D'Agosta	2683	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-38 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-38 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 23.
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Specification

Applicant is reminded of the proper language and format for an abstract of the disclosure.

The abstract should be in narrative form and generally limited to ***a single paragraph on a separate sheet within the range of 50 to 150 words***. It is important that the abstract not exceed 150 words in length since the space provided for the abstract on the computer tape used by the printer is limited. The form and legal phraseology often used in patent claims, such as "means" and "said," should be avoided. The abstract should describe the disclosure sufficiently to assist readers in deciding whether there is a need for consulting the full patent text for details.

The language should be clear and concise and should not repeat information given in the title. It should avoid using phrases which can be implied, such as, "The disclosure concerns," "The disclosure defined by this invention," "The disclosure describes," etc.

Drawings

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: **All drawings are missing reference numbers** . A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

Claims 1-3, 6-7, 17, 21, 24 and 26 rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

a. **Claims 1, 3, 7, 17, 21, 24 and 26**: The specification teaches switching between a plurality of service providers, not "communication options". The examiner believes the term "service provider" would be a better description of what the system is

switching between since communication options can be interpreted as the actual type of communication being used, ie. voice, data, etc.. A re-write is required.

b. **Claims 2 and 6**: How can one of the plurality of "wireless" communication options not use any "wireless" communication (?). The examiner has interpreted this to mean the mobile can connect to a wired network. A re-write is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-2, 17-18, 21, 28-33 and 36-38 rejected under 35 U.S.C. 103(a) as being unpatentable over Liu US 5,825,759 and further in view of Jones US 6,363,323 or Bruggemann US 5,493,291 and Andersson et al. US 5,530,917 (hereafter Liu, Anderson and Jones or Bruggemann).

As per **claims 1, 17, 21, 28-29 and 38**, Liu teaches a method of selecting which of a plurality of wireless communication options will be used by a mobile device, comprising the step of selecting which wireless communication option to use based on a location of the mobile communication device on a route and the availability for use of each of the plurality of wireless communication options along the route (abstract).

But is silent on the route (eg. being known beforehand).

Jones teaches tracking a vehicle on a predetermined schedule/route based on GPS tracking and cellular system (abstract and figure 1) while **Bruggemann** teaches transponders suitable for a navigation system for motor vehicles in which a predetermined route, or desired destination, is stored in a navigation apparatus of each vehicle by means of an input device. In the respective transponders, in this case, directional information and/or street names, can be stored which are read by navigational apparatus of vehicles and compared with desired data (C5, L61-67 to C6, L1-2).

With further regard to claim 28, Liu teaches cellular networks which are known in the art to have cell base stations/towers near roadways and highways (Liu also discloses data connectivity to the Internet, figure 18, which can be via wireless LAN technology (IEEE 802.11) which provides high bandwidth and limited geographical coverage). Since Liu teaches mobile data networking and connectivity to the Internet (figure 18), the content provider would respond back to the mobile user via an appropriate base station for full duplex communication via the TCP/IP protocol.

With further regard to claim 29, Liu teaches a system that uses a predictive mobility algorithm to determine where a mobile user is likely to be (which reads on determining a predicted time when the vehicle will be able to communicate with an info-fueling station* having a known/predictable position) [abstract].

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that the route is known beforehand, to provide means for inputting the route a user is to take so the device can track progress and inform the user if they are off course.

With further regard to claim 38, Liu **is silent on** a movable base station.

Andersson teaches base stations can be fixed or mobile (C20, L61-65) as can be wireless LAN systems if mounted on a mobile object.

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that the info-fueling station/base station is movable, to provide means for the station to be moved/relocated as needed for optimal RF communications.

*the examiner interprets an "info-fueling station" as a generic server that is connected to a localized high-speed wireless network (such as an IEEE802.11 network).

As per **claim 2**, Liu teaches claim 1 wherein one of the networks is a wired network (figure 18 and 19 show connectivity to wired networks, eg. Internet and LANs/WANs/MANs).

As per **claim 17**, Liu teaches a method of storing data in a database that is indicative of coverage areas for wireless communication options along a route that a mobile communication device is traversing, comprising the steps of:

a) storing boundary locations of the coverage areas for the wireless communication options along the route in the database

b) periodically obtaining updated information concerning the coverage areas of the wireless options as the mobile device traverses the route (abstract).

but is silent on

c) updating the database with updated information AND where the boundary locations are boundary locations on streets of the route

Jones teaches the storage device (eg. database) includes historical travel data pertaining to the vehicle schedule along the route. The historical travel data comprises a plurality of predetermined location values corresponding respectively with a plurality of locations along a predetermined route of travel of the mobile vehicle (C3, L7-32).

Bruggemann teaches described transponders can be set in the roadway pavement for a navigation system for motor vehicles in which a predetermined route, or

desired destination, is stored in a navigation apparatus of each vehicle by means of an input device. In the respective transponders, in this case, directional information and/or **street names**, can be stored which are read by navigational apparatus of vehicles passing over and compared with desired data (C5, L61-67 to C6, L1-2).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that the database is updated with boundary/street locations, to provide means for the user to know when they are approaching a boundary/handoff and the street name associated with said boundary.

As per **claim 18**, Liu teaches claim 17 wherein the step of updating includes determining whether the updated information is for a present location,

a) if the updated information is for a present location, then storing the updated information

b) if the updated information is for a present location, comparing the updated information updating the stored information if updated information is different from the stored information (abstract and C2, L11-43 teaches knowledge of multiple networks).

But is silent on a database.

Jones teaches the storage device (eg. database) includes historical travel data pertaining to the vehicle schedule along the route. The historical travel data comprises a plurality of predetermined location values corresponding respectively with a plurality of locations along a predetermined route of travel of the mobile vehicle. The predetermined location values are respectively associated with time values stored in the storage device. The processor uses one of the plurality of predetermined location values (along with its associated time value), a current time, and a current location value received from the sensor to determine whether the vehicle is off schedule. If the vehicle is off schedule by at least a predefined amount, the processor causes the communications device to transmit a message to a remote computer, associated with a tracking system or an advance notification system, indicating that the vehicle is off schedule by a specified time and/or distance (C3, L7-32).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that a database is used, to provide means to store all pertinent route/option data in a commercial database software package.

As per **claim 30**, Liu teaches claim 29 **but is silent on** wherein said info-fueling station has a fixed position relative to vehicles.

Bruggemann teaches roadway transponders that can allow the vehicle to determine it's location and the location of fixed objects (eg. traffic speed sign of figure 2, a transponder is built into a roadway pavement near a speed limit traffic sign. Information corresponding to that of the traffic sign 17 is stored in the memory 8 of the transponder 1. If a vehicle 13 with a coil antenna 14 drives over the transponder 1 then energy is transferred to the transponder 1 via the coil antenna 14 so that it, the transponder, is activated and sends out its stored, or memorized, information as a digital code signal. This energy transfer can be caused by a changing magnetic field at the transponder. The transponder information is received by the coil antenna 14 so that,

via the read-out device 4 and the analyzing circuit 15, the information of the traffic sign 17 is shown on the indicating device) [C3, L50-67 to C4, L1-2].

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that an info-fueling station has a fixed position, to provide means for the station to always be at a known, fixed location the user can roam to for data.

As per **claim 31**, Liu teaches claim 29, **but is silent on** an information request identifies said info-fueling station.

Liu does teach a predictive mobility algorithm that can determine where the mobile is likely to be.

Bruggemann teaches roadway transponders that can provide pinpoint accuracy as to the location of the user [C3, L50-67 to C4, L1-2]. While Bruggemann teaches a passive transponder that must be driven over, one skilled in the art would also use an information request and/or a GPS query for location information).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that an information request is used to identify the info-fueling station, to provide means for manual (and/or automatic) determination of a station.

As per **claim 32**, Liu teaches claim 29, **but is silent on** the wireless network identifies said info-fueling station.

Liu does teach a predictive mobility algorithm that can determine where the mobile is likely to be.

Bruggemann teaches roadway transponders that can provide pinpoint accuracy as to the location of the user AND fixed objects such as traffic speed signs, etc. and one skilled in the art would also provide means for identifying any other object (eg. info-fueling station) [C3, L50-67 to C4, L1-2].

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that the wireless network identifies the info-fueling station, to provide manual (or automatic) determination of the location/identity of said info-fueling station via the wireless network.

As per **claim 33**, Liu teaches claim 29, **but is silent on** the wireless device being coupled to an on-board communication network in said vehicle.

Bruggemann teaches an on-board communication network/system in a vehicle (abstract and figure 2).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that the wireless device is onboard a vehicle, to provide a system for use within a car/vehicle.

As per **claim 36**, Liu teaches claim 29 **but is silent on** a movable info-fueling station.

Andersson teaches base stations can be fixed or mobile (C20, L61-65) as can be wireless LAN systems if mounted on a mobile object.

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that the info-fueling station is movable, to provide means for the station to be moved/relocated as needed for optimal RF communications.

As per **claim 37**, Liu teaches claim 36 **but is silent on** moving each mobile info-fueling station to a location to optimize performance of info-fueling communication.

Liu teaches a cellular network which is known in the art as a RF network comprised of many base stations that are planned and tested for optimized performance and low co-interference. One skilled in the art would locate any RF device in a position such that it's performance is optimized for communication with users.

The examiner takes Official Notice that cellular service providers have engineers that work to determine optimal positions for RF cell sites.

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that each fueling station is moved to a location for optimal performance, to provide interference-free communication to users.

Claims 3-11 and 14 rejected under 35 U.S.C. 103(a) as being unpatentable over Liu, Jones and Bruggemann and further in view of Lyons US 6,282,412 (hereafter Lyons).

As per **claims 3 and 7**, Liu teaches a mobile device with method for selecting which in a plurality of wireless communication options will be used by the mobile device comprising the steps of:

c. determining where on the route the mobile device is as it traverses the route (abstract)

d. determining whether to switch from a first one of the wireless communication options presently being used to a second one when the device approaches a boundary of a coverage area (abstract)

e. switching from the first wireless option to a second one when the mobile crosses the boundary if the determination was made to switch to the second option (abstract).

But is silent on

a. storing in the mobile device route information that is indicative of the route that the mobile will be traversing

b. storing in the mobile information indicative of coverage areas for each of the plurality of wireless options along the route the mobile will traverse.

Liu does teach the system having knowledge of the coverage areas the mobile is near (C1, L58-67 to C2, L10). **Lyons** teachs a receiver with memory card to store information concerning a determined number of broadcast stations that serve at least a portion of a user-designated geographic area, and which have a program style that suits a designated user preference. Information corresponding to each station's operating or carrier frequency and an associated service coverage area, is stored by the card (C2, L33-44).

Jones teaches tracking a vehicle on a predetermined schedule/route based on GPS tracking and cellular system (abstract and figure 1) while **Bruggemann** teaches transponders suitable for a navigation system for motor vehicles in which a predetermined route, or desired destination, is stored in a navigation apparatus of each vehicle by means of an input device. In the respective transponders, in this case, directional information and/or street names, can be stored which are read by navigational apparatus of vehicles and compared with desired data C5, L61-67 to C6, L1-2).

With regard to claim 7, Liu teaches knowledge of network services and resources (eg. coverage areas) the mobile user is near or moving toward (abstract) **but is silent on** a database. **Jones** teaches the storage device (eg. database) includes historical travel data pertaining to the vehicle schedule along the route. The historical travel data comprises a plurality of predetermined location values corresponding respectively with a plurality of locations along a predetermined route of travel of the mobile vehicle. The predetermined location values are respectively associated with time values stored in the storage device. The processor uses one of the plurality of predetermined location values (along with its associated time value), a current time, and a current location value received from the sensor to determine whether the vehicle is off schedule. If the vehicle is off schedule by at least a predefined amount, the processor causes the communications device to transmit a message to a remote computer, associated with a tracking system or an advance notification system, indicating that the vehicle is off schedule by a specified time and/or distance (C3, L7-32).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that route/coverage data is stored in the mobile AND a database is used, to provide means for storing all possible data regarding route/coverage information for a trip route.

As per **claim 4**, Liu teaches a plurality of wireless networks (C2, L11-35 teaches service outside a service area, eg. other network).

As per **claim 5**, Liu teaches at least one of the wireless networks having a plurality of service levels (figures 20-23, 25a/25b).

As per **claim 6**, Liu teaches claim 2 wherein one of the networks is a wired network (figure 18 and 19 show connectivity to wired networks, eg. Internet and LANs/WANs/MANs).

As per **claim 8**, Liu teaches claim 7 and a "soft data structure handover" (abstract) which reads on the claimed limitation (connection to second system before dropping connection to first system).

As per **claim 9**, Liu teaches claim 7 **but is silent on** wherein the database stores coverage areas options along the route traversed includes storing boundary locations of the coverage areas where boundary locations stored are limited to boundary locations that are on streets of the route.

Bruggemann teaches described transponders can be set in the roadway pavement for a navigation system for motor vehicles in which a predetermined route, or desired destination, is stored in a navigation apparatus of each vehicle by means of an input device. In the respective transponders, in this case, directional information and/or **street names**, can be stored which are read by navigational apparatus of vehicles passing over and compared with desired data (C5, L61-67 to C6, L1-2).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that the database stores data includes boundary locations/streets, to provide means for knowing when a handoff may occur in regard to an actual street location.

As per **claim 10**, Liu teaches claim 9 **but is silent on** further including obtaining updated information concerning the coverage areas of the wireless communication options and updating the database with updated information.

Liu teaches a cellular system which inherently is aware of it's own coverage areas/cells.

Bruggemann teaches transponders that are set in pavement for vehicle navigation (Cxx, Lxx). One skilled in the art knows that as new pavement transponders are added to new pavement locations, the system will receive this new data and update it's database.

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that updated data can be received and stored, to provide means for newly received data to be stored in the device/system as the user roams.

As per **claim 11**, Liu teaches claim 10 obtaining updated information concerning the coverage areas of the wireless options includes obtaining this information from providers of the wireless options (abstract - Liu teaches cellular systems which are inherently aware of their coverage areas/cells).

Claims 12-14 rejected under 35 U.S.C. 103(a) as being unpatentable over Liu, Jones, Bruggemann and Lyons and further in view of Bottomley US 6,473,602 (hereafter Bottomley).

As per **claim 12**, Liu teaches claim 10 **but is silent on** wherein the step of obtaining updated information includes monitoring signal strengths of the wireless options as it passes through the coverage areas for the wireless options and developing updated information concerning coverage areas for the wireless options based on the monitored signal strengths of the wireless options.

Bottomley teaches measuring signal strength for determining a hand-off condition which can be used on several access technologies/systems (ie. FDMA, TDMA and CDMA) [title and abstract].

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that signal strength is monitored, to provide means for handing off when one system's strength begins to fade and another system's strength increases.

As per **claims 13 and 14**, Liu teaches claim 12 wherein the step of updating includes determining whether the updated information is for a present location,

a) if the updated information is for a present location, then storing the updated information

b) if the updated information is for a present location, comparing the updated information updating the stored information if updated information is different from the stored information (abstract and C2, L11-43 teaches knowledge of multiple networks).

But is silent on a database.

Jones teaches the storage device (eg. database) includes historical travel data pertaining to the vehicle schedule along the route. The historical travel data comprises a plurality of predetermined location values corresponding respectively with a plurality of locations along a predetermined route of travel of the mobile vehicle. The predetermined location values are respectively associated with time values stored in the storage device. The processor uses one of the plurality of predetermined location values (along with its associated time value), a current time, and a current location value received from the sensor to determine whether the vehicle is off schedule. If the vehicle is off schedule by at least a predefined amount, the processor causes the communications device to transmit a message to a remote computer, associated with a tracking system or an advance notification system, indicating that the vehicle is off schedule by a specified time and/or distance (C3, L7-32).

With regard to claim 14, the examiner interprets primary functions of a database as providing the ability to 1) store data, 2) can be searched to see if new data to be stored exists or not, 3) update previously stored data with new data. Hence, Jones' storage device/database reads on claim 14 (also ref. commercially available database software such as Microsoft Access/SQLServer, IBM DB-2, Oracle, etc.).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that a database is used and can store/update database entries as new data is received, to provide means for data to be stored in a commercially available software database and be manipulated as needed by the user/system.

Claims 15 and 19 rejected under 35 U.S.C. 103(a) as being unpatentable over Liu, Jones and Bruggemann and further in view of Wieczorek et al. US 6,125,278 (hereafter Wieczorek).

As per **claim 15**, Liu teaches claim 14 **but is silent on** updating stored information comprises shifting the stored information toward the updated information by a parameter and replacing stored information with the shifted stored information.

Wieczorek teaches a system that stores and uses the unit's location history which reads on the claimed limitation (eg. present data is replaced with newer data and present data is moved to different storage location).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that new data is stored and previous data is moved/stored, to keep the most current data in memory while maintaining a historical record as well.

As per **claim 19**, Liu teaches claim 18 **but is silent on** updating stored information comprises shifting the stored information toward the updated information by a parameter and replacing stored information with the shifted stored information.

Wieczorek teaches a system that stores and uses the unit's location history which reads on the claimed limitation (eg. present data is replaced with newer data and present data is moved to different storage location).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that new data is stored and previous data is moved/stored, to keep the most current data in memory while maintaining a historical record as well.

Claims 16 and 20 rejected under 35 U.S.C. 103(a) as being unpatentable over Liu, Jones and Bruggemann and further in view of Lee IEEE paper (hereafter Lee).

As per **claim 16**, Liu teaches claim 15 **but is silent on** the step of updating the stored information doing so with a running average method wherein the stored information is the running average of initial information and subsequent update information.

Lee teaches wireless communications and the use of a running average that uses data both from the past (known) and future (unknown) as well as calculations for weighting the data (page 753, abstract and Paragraph 1 to Paragraph 2).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that a running average is used, to provide means for properly calculating/measuring signal strength in a mobile system.

As per **claim 20**, Liu teaches claim 18 **but is silent on** the step of updating the stored information doing so with a running average method wherein the stored information is the running average of initial information and subsequent update information.

Lee teaches wireless communications and the use of a running average that uses data both from the past (known) and future (unknown) as well as calculations for weighting the data (page 753, abstract and Paragraph 1 to Paragraph 2).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that a running average is used, to provide means for properly calculating/measuring signal strength in a mobile system.

Claims 22-23 rejected under 35 U.S.C. 103(a) as being unpatentable over Liu, Jones, Bruggemann and Andersson and further in view of Mueller et al. US 6,185,413 (hereafter Mueller).

As per **claim 22**, Liu teaches claim 21 **but is silent on** determining cost of each wireless system.

Mueller teaches a mobile station with memory device in which a number of available applications are stored which can relate to different "carriers," i.e., mobile radio network systems or service providers within a single mobile radio network. A selection device of the mobile station calculates expected charges for a desired connection for each of these applications which are being considered for the transmission connection. Based upon the calculations, the most cost-efficient application for the desired transmission is selected. The actual transmission of the communication data for the base station is then carried out on the basis of this application (Abstract).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that cost is determined for each system, to provide means for the user to know the cost associated with each system it can connect with.

As per **claim 23**, Liu teaches claim 21 and determining which wireless system to use includes making the decision based upon performance level of each wireless system (figures 15-17 teach latency reduction, performance gain relating to mobility density).

But is silent on cost.

Mueller teaches a mobile station with memory device in which a number of available applications are stored which can relate to different "carriers," i.e., mobile radio network systems or service providers within a single mobile radio network. A selection device of the mobile station calculates expected charges for a desired connection for each of these applications which are being considered for the transmission connection. Based upon the calculations, the most cost-efficient application for the desired transmission is selected. The actual transmission of the communication data for the base station is then carried out on the basis of this application (Abstract).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that cost is determined, to provide means for the user to know the cost associated with each system it can connect with.

Claims 24-27 rejected under 35 U.S.C. 103(a) as being unpatentable over Liu in view of Mueller and Wieczorek.

As per **claims 24 and 26**, Liu teaches a method of providing a uniform content access layer application program interface for application programs that use mobile communications provided by a mobile device (abstract and figures 18-25b) **but is silent on** comprising the steps of:

a) providing a database accessible by the application program

b) storing in the database information concerning wireless options that are available for use by the mobile communication device as it traverses a route

c) the application program deciding its requirements for data transfer via wireless communication based on the information about wireless communications stored in the database.

Mueller teaches a mobile station having a number of applications that chooses a wireless network based on least cost and a database (abstract and figure 1, #18). **Wieczorek** teaches a method for optimizing resource allocation that chooses a wireless network based on loading conditions/data transfer capability (abstract). One skilled in the art would provide for Mueller's program to also decide based on system loading.

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that an application program can access a database and decide requirements for communication, to provide means for the application to determine which network(s) can provide the optimal data transfer.

As per **claims 25 and 27**, Liu teaches claim 24 wherein the information about the wireless options stored in the database includes information concerning performance (figure 15-17) **but is silent on** cost.

Mueller teaches a mobile station having a number of applications that chooses a wireless network based on least cost (abstract).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that cost is determined, to provide means for the user to know the cost associated with each system it can connect with.

Claim 34 rejected under 35 U.S.C. 103(a) as being unpatentable over Liu, Jones, Bruggemann and Andersson and further in view of Bottomley.

As per **claim 34**, Liu teaches claim 29 and the ability to pre-arrange for communications when a mobile user roams freely (abstract) which reads on the entire claim except for the fact of **being silent on** signal strength.

Bottomley teaches measuring signal strength for determining a hand-off condition which can be used on several access technologies/systems (ie. FDMA, TDMA and CDMA) [title and abstract].

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that signal strength is used, to provide means of knowing when a handoff will occur based on signal strength.

Claim 35 rejected under 35 U.S.C. 103(a) as being unpatentable over Lie, Jones, Bruggemann and Andersson and further in view of Baker US 6,505,046 (hereafter Baker).

As per **claim 35**, Liu teaches claim 29 **but is silent on** the wireless network routes previously stored requests for information to said vehicle through said info-fueling station.

Baker teaches a short message service center is a specialized computer system that accepts short message requests from various network entities. The message requests are stored and forwarded to various subscribers when they become available in the network (i.e., they turn their phone on) [C6, L56-61].

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that previously stored requests are routed, to provide means for storing (and not deleting) requests that cannot be delivered.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

1. Marlevi et al. US 5,572,221 teaches detecting/predicting motion of mobile.
2. Walgers et al. US 6,298,302 teaches optimal route from traffic messages.
3. Bahl et al. US 6,385,454 teaches resource management in cell network.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Stephen M. D'Agosta whose telephone number is 703-306-5426. The examiner can normally be reached on M-F, 8am to 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bill Trost can be reached on 703-308-5318. The fax phone numbers for the organization where this application or proceeding is assigned are 703-746-7493 for regular communications and 703-746-7493 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist on 703-306-0377.

SMD
8-26-03

WILLIAM TROST
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600

Notice of References Cited	Application/Control No. 09/718,007	Applicant(s)/Patent Under Reexamination JIANG, XI	
	Examiner Stephen M. D'Agosta	Art Unit 2683	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-5,825,759	10-1998	Liu, George	370/331
	B	US-6,363,323	03-2002	Jones, Martin Kelly	701/213
	C	US-5,493,291	02-1996	Bruggemann, Ulrich	340/905
	D	US-5,530,917	06-1996	Andersson et al.	455/436
	E	US-6,282,412	08-2001	Lyons, Francis R. X.	455/186.1
	F	US-6,185,413	02-2001	Mueller et al.	455/405
	G	US-6,473,602	10-2002	Bottomley, Gregory E.	455/226.1
	H	US-5,572,221	11-1996	Marlevi et al.	342/452
	I	US-6,385,454	05-2002	Bahl et al.	455/450
	J	US-6,298,302	10-2001	Walgers et al.	701/209
	K	US-6,505,046	01-2003	Baker, Steven F.	455/456.3
*	L	US-6,125,278	09-2000	Wieczorek et al.	455/437
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
*	U	Dr. William Lee, "The Proper Statistical Nature of Measuring and Estimating" Airtouch Communications, 1999, pages 753-756
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

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Form PTO-1449 U.S. Department of Commerce Patent & Trademark Office	Atty. Docket No. 1844/50414MI	Serial No. 09/718,007
	Applicant Xi JIANG	
INFORMATION DISCLOSURE STATEMENT *(Use several sheets if necessary)*	Filing Date November 21, 2000	Group

U.S. PATENT DOCUMENTS

Examiner Initial		Document Number	Date	Name	Class	Sub-Class	Filing Date (if appropriate)
	AA						
	AB						
	AC						
	AD						
	AE						
	AF						
	AG						
	AH						
	AI						
	AJ						

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FOREIGN PATENT DOCUMENTS

		Document	Date	Country	Class	Sub-class	Translation Yes | No
	AK						
	AL						
	AM						
	AN						
	AO						
	AP						

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

	AQ	*IEICE TRANS. COMMUN.*, Vol. E83-B, No. 8, August 2000 entitled "An Adaptive Radio Link Protocol for Efficient Packet Transmission in Infostation Systems" by Hua MAO et al., pp. 1-10
	AR	"Route Dependent Communication Planning for Vehicular Telematics Services" by Daniel Jiang et al., pp. 1-7, published May 2000
	AS	

EXAMINER	DATE CONSIDERED 5-10-03

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FORM PTO-1449 U.S. Department of Commerce Patent & Trademark Office	Attorney Docket No. 1844/50414MI	Serial No. 09/718,007
INFORMATION DISCLOSURE STATEMENT *(Use several sheets if necessary)*	Applicant: Xi JIANG	
	Filing Date November 21, 2000	Group

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U.S. PATENT DOCUMENTS

Examiner Initial		Document Number	Date	Name	Class	Sub-Class	Filing Date (if appropriate)
MP	AA	6125278	09/2000	Wieczorek, et al.			
MP	AB	5825759	10/1998	Liu			
	AC						
	AD						
	AE						
	AF						
	AG						
	AH						
	AI						
	AJ						

FOREIGN PATENT DOCUMENTS

Examiner Initial		Document Number	Date	Name	Class	Sub-Class	TRANSLATION Yes	TRANSLATION No
MP	AK	1085696	03/2001	Europe				
	AL	0199266	10/1986	Europe			Abstract	
	AM	99/59363	11/1999	WO				
	AN							
	AO							
	AP							

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, etc.)

MP	AQ	Dr. William LEE, "The Proper Statistical Nature of Measuring and Estimating" AirTouch Communications, 1999, pages 753-756
	AR	
	AS	

EXAMINER [signature] DATE CONSIDERED 5-10-03

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: XI JIANG

Serial No.: 09/718,007

Filed: NOVEMBER 21, 2000

Title: ROUTE-BASED COMMUNICATION PLANNING ARCHITECTURE AND METHOD FOR WIRELESS COMMUNICATION

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AMENDMENT

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Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

The following amendments and remarks are provided in response to the Office Action mailed September 8, 2003, for which the three-month due date is December 8, 2003.

IN THE ABSTRACT:

Please amend the Abstract as follows:

A method for selecting which of a plurality of wireless communication options will be used by a mobile communication device based on the location of the ~~mobile communication~~ device on a route, the route, and the availability ~~for use~~ of each of the ~~plurality of~~ wireless communication options along the route. Information indicative of coverage areas for the wireless communication options available along the route are stored in a database ~~by storing boundary locations of the coverage areas for the wireless communication options along the route where the boundary locations stored are boundary locations that are on streets of the route~~. In a further embodiment, selection of a wireless communications option may be based on the needs of ~~A method of providing a uniform content layer application program interface for~~ application programs that use ~~mobile communication provided by a~~ the mobile communication device ~~stores information concerning any wireless communication options that are available for use by the mobile communication device as it traverses a route is stored in a database. The application program decide which wireless communication option to use based upon the information about the wireless communication options in the database~~. In another embodiment, a request for information is sent from the vehicle to a wireless communications network, and the information is routed, based on ~~A method of fueling a vehicle with information through a wireless communication device determines~~ a predicted time when the vehicle will be able to communicate with an info-fueling station

~~having a predictable geographic position. A request for information from the vehicle is sent through the wireless communication device to at least one wireless communication network. The information is routed from an information source in communication with the wireless communication network~~, to the info-fueling station and downloaded to the vehicle.

IN THE DRAWINGS

Examiner approval of the red-ink amendments to the attached drawings is respectfully requested.

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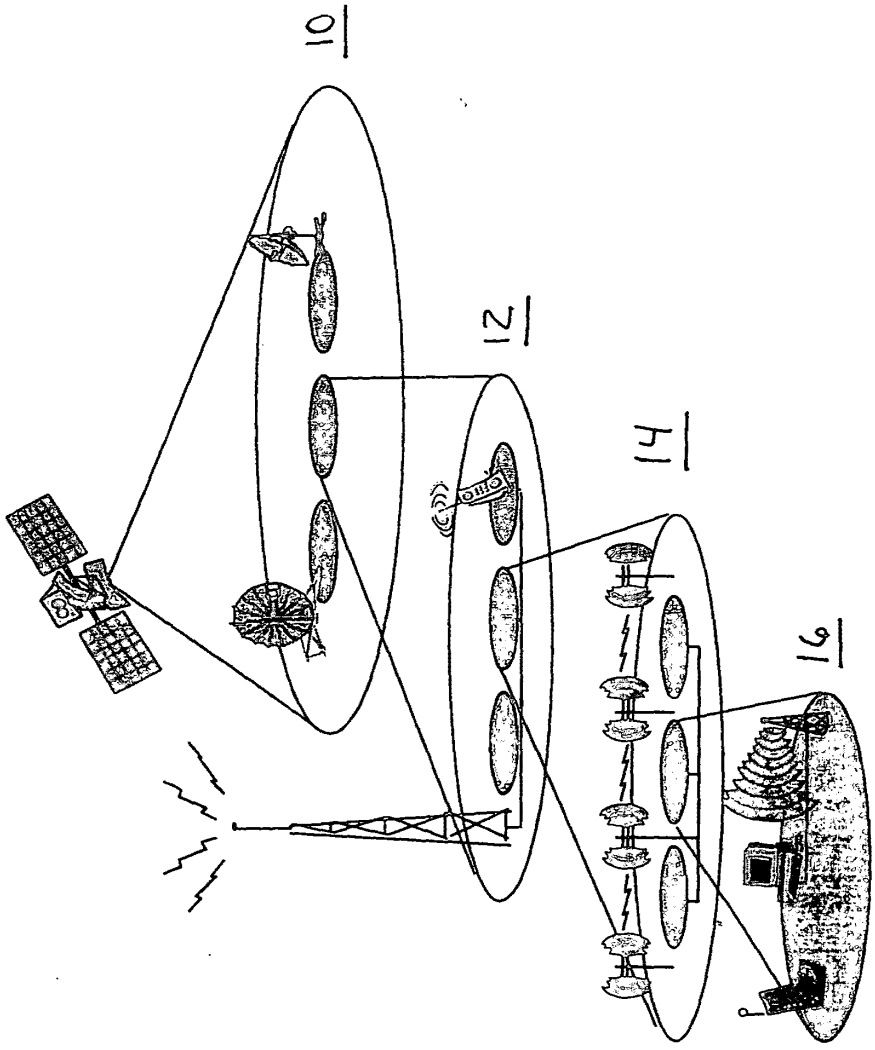


FIG. 1
(Prior Art)

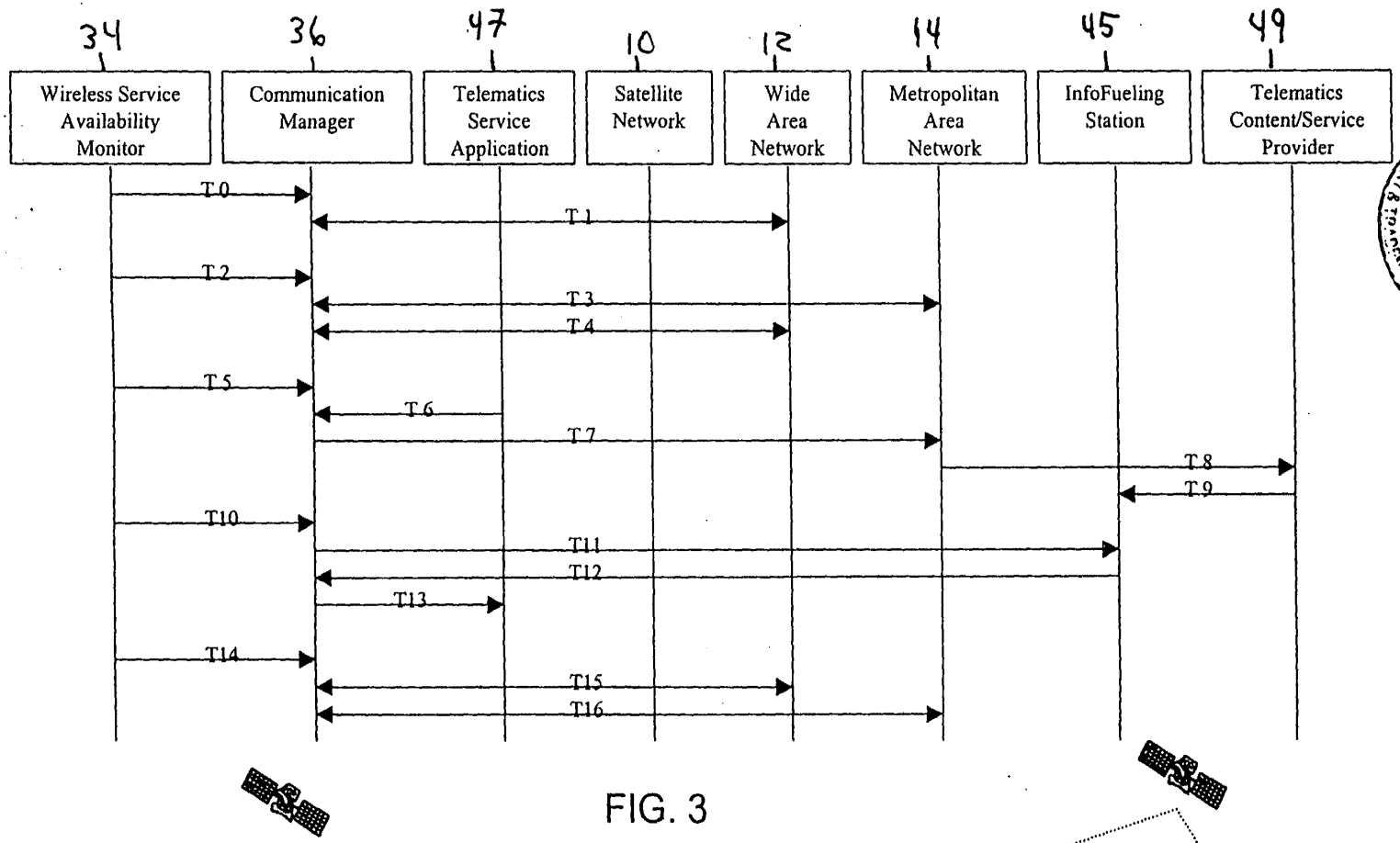


FIG. 3

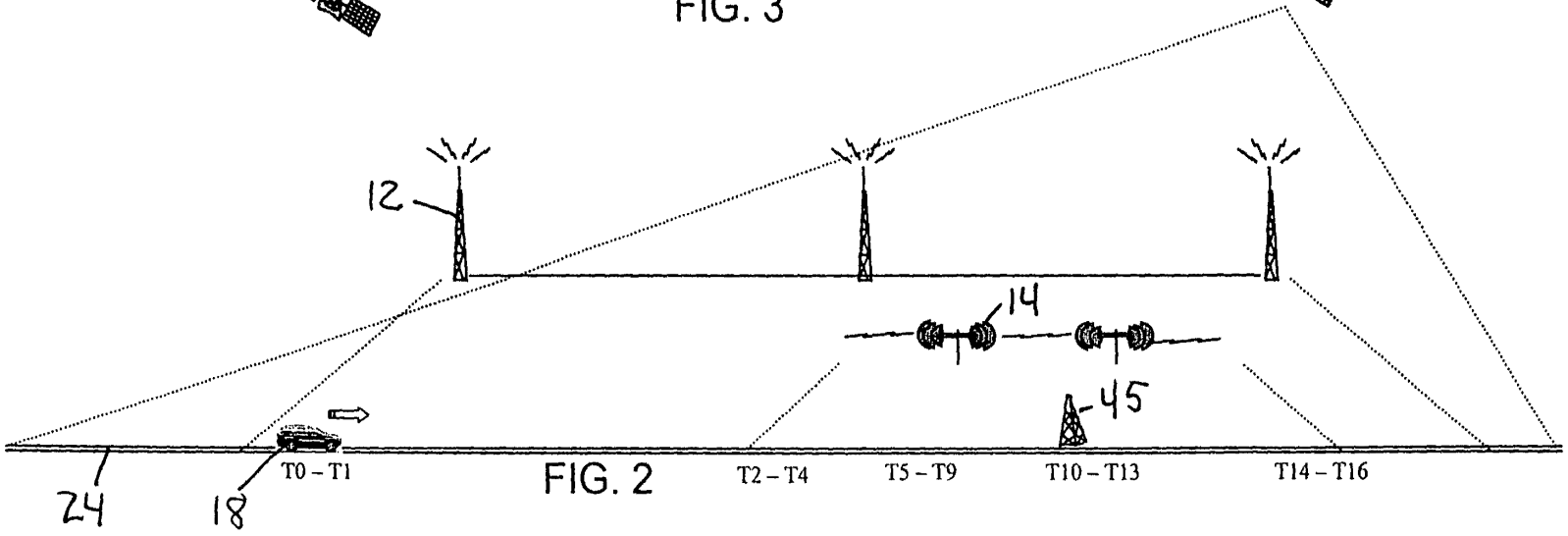


FIG. 2

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<HW101, (x1,y1), MAN boundary>
<HW101, (x2,y2), MAN boundary>
...
<HW85, (x5,y5), MAN boundary>
... ...
<HW280, (x8,y8), MAN boundary>
... ...

FIG. 4

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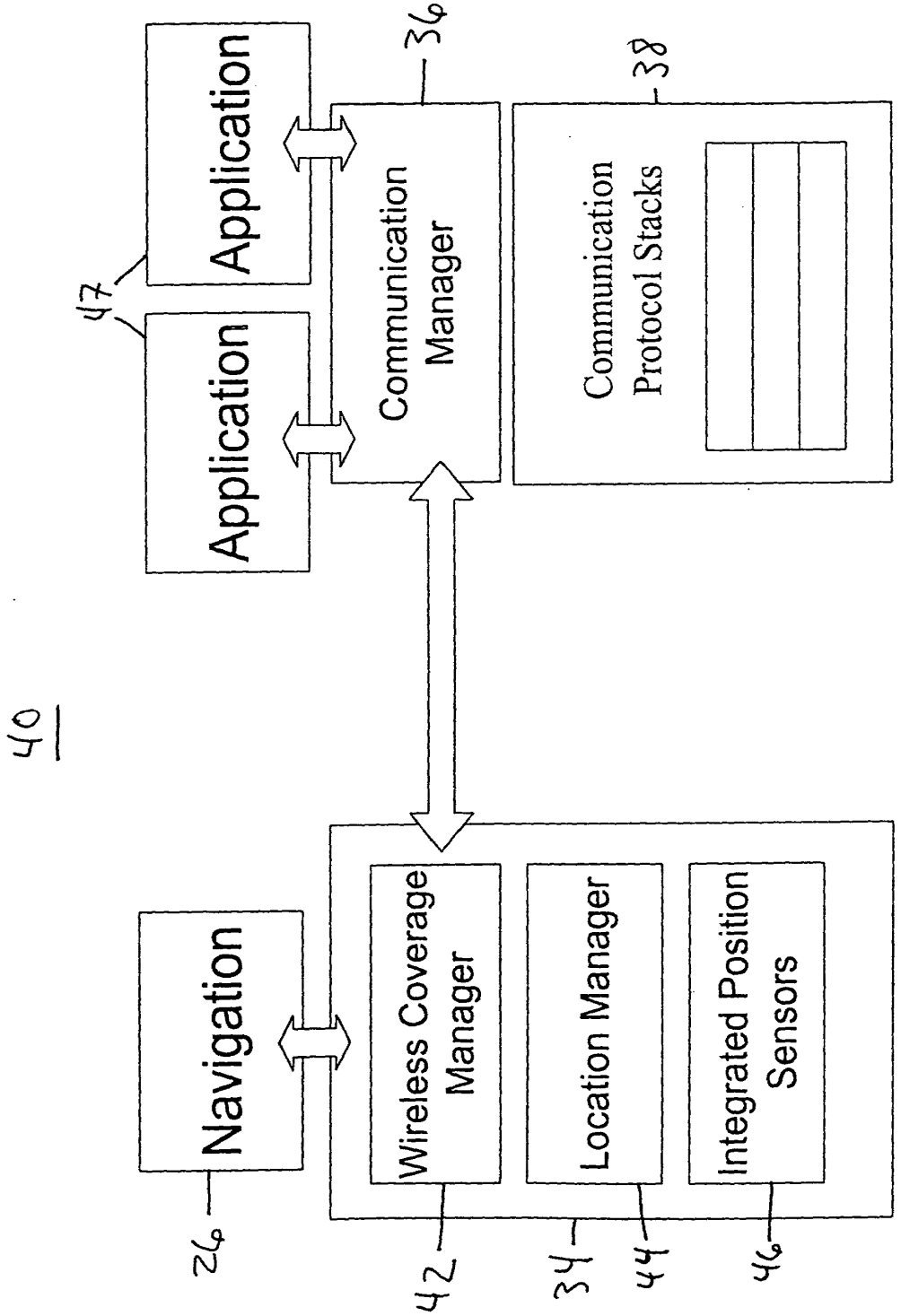


FIG. 5

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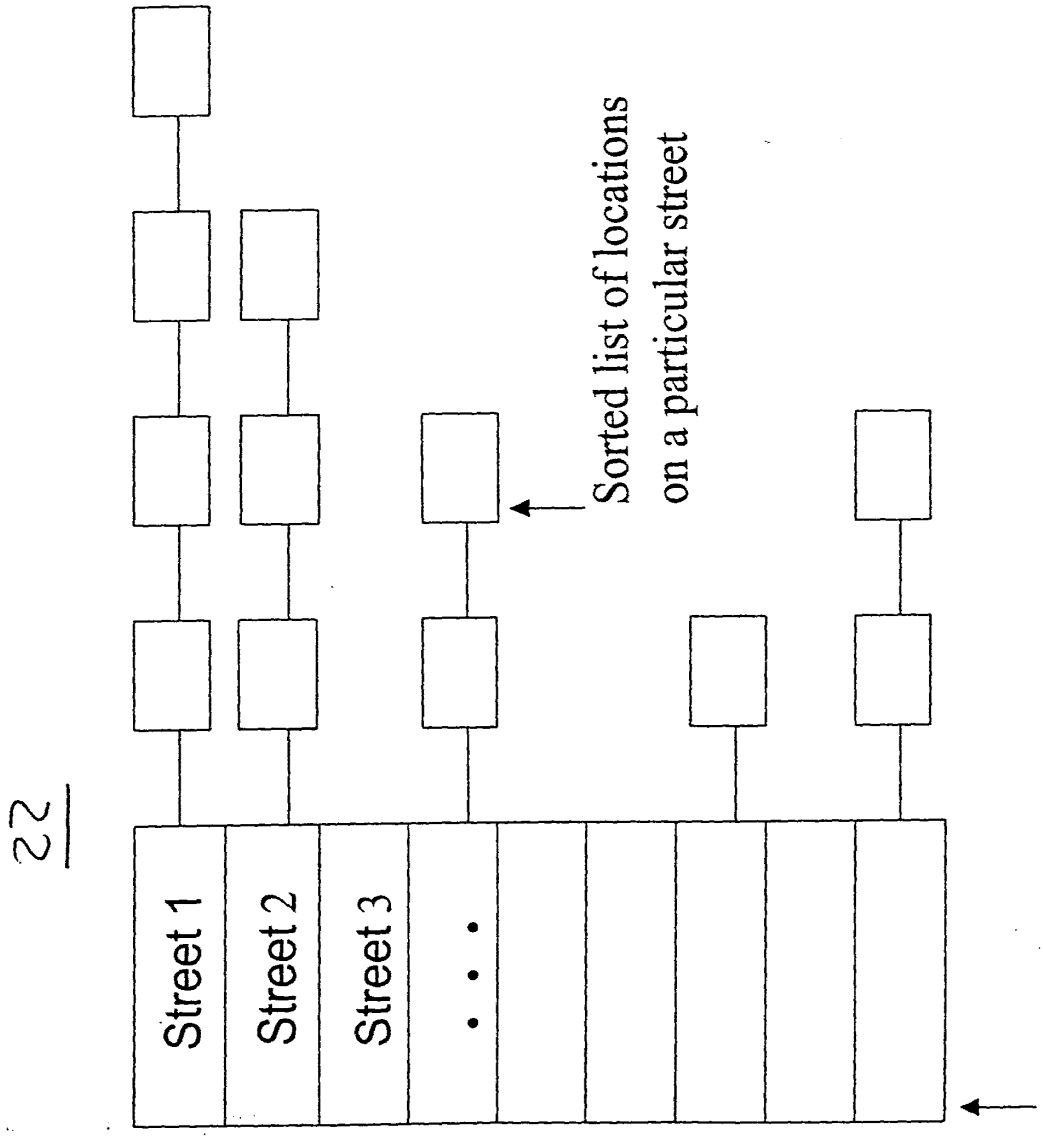


FIG. 6

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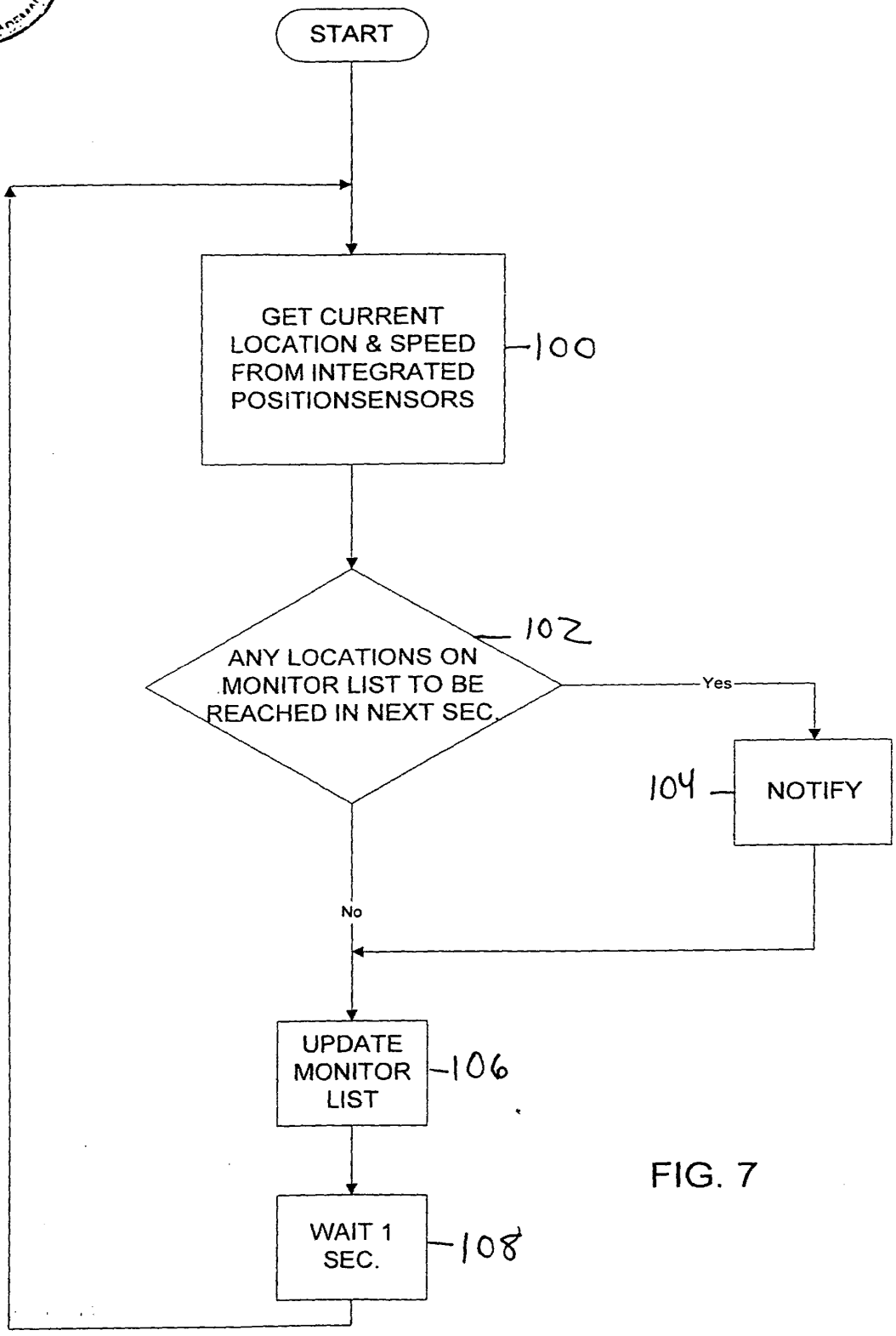


FIG. 7

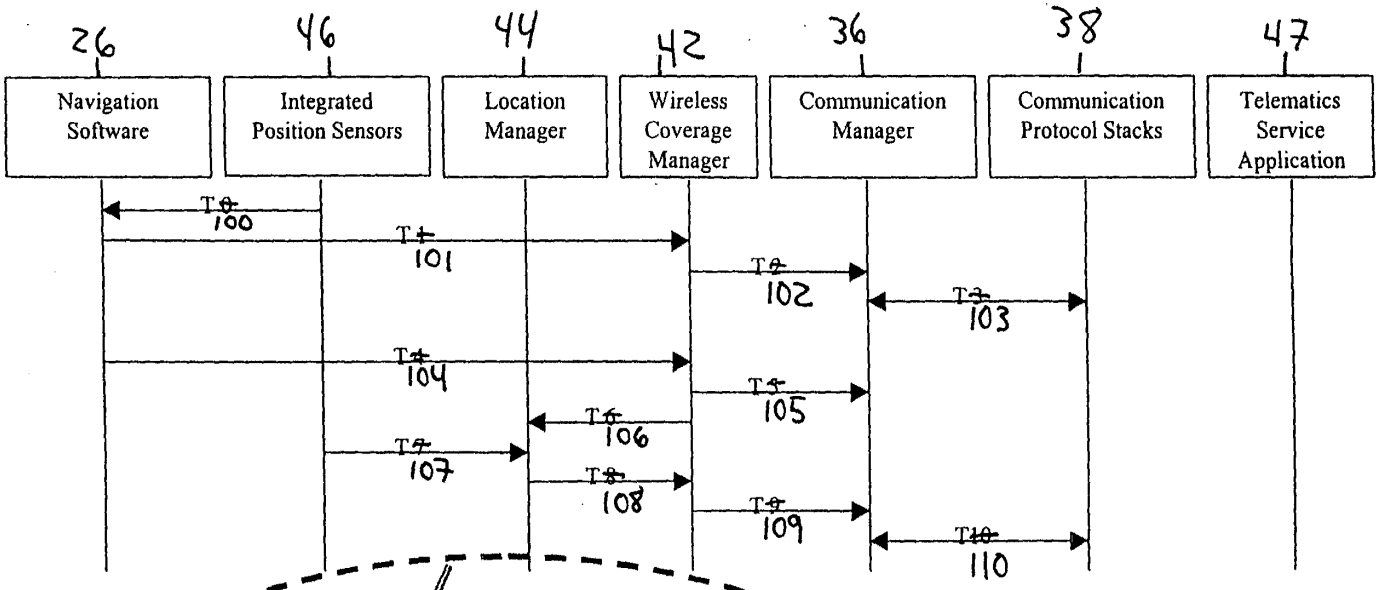


FIG. 8

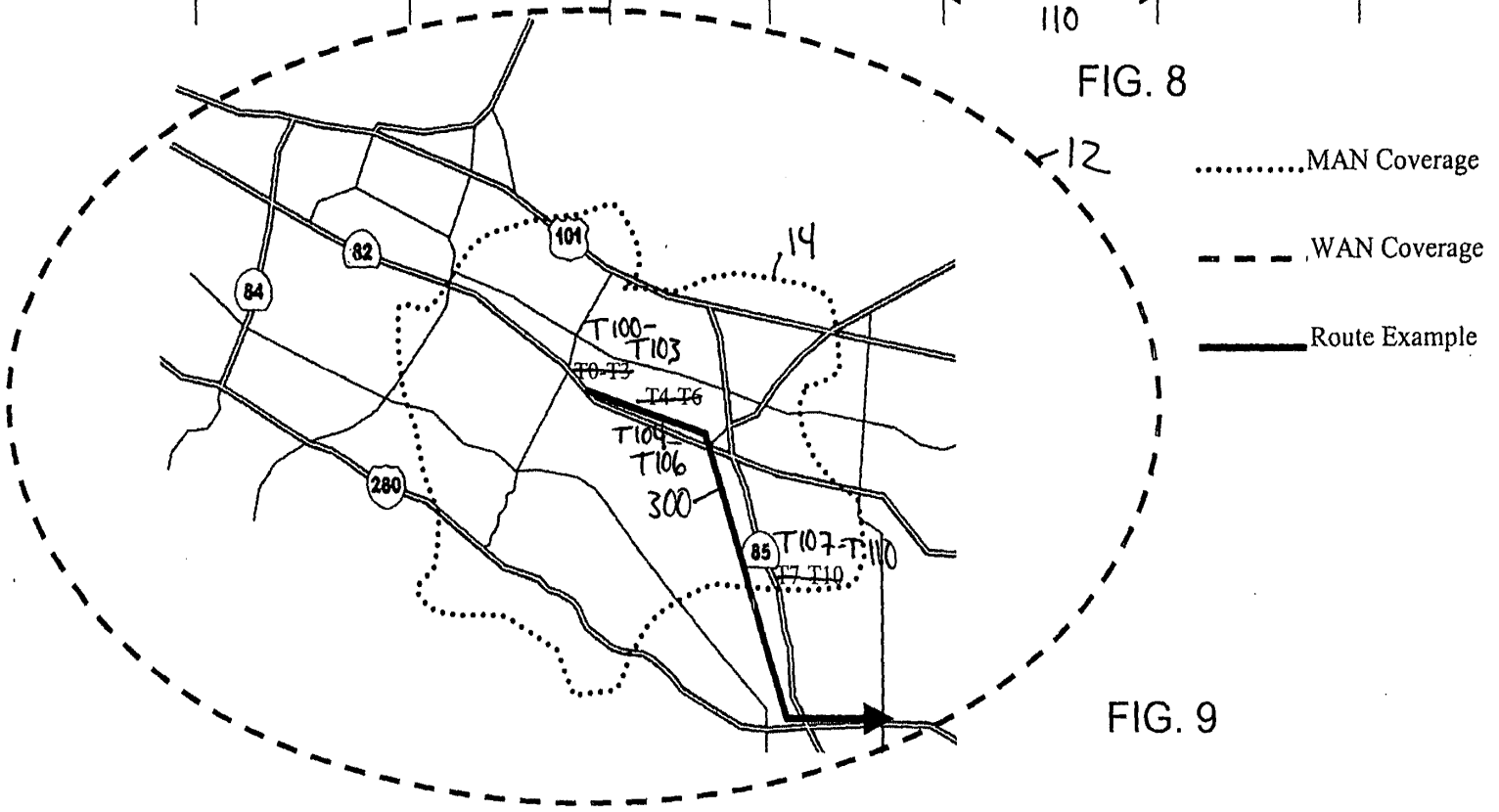


FIG. 9

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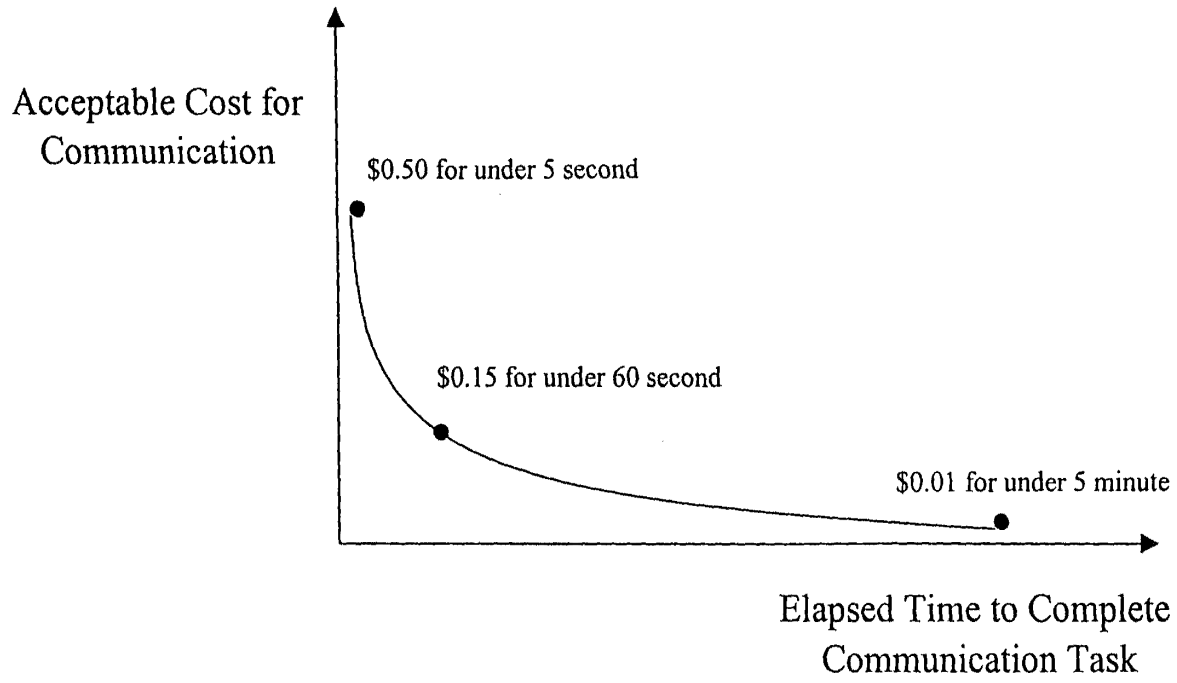


FIG. 10

REMARKS

Claims 1-38 are currently pending in the present Application.

Claims 1-3, 6-7, 17, 21, 24 and 26 stand rejected under 35 U.S.C. § 112, second paragraph as indefinite for use of the term "communications options" and for reference to wireless communications options not using wireless communications.

Rejections under 35 U.S.C. § 103(a) include:

- Claims 1-2, 17-18 21, 28-33 and 36-38 as unpatentable over U.S. Patent No. 5,825,759 to Liu ("Liu") in view of U.S. Patent No. 6,363,323 to Jones ("Jones") or U.S. Patent No. 5493,291 to Bruggemann ("Bruggemann"), and further in view of U.S. Patent No. 5,530,917 to Andersson, *et al.* ("Andersson");
- Claims 3-11 and 14 as unpatentable over Liu, Jones and Bruggemann in further view of U.S. Patent No. 6,282,412 to Lyons ("Lyons");
- Claims 12-14 as unpatentable over Liu, Jones, Bruggemann and Lyons in further view of U.S. Patent No. 6,473,602 to Bottomley ("Bottomley");
- Claims 15 and 19 as unpatentable over Liu, Jones and Bruggemann in further view of U.S. Patent No. 6,125,278 to Wieczorek, *et al.* ("Wieczorek");
- Claims 16 and 20 as unpatentable over Liu, Jones and Bruggemann in further view of IEEE Paper The Proper Statistical Nature of Measuring and Estimating, Dr. Wm. Lee, Airtouch Communications 1999 ("Lee Paper");
- Claims 22-23 as unpatentable over Liu, Jones, Bruggemann and Andersson in further view of U.S. Patent No. 6,185,413 to Mueller, *et al.* ("Mueller");

- Claims 24-27 as unpatentable over Liu in view of Mueller and Wieczorek;
- Claim 34 as unpatentable over Liu, Jones, Bruggemann and Andersson in further view of Bottomley; and
- Claim 35 as unpatentable over Liu, Jones, Bruggemann and Andersson in further view of U.S. Patent No. 6,505,046 to Baker ("Baker").

Finally, objections to the Abstract and the drawings have been entered.

The Applicant wishes to express his appreciation for the courtesies extended by the Examiner in the Interview on November 13, 2003. Consistent with the discussions in the Interview, the Applicant respectfully submits the foregoing amendments and following remarks. For the reasons set forth below, the Applicant maintains the pending claims are patentable over the cited references, and respectfully requests withdrawal of the pending rejections and allowance of claims 1-38.

1. <u>The Abstract Has Been Amended In the Manner Requested</u>.

The Applicant has amended the abstract to conform to the stated length requirement and to improve readability. No new matter has been entered. The Applicant respectfully requests withdrawal of the pending Abstract objection.

2. <u>The Drawing Objection Has Been Addressed</u>.

The Applicant respectfully requests Examiner approval of the attached red-ink amendments to the drawings to add reference numerals as requested. No new matter has been entered. In view of requested changes, the Applicant respectfully requests withdrawal of the pending drawing objection.

3. **The Claims Are Sufficiently Definite Under § 112.**

The Applicant respectfully traverses the pending rejection under § 112, second paragraph, of claims 1, 3, 7, 17, 21, 24, 26 as indefinite, on the grounds that the term "wireless communication options" is sufficiently defined in the specification.

For example, the Applicant at page 2 provides an express statement regarding what he means by this term: "By wireless communication options, it is meant the various wireless communication networks available, ..." Application at 2:9-13. The Applicant goes on to provide specific examples, *e.g.*, regional area wireless networks 10, wide area networks 12, metropolitan area networks 14, and local area networks 16. Application at 3:19-21; *see also* Figure 1.

In view of the Applicant's discussion of what he means by "wireless communication options," it is respectfully submitted that this term is adequately defined for the purposes of § 112, second paragraph. Reconsideration and withdrawal of the pending § 112 rejection is respectfully requested.

With regard to the remaining § 112, second paragraph, rejection, claims 2 and 6 stand rejected as indefinite as reciting wireless communication without use of wireless networks. The Applicant notes that claim 2, which depends from claim 1, recites that "one of the plurality of wireless communication options is not using any wireless communication." In other words, this claim recites that one option, among the plurality of communication options, is to simply choose to not engage in wireless communication if, in accordance with the method of the

present invention, such a choice is the preferred option. The Applicant further notes that this interpretation is consistent with the teachings of the present specification (*see, e.g.*, Application at 17-18; Fig. 10 (describing use cost/speed trade-offs for determining which wireless communication option to use, where no communications available at a reasonable cost is a potential choice)), and is sufficiently definite because the alternative interpretation – the connection to a wired network assumed in the pending Office Action – is unsupported in, and inconsistent with, the teachings of the present specification.

In view of the foregoing the Applicant respectfully submits that claims 2 and 6 are sufficiently definite and respectfully request withdrawal of the pending § 112 rejection.

4. **The Claims Are Patentable Over the References Under § 103(a).**

The Applicant respectfully traverses the pending rejections under § 103(a) of the claims as unpatentable over Liu and the remaining cited references on the grounds that Liu does not teach or suggest all the features of the present invention for which it is cited, and these features are not taught or suggested by the remaining references.

The present invention is directed to a method by which a mobile communication device selects from a variety of available wireless communications options along its travel route to ensure optimal, seamless vertical handoff between the communication options. The predictive method provides for determining which of several available communication options should be used at various locations along a route, based on factors such as

location of the mobile communication device, the route, data on the availability of various wireless communication networks in a geographic area, amount and timeliness requirements for information transfer, the speed of the vehicle and hence the length of time it will be within range of a communication option, and cost of use of each communications option.

In contrast, Liu discusses how , *on one network*, a company could distribute its mobile services based on where it predicts its customers will ultimately be located. *See, e.g.,* Liu at 1:58-2:10; Abstract. Because Liu teaches distribution of facilities on one network (*i.e.*, a "provider-side" focus rather than teaching a "user-side" method), this reference does not teach or suggest the present invention's predictive vertical handoff between *alternative* wireless communications options by a single mobile communications device.

For the foregoing reasons, the Applicant respectfully submits that the Liu reference fails to teach or suggest all the limitations of the present invention for which it is cited, and these limitations are not taught or suggested by any of the remaining references, either alone or in combination. Accordingly, reconsideration and withdrawal of the § 103(a) rejections of Claims 1-38 is respectfully requested.

Conclusion

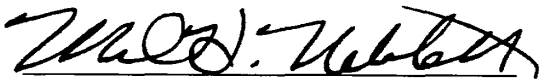
For the foregoing reasons, the Applicants believe currently pending Claims 1-38 are allowable, and the Application is in allowable form. Issuance of a Notice of Allowance for the pending claims is respectfully requested.

If there are any questions regarding this amendment or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket #225/51484US).

Respectfully submitted,

November 24, 2003



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/718,007	11/21/2000	Xi Jiang	705835US1RAF	9318

7590 12/08/2003

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EXAMINER	
D AGOSTA, STEPHEN M	

ART UNIT	PAPER NUMBER
2683	6

DATE MAILED: 12/08/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)	
	09/718,007	JIANG, XI	
	Examiner	Art Unit	
	Stephen M. D'Agosta	2683	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 November 2003*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-38* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-38* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

13)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Response to Arguments

Applicant's arguments filed 11-24-03 have been fully considered but they are not persuasive:

1. The examiner acknowledges modifications to the abstract and drawings – all are accepted.

2. The examiner also acknowledges the clarification provided by the applicant regarding the 112 rejections – both have been overcome.

3. The applicant argues that Liu does not teach support for operating on more than one network. The examiner disagrees for several reasons: **1**) Liu's figure 3 shows that a user can interface to multiple networks (ref. transceivers #34 to #37 supporting different network protocols) and Liu states that a user may need to connect to different networks (C5, L35-61, specifically L45-54), **2**) multi-mode mobile devices have been available for many years and can operate on different systems, **3**) Liu discloses access networks include cellular, PCN, WLAN, outdoor macrocells and indoor picocells which support a wireless user (C4, L60-64), **4**) Liu discloses a virtual HLR/VLR to support a user as they roam to/from the same (or different) systems and **5**) Liu discloses that "...a variety of different systems and networks are accessible to a user" (C5, L6-15). These FIVE points provide disclosure of a mobile user being able to connect to more than one system as they roam.

4. The original rejection stands and is provided below.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-2, 17-18, 21, 28-33 and 36-38 rejected under 35 U.S.C. 103(a) as being unpatentable over Liu US 5,825,759 and further in view of Jones US 6,363,323 or Bruggemann US 5,493,291 and Andersson et al. US 5,530,917 (hereafter Liu, Anderson and Jones or Bruggemann).

As per **claims 1, 17, 21, 28-29 and 38,** Liu teaches a method of selecting which of a plurality of wireless communication options will be used by a mobile device, comprising the step of selecting which wireless communication option to use based on a location of the mobile communication device on a route and the availability for use of each of the plurality of wireless communication options along the route (abstract).

But is silent on the route (eg. being known beforehand).

Jones teaches tracking a vehicle on a predetermined schedule/route based on GPS tracking and cellular system (abstract and figure 1) while **Bruggemann** teaches transponders suitable for a navigation system for motor vehicles in which a predetermined route, or desired destination, is stored in a navigation apparatus of each vehicle by means of an input device. In the respective transponders, in this case, directional information and/or street names, can be stored which are read by navigational apparatus of vehicles and compared with desired data (C5, L61-67 to C6, L1-2).

With further regard to claim 28, Liu teaches cellular networks which are known in the art to have cell base stations/towers near roadways and highways (Liu also discloses data connectivity to the Internet, figure 18, which can be via wireless LAN technology (IEEE 802.11) which provides high bandwidth and limited geographical coverage). Since Liu teaches mobile data networking and connectivity to the Internet (figure 18), the content provider would respond back to the mobile user via an appropriate base station for full duplex communication via the TCP/IP protocol.

With further regard to claim 29, Liu teaches a system that uses a predictive mobility algorithm to determine where a mobile user is likely to be (which reads on determining a predicted time when the vehicle will be able to communicate with an info-fueling station* having a known/predictable position) [abstract].

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that the route is known beforehand, to provide means for inputting the

route a user is to take so the device can track progress and inform the user if they are off course.

With further regard to claim 38, Liu **is silent on** a movable base station.

Andersson teaches base stations can be fixed or mobile (C20, L61-65) as can be wireless LAN systems if mounted on a mobile object.

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that the info-fueling station/base station is movable, to provide means for the station to be moved/relocated as needed for optimal RF communications.
*the examiner interprets an "info-fueling station" as a generic server that is connected to a localized high-speed wireless network (such as an IEEE802.11 network).

As per **claim 2**, Liu teaches claim 1 wherein one of the networks is a wired network (figure 18 and 19 show connectivity to wired networks, eg. Internet and LANs/WANs/MANs).

As per **claim 17**, Liu teaches a method of storing data in a database that is indicative of coverage areas for wireless communication options along a route that a mobile communication device is traversing, comprising the steps of:

a) storing boundary locations of the coverage areas for the wireless communication options along the route in the database

b) periodically obtaining updated information concerning the coverage areas of the wireless options as the mobile device traverses the route (abstract).

but is silent on

c) updating the database with updated information AND where the boundary locations are boundary locations on streets of the route

Jones teaches the storage device (eg. database) includes historical travel data pertaining to the vehicle schedule along the route. The historical travel data comprises a plurality of predetermined location values corresponding respectively with a plurality of locations along a predetermined route of travel of the mobile vehicle (C3, L7-32).

Bruggemann teaches described transponders can be set in the roadway pavement for a navigation system for motor vehicles in which a predetermined route, or desired destination, is stored in a navigation apparatus of each vehicle by means of an input device. In the respective transponders, in this case, directional information and/or **street names**, can be stored which are read by navigational apparatus of vehicles passing over and compared with desired data (C5, L61-67 to C6, L1-2).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that the database is updated with boundary/street locations, to provide means for the user to know when they are approaching a boundary/handoff and the street name associated with said boundary.

As per **claim 18**, Liu teaches claim 17 wherein the step of updating includes determining whether the updated information is for a present location,

a) if the updated information is for a present location, then storing the updated information

b) if the updated information is for a present location, comparing the updated information updating the stored information if updated information is different from the stored information (abstract and C2, L11-43 teaches knowledge of multiple networks).

But is silent on a database.

Jones teaches the storage device (eg. database) includes historical travel data pertaining to the vehicle schedule along the route. The historical travel data comprises a plurality of predetermined location values corresponding respectively with a plurality of locations along a predetermined route of travel of the mobile vehicle. The predetermined location values are respectively associated with time values stored in the storage device. The processor uses one of the plurality of predetermined location values (along with its associated time value), a current time, and a current location value received from the sensor to determine whether the vehicle is off schedule. If the vehicle is off schedule by at least a predefined amount, the processor causes the communications device to transmit a message to a remote computer, associated with a tracking system or an advance notification system, indicating that the vehicle is off schedule by a specified time and/or distance (C3, L7-32).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that a database is used, to provide means to store all pertinent route/option data in a commercial database software package.

As per **claim 30**, Liu teaches claim 29 **but is silent on** wherein said info-fueling station has a fixed position relative to vehicles.

Bruggemann teaches roadway transponders that can allow the vehicle to determine it's location and the location of fixed objects (eg. traffic speed sign of figure 2, a transponder is built into a roadway pavement near a speed limit traffic sign. Information corresponding to that of the traffic sign 17 is stored in the memory 8 of the transponder 1. If a vehicle 13 with a coil antenna 14 drives over the transponder 1 then energy is transferred to the transponder 1 via the coil antenna 14 so that it, the transponder, is activated and sends out its stored, or memorized, information as a digital code signal. This energy transfer can be caused by a changing magnetic field at the transponder. The transponder information is received by the coil antenna 14 so that, via the read-out device 4 and the analyzing circuit 15, the information of the traffic sign 17 is shown on the indicating device) [C3, L50-67 to C4, L1-2].

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that an info-fueling station has a fixed position, to provide means for the station to always be at a known, fixed location the user can roam to for data.

As per **claim 31**, Liu teaches claim 29, **but is silent on** an information request identifies said info-fueling station.

Liu does teach a predictive mobility algorithm that can determine where the mobile is likely to be.

Bruggemann teaches roadway transponders that can provide pinpoint accuracy as to the location of the user [C3, L50-67 to C4, L1-2]. While Bruggemann teaches a

passive transponder that must be driven over, one skilled in the art would also use an information request and/or a GPS query for location information).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that an information request is used to identify the info-fueling station, to provide means for manual (and/or automatic) determination of a station.

As per **claim 32**, Liu teaches claim 29, **but is silent on** the wireless network identifies said info-fueling station.

Liu does teach a predictive mobility algorithm that can determine where the mobile is likely to be.

Bruggemann teaches roadway transponders that can provide pinpoint accuracy as to the location of the user AND fixed objects such as traffic speed signs, etc. and one skilled in the art would also provide means for identifying any other object (eg. info-fueling station) [C3, L50-67 to C4, L1-2].

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that the wireless network identifies the info-fueling station, to provide manual (or automatic) determination of the location/identity of said info-fueling station via the wireless network.

As per **claim 33**, Liu teaches claim 29, **but is silent on** the wireless device being coupled to an on-board communication network in said vehicle.

Bruggemann teaches an on-board communication network/system in a vehicle (abstract and figure 2).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that the wireless device is onboard a vehicle, to provide a system for use within a car/vehicle.

As per **claim 36**, Liu teaches claim 29 **but is silent on** a movable info-fueling station.

Andersson teaches base stations can be fixed or mobile (C20, L61-65) as can be wireless LAN systems if mounted on a mobile object.

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that the info-fueling station is movable, to provide means for the station to be moved/relocated as needed for optimal RF communications.

As per **claim 37**, Liu teaches claim 36 **but is silent on** moving each mobile info-fueling station to a location to optimize performance of info-fueling communication.

Liu teaches a cellular network which is known in the art as a RF network comprised of many base stations that are planned and tested for optimized performance and low co-interference. One skilled in the art would locate any RF device in a position such that it's performance is optimized for communication with users.

The examiner takes Official Notice that cellular service providers have engineers that work to determine optimal positions for RF cell sites.

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that each fueling station is moved to a location for optimal performance, to provide interference-free communication to users.

Claims 3-11 and 14 rejected under 35 U.S.C. 103(a) as being unpatentable over Liu, Jones and Bruggemann and further in view of Lyons US 6,282,412 (hereafter Lyons).

As per **claims 3 and 7**, Liu teaches a mobile device with method for selecting which in a plurality of wireless communication options will be used by the mobile device comprising the steps of:

c. determining where on the route the mobile device is as it traverses the route (abstract)

d. determining whether to switch from a first one of the wireless communication options presently being used to a second one when the device approaches a boundary of a coverage area (abstract)

e. switching from the first wireless option to a second one when the mobile crosses the boundary if the determination was made to switch to the second option (abstract).

But is silent on

a. storing in the mobile device route information that is indicative of the route that the mobile will be traversing

b. storing in the mobile information indicative of coverage areas for each of the plurality of wireless options along the route the mobile will traverse.

Liu does teach the system having knowledge of the coverage areas the mobile is near (C1, L58-67 to C2, L10). **Lyons** teachs a receiver with memory card to store information concerning a determined number of broadcast stations that serve at least a portion of a user-designated geographic area, and which have a program style that suits a designated user preference. Information corresponding to each station's operating or carrier frequency and an associated service coverage area, is stored by the card (C2, L33-44).

Jones teaches tracking a vehicle on a predetermined schedule/route based on GPS tracking and cellular system (abstract and figure 1) while **Bruggemann** teaches transponders suitable for a navigation system for motor vehicles in which a predetermined route, or desired destination, is stored in a navigation apparatus of each vehicle by means of an input device. In the respective transponders, in this case, directional information and/or street names, can be stored which are read by navigational apparatus of vehicles and compared with desired data C5, L61-67 to C6, L1-2).

With regard to claim 7, Liu teaches knowledge of network services and resources (eg. coverage areas) the mobile user is near or moving toward (abstract) **but is silent on** a database. **Jones** teaches the storage device (eg. database) includes historical travel data pertaining to the vehicle schedule along the route. The historical

travel data comprises a plurality of predetermined location values corresponding respectively with a plurality of locations along a predetermined route of travel of the mobile vehicle. The predetermined location values are respectively associated with time values stored in the storage device. The processor uses one of the plurality of predetermined location values (along with its associated time value), a current time, and a current location value received from the sensor to determine whether the vehicle is off schedule. If the vehicle is off schedule by at least a predefined amount, the processor causes the communications device to transmit a message to a remote computer, associated with a tracking system or an advance notification system, indicating that the vehicle is off schedule by a specified time and/or distance (C3, L7-32).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that route/coverage data is stored in the mobile AND a database is used, to provide means for storing all possible data regarding route/coverage information for a trip route.

As per **claim 4**, Liu teaches a plurality of wireless networks (C2, L11-35 teaches service outside a service area, eg. other network).

As per **claim 5**, Liu teaches at least one of the wireless networks having a plurality of service levels (figures 20-23, 25a/25b).

As per **claim 6**, Liu teaches claim 2 wherein one of the networks is a wired network (figure 18 and 19 show connectivity to wired networks, eg. Internet and LANs/WANs/MANs).

As per **claim 8**, Liu teaches claim 7 and a "soft data structure handover" (abstract) which reads on the claimed limitation (connection to second system before dropping connection to first system).

As per **claim 9**, Liu teaches claim 7 **but is silent on** wherein the database stores coverage areas options along the route traversed includes storing boundary locations of the coverage areas where boundary locations stored are limited to boundary locations that are on streets of the route.

Bruggemann teaches described transponders can be set in the roadway pavement for a navigation system for motor vehicles in which a predetermined route, or desired destination, is stored in a navigation apparatus of each vehicle by means of an input device. In the respective transponders, in this case, directional information and/or **street names**, can be stored which are read by navigational apparatus of vehicles passing over and compared with desired data (C5, L61-67 to C6, L1-2).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that the database stores data includes boundary locations/streets, to provide means for knowing when a handoff may occur in regard to an actual street location.

As per **claim 10**, Liu teaches claim 9 **but is silent on** further including obtaining updated information concerning the coverage areas of the wireless communication options and updating the database with updated information.

Liu teaches a cellular system which inherently is aware of it's own coverage areas/cells.

Bruggemann teaches transponders that are set in pavement for vehicle navigation (Cxx, Lxx). One skilled in the art knows that as new pavement transponders are added to new pavement locations, the system will receive this new data and update it's database.

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that updated data can be received and stored, to provide means for newly received data to be stored in the device/system as the user roams.

As per **claim 11**, Liu teaches claim 10 obtaining updated information concerning the coverage areas of the wireless options includes obtaining this information from providers of the wireless options (abstract - Liu teaches cellular systems which are inherently aware of their coverage areas/cells).

Claims 12-14 rejected under 35 U.S.C. 103(a) as being unpatentable over Liu, Jones, Bruggemann and Lyons and further in view of Bottomley US 6,473,602 (hereafter Bottomley).

As per **claim 12**, Liu teaches claim 10 **but is silent on** wherein the step of obtaining updated information includes monitoring signal strengths of the wireless options as it passes through the coverage areas for the wireless options and developing updated information concerning coverage areas for the wireless options based on the monitored signal strengths of the wireless options.

Bottomley teaches measuring signal strength for determining a hand-off condition which can be used on several access technologies/systems (ie. FDMA, TDMA and CDMA) [title and abstract].

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that signal strength is monitored, to provide means for handing off when one system's strength begins to fade and another system's strength increases.

As per **claims 13 and 14**, Liu teaches claim 12 wherein the step of updating includes determining whether the updated information is for a present location,

a) if the updated information is for a present location, then storing the updated information

b) if the updated information is for a present location, comparing the updated information updating the stored information if updated information is different from the stored information (abstract and C2, L11-43 teaches knowledge of multiple networks).

But is silent on a database.

Jones teaches the storage device (eg. database) includes historical travel data pertaining to the vehicle schedule along the route. The historical travel data comprises a plurality of predetermined location values corresponding respectively with a plurality of locations along a predetermined route of travel of the mobile vehicle. The predetermined location values are respectively associated with time values stored in the storage device. The processor uses one of the plurality of predetermined location values (along with its associated time value), a current time, and a current location value received from the sensor to determine whether the vehicle is off schedule. If the vehicle is off schedule by at least a predefined amount, the processor causes the communications device to transmit a message to a remote computer, associated with a tracking system or an advance notification system, indicating that the vehicle is off schedule by a specified time and/or distance (C3, L7-32).

With regard to claim 14, the examiner interprets primary functions of a database as providing the ability to 1) store data, 2) can be searched to see if new data to be stored exists or not, 3) update previously stored data with new data. Hence, Jones' storage device/database reads on claim 14 (also ref. commercially available database software such as Microsoft Access/SQLServer, IBM DB-2, Oracle, etc.).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that a database is used and can store/update database entries as new data is received, to provide means for data to be stored in a commercially available software database and be manipulated as needed by the user/system.

Claims 15 and 19 rejected under 35 U.S.C. 103(a) as being unpatentable over Liu, Jones and Bruggemann and further in view of Wieczorek et al. US 6,125,278 (hereafter Wieczorek).

As per **claim 15**, Liu teaches claim 14 **but is silent on** updating stored information comprises shifting the stored information toward the updated information by a parameter and replacing stored information with the shifted stored information.

Wieczorek teaches a system that stores and uses the unit's location history which reads on the claimed limitation (eg. present data is replaced with newer data and present data is moved to different storage location).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that new data is stored and previous data is moved/stored, to keep the most current data in memory while maintaining a historical record as well.

As per **claim 19**, Liu teaches claim 18 **but is silent on** updating stored information comprises shifting the stored information toward the updated information by a parameter and replacing stored information with the shifted stored information.

Wieczorek teaches a system that stores and uses the unit's location history which reads on the claimed limitation (eg. present data is replaced with newer data and present data is moved to different storage location).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that new data is stored and previous data is moved/stored, to keep the most current data in memory while maintaining a historical record as well.

Claims 16 and 20 rejected under 35 U.S.C. 103(a) as being unpatentable over Liu, Jones and Bruggemann and further in view of Lee IEEE paper (hereafter Lee).

As per **claim 16**, Liu teaches claim 15 **but is silent on** the step of updating the stored information doing so with a running average method wherein the stored information is the running average of initial information and subsequent update information.

Lee teaches wireless communications and the use of a running average that uses data both from the past (known) and future (unknown) as well as calculations for weighting the data (page 753, abstract and Paragraph 1 to Paragraph 2).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that a running average is used, to provide means for properly calculating/measuring signal strength in a mobile system.

As per **claim 20**, Liu teaches claim 18 **but is silent on** the step of updating the stored information doing so with a running average method wherein the stored information is the running average of initial information and subsequent update information.

Lee teaches wireless communications and the use of a running average that uses data both from the past (known) and future (unknown) as well as calculations for weighting the data (page 753, abstract and Paragraph 1 to Paragraph 2).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that a running average is used, to provide means for properly calculating/measuring signal strength in a mobile system.

Claims 22-23 rejected under 35 U.S.C. 103(a) as being unpatentable over Liu, Jones, Bruggemann and Andersson and further in view of Mueller et al. US 6,185,413 (hereafter Mueller).

As per **claim 22**, Liu teaches claim 21 **but is silent on** determining cost of each wireless system.

Mueller teaches a mobile station with memory device in which a number of available applications are stored which can relate to different "carriers," i.e., mobile radio network systems or service providers within a single mobile radio network. A selection device of the mobile station calculates expected charges for a desired connection for each of these applications which are being considered for the transmission connection. Based upon the calculations, the most cost-efficient application for the desired transmission is selected. The actual transmission of the communication data for the base station is then carried out on the basis of this application (Abstract).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that cost is determined for each system, to provide means for the user to know the cost associated with each system it can connect with.

As per **claim 23**, Liu teaches claim 21 and determining which wireless system to use includes making the decision based upon performance level of each wireless system (figures 15-17 teach latency reduction, performance gain relating to mobility density).

But is silent on cost.

Mueller teaches a mobile station with memory device in which a number of available applications are stored which can relate to different "carriers," i.e., mobile radio network systems or service providers within a single mobile radio network. A selection device of the mobile station calculates expected charges for a desired connection for each of these applications which are being considered for the transmission connection. Based upon the calculations, the most cost-efficient application for the desired transmission is selected. The actual transmission of the communication data for the base station is then carried out on the basis of this application (Abstract).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that cost is determined, to provide means for the user to know the cost associated with each system it can connect with.

Claims 24-27 rejected under 35 U.S.C. 103(a) as being unpatentable over Liu in view of Mueller and Wieczorek.

As per **claims 24 and 26**, Liu teaches a method of providing a uniform content access layer application program interface for application programs that use mobile communications provided by a mobile device (abstract and figures 18-25b) **but is silent on** comprising the steps of:

a) providing a database accessible by the application program

b) storing in the database information concerning wireless options that are available for use by the mobile communication device as it traverses a route

c) the application program deciding its requirements for data transfer via wireless communication based on the information about wireless communications stored in the database.

Mueller teaches a mobile station having a number of applications that chooses a wireless network based on least cost and a database (abstract and figure 1, #18). **Wieczorek** teaches a method for optimizing resource allocation that chooses a wireless network based on loading conditions/data transfer capability (abstract). One skilled in the art would provide for Mueller's program to also decide based on system loading.

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that an application program can access a database and decide requirements for communication, to provide means for the application to determine which network(s) can provide the optimal data transfer.

As per **claims 25 and 27**, Liu teaches claim 24 wherein the information about the wireless options stored in the database includes information concerning performance (figure 15-17) **but is silent on** cost.

Mueller teaches a mobile station having a number of applications that chooses a wireless network based on least cost (abstract).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that cost is determined, to provide means for the user to know the cost associated with each system it can connect with.

Claim 34 rejected under 35 U.S.C. 103(a) as being unpatentable over Liu, Jones, Bruggemann and Andersson and further in view of Bottomley.

As per **claim 34**, Liu teaches claim 29 and the ability to pre-arrange for communications when a mobile user roams freely (abstract) which reads on the entire claim except for the fact of **being silent on** signal strength.

Bottomley teaches measuring signal strength for determining a hand-off condition which can be used on several access technologies/systems (ie. FDMA, TDMA and CDMA) [title and abstract].

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that signal strength is used, to provide means of knowing when a handoff will occur based on signal strength.

Claim 35 rejected under 35 U.S.C. 103(a) as being unpatentable over Lie, Jones, Bruggemann and Andersson and further in view of Baker US 6,505,046 (hereafter Baker).

As per **claim 35**, Liu teaches claim 29 **but is silent on** the wireless network routes previously stored requests for information to said vehicle through said info-fueling station.

Baker teaches a short message service center is a specialized computer system that accepts short message requests from various network entities. The message requests are stored and forwarded to various subscribers when they become available in the network (i.e., they turn their phone on) [C6, L56-61].

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that previously stored requests are routed, to provide means for storing (and not deleting) requests that cannot be delivered.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Stephen M. D'Agosta whose telephone number is 703-306-5426. The examiner can normally be reached on M-F, 8am to 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bill Trost can be reached on 703-308-5318. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9314.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-306-0377.

SMD
12-3-03

WILLIAM TROST
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600

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APR 08 2004
PATENT & TRADEMARK OFFICE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: XI JIANG

Serial No.: 09/718,007

Filed: NOVEMBER 21, 2000

Title: ROUTE-BASED COMMUNICATION PLANNING ARCHITECTURE AND METHOD FOR WIRELESS COMMUNICATION

Customer No. 23911

PRELIMINARY AMENDMENT

RECEIVED
APR 15 2004
Technology Center 2600

Mail Stop NON-FEE AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This Preliminary Amendment is presented in conjunction with a Request for Continued Examination filed concurrently herewith. Please enter the following amendments to the claims.

Amendments to the Claims begin on page 2 of this paper.

Remarks begin on page 13 of this paper.

IN THE CLAIMS:

Please amend the claims as follows:

1-6. (canceled)

7. (currently amended) A method of selecting which of a plurality of wireless communication options will be used by a mobile communication device, comprising the steps of

B1 (a) storing in a database information indicative of coverage areas for the wireless communication options along a route that the mobile communication device will be traversing, including storing boundary locations of the coverage areas for the wireless communication options along the route where the boundary locations stored are limited to boundary locations that are on streets of the route;

(b) determining at the mobile communication device where on the route that the mobile communication device is at as it traverses the route;

(~~d~~c) accessing the database to obtain information regarding the communication options available along the route, ~~and~~

(d) determining whether to switch from a first one of the wireless communication options presently being used to a second one of the wireless communication options when the mobile communication device approaches a boundary of a coverage area of one of the wireless ~~networks~~ communication options based on the wireless communication options available once the

boundary is crossed and those that will be available further along the route; and

(~~f~~e) switching from the first one of the wireless communication options to the second one of the wireless communication options if the determination was made to switch to that second one of the wireless communication options,

wherein one of the plurality of wireless communication options is not using any wireless communication.

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8. (original) The method of Claim 7 wherein the step of switching from the first one of the wireless communication options to the second one of the wireless communication options comprises establishing a connection with the second one of the wireless communication options and dropping a connection to the first one of the wireless communication options only after the connection with the second one of the wireless communication options has been established.

9. (canceled)

10. (currently amended) The method of Claim ~~9~~ 7 and further including the step of obtaining updated information concerning the coverage areas of the wireless communication options and updating the database with the updated information.

11. (original) The method of Claim 10 wherein the step of obtaining updated information concerning the coverage areas of the wireless communication options 10 includes obtaining this information from providers of the wireless communication options.

12. (original) The method of Claim 10, wherein the step of obtaining updated information concerning the coverage areas of the wireless communication options includes the mobile communication device monitoring signal strengths of the wireless communication options as it passes through the coverage areas for the wireless communication options and developing updated information concerning coverage areas for the wireless communication options based on the monitored signal strengths of the wireless communication options.

13. (original) The method of Claim 12 wherein the step of updating the database with the updated information includes determining whether the updated information is for a location presently in the database,

(a) if the updated information is for a location not presently in the database, then storing the updated information in the database for the location;

(b) if the updated information is for a location presently in the database, comparing the updated information with the information stored in the database for the location and updating the stored information if updated information is different from the stored information.

14. (original) The method of Claim 10 wherein the step of updating the database with the updated information includes determining whether the updated information is for a location for which information is presently stored in the database,

(a) if the updated information is for a location not presently in the database, then storing the updated information in the database for the location;

(b) if the updated information is for a location presently in the database, comparing the updated information with the information stored in the database for the location and updating the stored information if updated information is different from the stored information.

15. (original) The method of claim 14, wherein the step of updating stored information comprises shifting the stored information toward the updated information by a parameter and replacing the stored information with the shifted stored information.

16. (original) The method of claim 15 wherein the step of updating the stored information comprises doing so with a running average method wherein the stored information is the running average of initial information and subsequent update information.

17. (currently amended) A method of storing data in a database that is indicative of coverage areas for wireless communication options along a route that a mobile communication device is traversing, comprising the steps of

(a) storing boundary locations of the coverage areas for the wireless communication options along the route in the database where the boundary locations are boundary locations on streets of the route; ~~to~~

(b) periodically obtaining updated information at the location of the mobile communication device concerning the coverage areas of the wireless communication options as the mobile communication device traverses the route; and

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(c) updating the database with the updated information.

18. (original) The method of Claim 17 wherein the step of updating the database with the updated information includes determining whether the updated information is for a location for which information is presently stored in the database,

(a) if the updated information is for a location not presently in the database, then storing the updated information in the database for the location;

(b) if the updated information is for a location presently in the database, comparing the updated information with the information stored in the database for the location and updating the stored information if updated information is different from the stored information.

19. (original) The method of claim 18, wherein the step of updating stored information comprises shifting the stored information toward the updated information by a parameter and replacing the stored information with the shifted stored information.

20. (original) The method of claim 18 wherein the step of updating the stored information comprises doing so with a running average method wherein the stored information is the running average of initial information and subsequent update information.

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21. (currently amended) A method of determining which of a plurality of wireless communication options to use for data transmission with a mobile wireless communication device that is traversing a route, comprising the steps of determining at the mobile communication device where the mobile wireless communication device is on the route, determining which wireless communication option to use for the data communications and when to use it based upon the location of the mobile wireless communication device on the route and the availability of the wireless communication options at the location where the mobile wireless communication device is at on the route and locations on the route where the mobile wireless communication device will subsequently be at as it travels the route.

wherein the step of determining which wireless communication option to use and when to use it includes making the determination based upon the cost to use and performance level of each wireless communication option, and

wherein one of the plurality of wireless communication options is not using any wireless communication.

22. (original) The method of claim 21, wherein the step of determining which wireless communication to use and when to use it includes making the determination based upon the cost to use each wireless communication option.

23. (canceled)

24. (currently amended) A method of providing a uniform content access layer application program interface for application programs that use mobile communication provided by a mobile communication device, comprising the steps of

(a) providing a database accessible by the application program at the mobile communication device;

(b) storing in the database information concerning any wireless ~~to~~ communication options that are available for use by the mobile communication device as it traverses a route;

(c) the application program deciding its requirements for data transfer via wireless communication based on the information about the

wireless communication options stored in the database,

wherein the information about the wireless communication options stored in the database includes information concerning cost and performance of the wireless communication options.

25-27. (canceled).

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28. (currently amended) A method of wireless transmission of data to mobile data communication devices using wireless communication technology that has high bandwidth but low geographic coverage, comprising the steps of.

(a) providing multiple wireless communication base stations along roads, each base station having a high bandwidth and low geographic coverage;

(~~a~~b) storing in the mobile data communication device route information that is indicative of the route that the mobile communication device will be traversing;

(~~b~~c) storing in the mobile communication device information indicative of coverage areas for each base station located along the route that the mobile communication device will be traversing;

(ed) determining at the mobile communication device which base station to use to send data to the mobile data communication device based on the location of the mobile data communication device on the route that it is travelling;

(~~d~~e) transferring data to be sent to the mobile data communication device from a content provider to the base station that it was determined to use to send the data to the mobile data communication device; and

(e~~f~~) the base station to which the data was transferred transmitting the data to the mobile data communication device when the mobile data communication device ~~enter~~ enters that base ~~stations~~ station's coverage area.

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29. (original) A method of fueling a vehicle with information through a wireless communication device in said vehicle, comprising the steps of.

(a) determining a predicted time when said vehicle will be able to communicate with an info-fueling station having a predictable geographic position;

(b) sending a request for information from said vehicle through said wireless communication device to at least one wireless communication network;

(c) routing said information from an information source in communication with said wireless communication network to said info-fueling station; and

(d) downloading said requested information to said vehicle through said info-fueling station during the time that said wireless communication device in said vehicle is in communication range of said info-fueling station.

30. (original) The method according to Claim 29, wherein said info-fueling station has a fixed position relative to vehicles.

31. (original) The method according to Claim 29, wherein said information request identifies said info-fueling station.

32. (original) The method according to Claim 29, wherein said wireless communication network identifies said info-fueling station.

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33. (original) The method according to Claim 29, wherein said wireless communication device is coupled to an on-board communication network in said vehicle.

34. (original) The method according to Claim 29, wherein said downloading of information commences once the detected signal strength of communication between said wireless communication device in said vehicle with said info-fueling station reaches a predetermined level.

35. (original) The method according to Claim 29, wherein said wireless communication network also routes previously stored requests for information to said vehicle through said info-fueling station.

36. (original) The method according to Claim 29, wherein said info-fueling station is mobile.

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37. (original) The method according to Claim 36, and further including the steps of moving each mobile info-fueling station to a location to optimize performance of info-fueling communication.

38. (canceled)

REMARKS

This Preliminary Amendment is being filed concurrently with a Request for Continued Examination.

The Applicant wishes to express his gratitude for the courtesies extended by the Examiner and his supervisor in the Interview conducted on March 4, 2004. Consistent with the discussions and helpful suggestions in the Interview, the foregoing amendments and following remarks are directed to refining the claims' recitation of the present invention.

Specifically, the Applicant has canceled claims 1-6, and amended independent claims 7, 17, 21 and 24 to incorporate the limitations of respective dependent claims and to add limitations regarding features of the present invention disclosed in the written description. In addition, conforming amendments and amendments to correct typographic errors have been made to claims 10 and 28, and claims 9, 23, 25-27 and 38 have been canceled without prejudice to the subject matter contained therein.

Rejections under 35 U.S.C. § 103(a) include:

- Claims 1-2, 17-18, 21, 28-33 and 36-38 as unpatentable over U.S. Patent No. 5,825,759 to Liu ("Liu") in view of U.S. Patent No. 6,363,323 to Jones ("Jones") or U.S. Patent No. 5493,291 to Bruggemann ("Bruggemann"), and further in view of U.S. Patent No. 5,530,917 to Andersson, *et al.* ("Andersson");
- Claims 3-11 and 14 as unpatentable over Liu, Jones and Bruggemann in further view of U.S. Patent No. 6,282,412 to Lyons ("Lyons");

- Claims 12-14 as unpatentable over Liu, Jones, Bruggemann and Lyons in further view of U.S. Patent No. 6,473,602 to Bottomley ("Bottomley");
- Claims 15 and 19 as unpatentable over Liu, Jones and Bruggemann in further view of U.S. Patent No. 6,125,278 to Wieczorek, *et al.* ("Wieczorek");
- Claims 16 and 20 as unpatentable over Liu, Jones and Bruggemann in further view of IEEE Paper The Proper Statistical Nature of Measuring and Estimating, Dr. Wm. Lee, Airtouch Communications 1999 ("Lee Paper");
- Claims 22-23 as unpatentable over Liu, Jones, Bruggemann and Andersson in further view of U.S. Patent No. 6,185,413 to Mueller, *et al.* ("Mueller");
- Claims 24-27 as unpatentable over Liu in view of Mueller and Wieczorek;
- Claim 34 as unpatentable over Liu, Jones, Bruggemann and Andersson in further view of Bottomley; and
- Claim 35 as unpatentable over Liu, Jones, Bruggemann and Andersson in further view of U.S. Patent No. 6,505,046 to Baker ("Baker").

The following addresses each of the pending rejections.

1. Rejection of Claims 3 and 7 and Their Dependent Claims.

The Applicant respectfully traverses the pending rejections under § 103(a) of claim 7 and its dependent claims 8-16 as unpatentable over the various recited combinations of Liu, Jones, Bruggemann, Lyons, Bottomley, Wieczorek and the IEEE Paper, on the grounds that these references do not teach or suggest all the features of the present invention as recited in amended claim 7.

Amended claim 7 and its dependent claims 8 and 10-16 now recite a method of selecting which of a plurality of wireless communication options will be used, wherein, *inter alia*, the mobile communications device determines where it is located on a route, the coverage area boundary locations on the streets along the route (and only the boundary locations on the route) are stored, and the determination of whether to switch from one wireless communication option to another is based on *both* the wireless communication options available once the boundary is crossed *and* the options that will be available *further along the route.* The Applicant respectfully submits that no combination of the cited references suggests the features now recited in amended claim 7.

In view of the foregoing amendments and remarks, the Applicant respectfully requests reconsideration and withdrawal of the pending § 103(a) rejections of claims 7-8 and 10-16.

2. Rejection of Claims 17-20.

The Applicant respectfully traverses the pending rejections under § 103(a) of 17 and its dependent claims 18-20, on the grounds that the cited references do not teach or suggest all the features of the present invention.

The pending Office Action maintains that Liu teaches a method of selecting which of a plurality of wireless communication options will be used, that Jones teaches tracking a vehicle on a schedule/route, and that Bruggemann teaches use of transponders transmitting street names, suitable for navigation in which a predetermined route is stored and compared to the transmitted route information.

Claim 17, as amended, recites obtaining updated coverage information *at the mobile communication device*, wherein the coverage information is coverage boundary locations *on the streets of the route*. While Bruggemann may teach that it is possible for a vehicle navigation system to ascertain its location from transponders located in the road, there is nothing in this reference, Liu or Jones which begins to suggest the storage and/or updating of coverage boundary location information, at the mobile communication device, in the form of boundary locations on the streets of a predetermined route. Accordingly, the Applicant respectfully submits that the invention recited in amended claim 17 and its dependent claims 18-20 is patentable over the cited references. Reconsideration and withdrawal of the § 103(a) rejections of these claims is respectfully requested.

3. **Rejection of Claims 21-22.**

The Applicant respectfully traverses the pending rejections under § 103(a) of claim 21 (amended to incorporate the limitations of claims 23 and 2) and its dependent claim 22, on the grounds that the cited references do not teach or suggest all the features of the present invention.

As in amended claim 7, amended claim 21 recites that the determination of whether to switch from one wireless communication option to another is based on *both* the wireless communication options available once the boundary is crossed *and* the options that will be available *further along the route*. The Applicant respectfully submits that no combination of the cited references suggests this feature, or claim 21's consideration of cost and performance both in

the next coverage area and subsequent coverage areas along the route in is coverage selection determination. Reconsideration and withdrawal of the § 103(a) rejections of these claims is respectfully requested.

4. **Rejection of Claim 24.**

The Applicant respectfully traverses the pending rejections under § 103(a) of claim 24, on the grounds that the cited references do not teach or suggest all the features of the present invention.

Claim 24, as amended, recites a method for providing a uniform content access layer application program interface for application programs that use mobile communication, wherein, *inter alia*, a database accessible by the application program is provided "at the mobile communication device," and there is stored in the database information concerning any wireless communication options that are available for use by the mobile communication device *as it traverses a route.* In other words, the present invention is directed to providing an API which functions *based on knowledge, placed with the mobile device, regarding the resources available along a route* – a feature that is not either taught or suggested by the cited references. At most, Liu teaches hand-off functions and Wieczorek teaches load optimization – neither reference appears to suggest any such function from the perspective of the *mobile device* selecting a communication option, or doing so along a predetermined path. The invention recited in amended claim 24 is thus not taught or suggested by Liu, Mueller and/or Wieczorek. Reconsideration and withdrawal of the § 103(a) rejection of this claim is respectfully requested.

5. Rejection of Claims 28-29 and Their Dependent Claims 30-37.

The Applicant respectfully traverses the pending rejections under § 103(a) of claims 28 and 29, and their respective dependent claims 30-37, on the grounds that the cited references do not teach or suggest all the features of the present invention.

Claim 28, as amended, recites a method for wireless transmission of data in which, *inter alia*, route information and coverage area information along the route are stored in a mobile data communications device, a determination is made "at the mobile device" of which base station along the route should be used to transfer data to the mobile communication device, and having the desired information forwarded to the selected base station for transfer during the time the mobile device is within range of the selected based station. Claim 29 similarly provides for *the mobile device* in a vehicle to initiate a request to a wireless network to place information at a selected "info-fueling station" and having requested information transferred to the vehicle during the time the vehicle is in range of info-fueling station. *See, e.g.*, Application at 21:17-22:9 (request from mobile device designating base station to which information is to be forwarded).

The Applicant respectfully submits there is no teaching or suggestion in the cited references of claims 28-29's *mobile communication device-based* predictive data requesting and pre-positioned delivery method. As previously noted, Liu teaches an approach for a *service provider* to make a prediction as to where a mobile user may travel, and to make resources (such as user-related

information) available at that location. Liu does not teach or suggest anything regarding the *mobile device's* instructing a service provider to provide information to a mobile-device-selected base station based on the mobile device's knowledge of the route to be covered and its evaluation of the optimal location for transfer of the desired information to the vehicle. The mere fact that connectivity to the Internet can be established using base stations along a highway (*e.g.*, the IEEE 802.11 referred to in the Office Action) does not *a priori* teach or suggest the present invention's method for its mobile device to determine, based on a planned route, which particular base station should receive requested information for transfer when the vehicle passes within range.

For the foregoing reasons, the Applicant respectfully submits that invention recited in amended claims 28 and 29 and their respective dependent claims 30-37 is not taught or suggested the cited references. Accordingly, reconsideration and withdrawal of the § 103(a) rejection of claims 29-37 is respectfully requested.

CONCLUSION

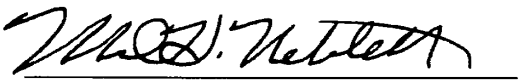
In view of the foregoing amendments and remarks, the Applicant respectfully submits that claims 7-8, 10-22, 24 and 28-37 are allowable over the cited references. Early and favorable consideration and issuance of a Notice of Allowance for these claims is respectfully requested.

If there are any questions regarding this amendment or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket #1844/50414MI).

Respectfully submitted,

April 8, 2004



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#26
R4/20/04
2700

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	: 09/718,007	Confirmation No.	: 9318
Applicant	: XI JIANG, et al.		
Filed	: November 21, 2000		
TC/A.U.	: 2683		
Examiner	: Stephen Dagosta		
Docket No.	: 037188.50414MI		
Customer No.	: 23911		
Title	: ROUTE-BASED COMMUNICATION PLANNING ARCHITECTURE AND METHOD FOR WIRELESS COMMUNICATION		

REQUEST FOR CONTINUED EXAMINATION (RCE) TRANSMITTAL

Mail Stop RCE
Commissioner of Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RECEIVED
APR 15 2004
Technology Center 2600

Sir:

This is a Request for Continued Examination (RCE) under 37 CFR § 1.114 of the above-identified application.

1. Submission required under 37 CFR § 1.114

   a. ☐ Previously submitted

      i. ☐ Consider the amendment(s)/reply under 37 CFR 1.116 previously filed on _

      ii. ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _

      iii. ☐ Other _

   b. Enclosed

      i. ☐ Amendment/Reply

04/09/2004 CNGUYEN 00000077 09718007

01 FC:1801 770.00 OP
02 FC:1251 110.00 OP

ii. ☐ Affidavit(s)/Declaration(s)

iii. ☐ Information Disclosure Statement (IDS)

iv. ☐ Other

2. Miscellaneous

a. ☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of _ months (not to exceed three months). The required fee under 37 CFR 1.17(i) is included in Section 3. a. iii. below.

b. ☐ Other

3. Fees

a. ☒ The following fees are included in the payment indicated below:

i. ☒ RCE fee required under 37 CFR 1.17(e) ($770)

ii. ☒ Extension of time fee required under 37 CFR 1.136 & 1.17 (1-month extension equals $110).

iii. Other _

b. ☒ Payment:

i. ☒ A check in the amount of $880.00 is enclosed

ii. The Director is hereby authorized to charge the fees listed above in Section 3 a i-iii to the Deposit Account of Crowell & Moring, L.L.P., Account No. 05-1323 (Docket No. *)

iii. ☒ If a check should become detached or if there is any deficiency in fees, any necessary fees should be charged, or any overpayment in fees should be credited, to the Deposit Account of

Crowell & Moring, L.L.P.,Account No. 05-1323 (Docket No. 037188.50414MI).

Respectfully submitted,

April 8, 2004



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/718,007	11/21/2000	Xi Jiang	705835US1RAF	9318

7590 04/29/2004

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EXAMINER	
D AGOSTA, STEPHEN M	

ART UNIT	PAPER NUMBER
2683	9

DATE MAILED: 04/29/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)	
	09/718,007	JIANG, XI	
	Examiner	Art Unit	
	Stephen M. D'Agosta	2683	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 April 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *7,8,10-22,24 and 28-37* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *7,8,10,17,18,21,22,24 and 28-37* is/are rejected.

7)☒ Claim(s) *11-16 and 19-20* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

Applicant's arguments with respect to claim 7,8,10-22,24 and 28-37 have been considered but are moot in view of the new ground(s) of rejection.

1. A new rejection is shown below.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 7-8 and 10 rejected under 35 U.S.C. 103(a) as being unpatentable over Liu, Jones and Bruggemann and further in view of Lyons US 6,282,412.

As per **claim 7**, Liu teaches a mobile device with method for selecting which in a plurality of wireless communication options will be used by the mobile device comprising the steps of:

B. determining at the mobile where on the route the mobile device is as it traverses the route (abstract)

D. determining whether to switch from a first one of the wireless communication options presently being used to a second one when the device approaches a boundary of a coverage area (abstract)

E. switching from the first wireless option to a second one when the mobile crosses the boundary if the determination was made to switch to the second option (abstract and figures 20-23, 25a/25b show options).

But is silent on

c. accessing a database to obtain information regarding the communication options available along the route

A. storing in a database mobile information indicative of coverage areas for each of the plurality of wireless options along the route the mobile will traverse including storing boundary locations of the coverage areas for the wireless options along the route where the boundary locations stored are limited to boundary locations that are on streets of the route;

wherein one of the plurality of wireless options is not using any wireless communication.

Liu does teach the system having knowledge of the coverage areas the mobile is near (C1, L58-67 to C2, L10). **Lyons** teachs a receiver with memory card to store information concerning a determined number of broadcast stations that serve at least a portion of a user-designated geographic area, and which have a program style that suits a designated user preference. Information corresponding to each station's operating or carrier frequency and an associated service coverage area, is stored by the card (C2, L33-44). If a preference isn't found, the user always has the option of not using wireless communications or a specific option requested.

Jones teaches tracking a vehicle on a predetermined schedule/route based on GPS tracking and cellular system (abstract and figure 1) while **Bruggemann** teaches transponders suitable for a navigation system for motor vehicles in which a predetermined route, or desired destination, is stored in a navigation apparatus of each vehicle by means of an input device. In the respective transponders, in this case, directional information and/or street names, can be stored which are read by navigational apparatus of vehicles and compared with desired data C5, L61-67 to C6, L1-2).

Liu teaches knowledge of network services and resources (eg. coverage areas) the mobile user is near or moving toward (abstract) **but is silent on** a database. **Jones** teaches the storage device (eg. database) includes historical travel data pertaining to the vehicle schedule along the route. The historical travel data comprises a plurality of predetermined location values corresponding respectively with a plurality of locations along a predetermined route of travel of the mobile vehicle. The predetermined location values are respectively associated with time values stored in the storage device. The processor uses one of the plurality of predetermined location values (along with its associated time value), a current time, and a current location value received from the sensor to determine whether the vehicle is off schedule. If the vehicle is off schedule by at least a predefined amount, the processor causes the communications device to transmit a message to a remote computer, associated with a tracking system or an advance notification system, indicating that the vehicle is off schedule by a specified time and/or distance (C3, L7-32).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that route/coverage data is stored in the mobile AND a database is used, to provide means for storing all possible data regarding route/coverage information for a trip route.

As per **claim 8**, Liu teaches claim 7 and a "soft data structure handover" (abstract) which reads on the claimed limitation (connection to second system before dropping connection to first system).

As per **claim 10**, Liu teaches claim 7 **but is silent on** further including obtaining updated information concerning the coverage areas of the wireless communication options and updating the database with updated information.

Liu teaches a cellular system which inherently is aware of it's own coverage areas/cells.

Bruggemann teaches transponders that are set in pavement for vehicle navigation (abstract and figures). One skilled in the art knows that as new pavement transponders are added to new pavement locations, the system will receive this new data and update it's database.

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that updated data can be received and stored, to provide means for newly received data to be stored in the device/system as the user roams.

Claims 17-18, 21, 28-33 and 36-37 rejected under 35 U.S.C. 103(a) as being unpatentable over Liu US 5,825,759 and further in view of Jones US 6,363,323 or Bruggemann US 5,493,291 and Andersson et al. US 5,530,917 or Mueller (hereafter Liu, Anderson and Jones or Bruggemann or Mueller (claim 21)).

As per **claim 17**, Liu teaches a method of storing data in a database that is indicative of coverage areas for wireless communication options along a route that a mobile communication device is traversing, comprising the steps of:

a) storing boundary locations of the coverage areas for the wireless communication options along the route in the database

b) periodically obtaining updated information at the location of the mobile concerning the coverage areas of the wireless options as the mobile device traverses the route (abstract).

but is silent on

c) updating the database with updated information AND where the boundary locations are boundary locations on streets of the route

Jones teaches the storage device (eg. database) includes historical travel data pertaining to the vehicle schedule along the route. The historical travel data comprises a plurality of predetermined location values corresponding respectively with a plurality of locations along a predetermined route of travel of the mobile vehicle (C3, L7-32).

Bruggemann teaches described transponders can be set in the roadway pavement for a navigation system for motor vehicles in which a predetermined route, or desired destination, is stored in a navigation apparatus of each vehicle by means of an input device. In the respective transponders, in this case, directional information and/or **street names**, can be stored which are read by navigational apparatus of vehicles passing over and compared with desired data (C5, L61-67 to C6, L1-2).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that the database is updated with boundary/street locations, to provide means for the user to know when they are approaching a boundary/handoff and the street name associated with said boundary.

As per **claim 18**, Liu teaches claim 17 wherein the step of updating includes determining whether the updated information is for a present location,

a) if the updated information is for a present location, then storing the updated information

b) if the updated information is for a present location, comparing the updated information updating the stored information if updated information is different from the stored information (abstract and C2, L11-43 teaches knowledge of multiple networks).

But is silent on a database.

Jones teaches the storage device (eg. database) includes historical travel data pertaining to the vehicle schedule along the route. The historical travel data comprises a plurality of predetermined location values corresponding respectively with a plurality of locations along a predetermined route of travel of the mobile vehicle. The predetermined location values are respectively associated with time values stored in the storage device. The processor uses one of the plurality of predetermined location values (along with its associated time value), a current time, and a current location value received from the sensor to determine whether the vehicle is off schedule. If the vehicle is off schedule by at least a predefined amount, the processor causes the communications device to transmit a message to a remote computer, associated with a tracking system or an advance notification system, indicating that the vehicle is off schedule by a specified time and/or distance (C3, L7-32).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that a database is used, to provide means to store all pertinent route/option data in a commercial database software package.

As per **claims 21, 28-29**, Liu teaches a method of selecting which of a plurality of wireless communication options will be used by a mobile device, comprising the step of selecting which wireless communication option to use based on a location of the mobile communication device on a route and the availability for use of each of the plurality of wireless communication options along the route (abstract) – periodically obtaining updated information at the location of the mobile device (abstract).

But is silent on the route (eg. being known beforehand).

Jones teaches tracking a vehicle on a predetermined schedule/route based on GPS tracking and cellular system (abstract and figure 1) while **Bruggemann** teaches transponders suitable for a navigation system for motor vehicles in which a predetermined route, or desired destination, is stored in a navigation apparatus of each vehicle by means of an input device. In the respective transponders, in this case, directional information and/or street names, can be stored which are read by navigational apparatus of vehicles and compared with desired data (C5, L61-67 to C6, L1-2).

With further regard to claim 21, Lie **is silent on** determining which option to use and when to use it includes making determination based upon the cost to use and performance level of each option AND wherein one option is not using any wireless communcations. Mueller teaches a mobile station with memory device in which a number of available applications are stored which can relate to different "carriers," i.e.,

mobile radio network systems or service providers within a single mobile radio network. A selection device of the mobile station calculates expected charges for a desired connection for each of these applications which are being considered for the transmission connection. Based upon the calculations, the most cost-efficient application for the desired transmission is selected. The actual transmission of the communication data for the base station is then carried out on the basis of this application (Abstract).

With further regard to claim 28, Liu teaches cellular networks which are known in the art to have cell base stations/towers near roadways and highways (Liu also discloses data connectivity to the Internet, figure 18, which can be via wireless LAN technology (IEEE 802.11) which provides high bandwidth and limited geographical coverage). Since Liu teaches mobile data networking and connectivity to the Internet (figure 18), the content provider would respond back to the mobile user via an appropriate base station for full duplex communication via the TCP/IP protocol.

With further regard to claim 29, Liu teaches a system that uses a predictive mobility algorithm to determine where a mobile user is likely to be (which reads on determining a predicted time when the vehicle will be able to communicate with an info-fueling station* having a known/predictable position) [abstract].

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that the route is known beforehand, to provide means for inputting the route a user is to take so the device can track progress and inform the user if they are off course.

Andersson teaches base stations can be fixed or mobile (C20, L61-65) as can be wireless LAN systems if mounted on a mobile object.

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that the info-fueling station/base station is movable, to provide means for the station to be moved/relocated as needed for optimal RF communications.
*the examiner interprets an "info-fueling station" as a generic server that is connected to a localized high-speed wireless network (such as an IEEE802.11 network).

As per **claim 30**, Liu teaches claim 29 **but is silent on** wherein said info-fueling station has a fixed position relative to vehicles.

Bruggemann teaches roadway transponders that can allow the vehicle to determine it's location and the location of fixed objects (eg. traffic speed sign of figure 2, a transponder is built into a roadway pavement near a speed limit traffic sign. Information corresponding to that of the traffic sign 17 is stored in the memory 8 of the transponder 1. If a vehicle 13 with a coil antenna 14 drives over the transponder 1 then energy is transferred to the transponder 1 via the coil antenna 14 so that it, the transponder, is activated and sends out its stored, or memorized, information as a digital code signal. This energy transfer can be caused by a changing magnetic field at the transponder. The transponder information is received by the coil antenna 14 so that, via the read-out device 4 and the analyzing circuit 15, the information of the traffic sign 17 is shown on the indicating device) [C3, L50-67 to C4, L1-2].

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that an info-fueling station has a fixed position, to provide means for the station to always be at a known, fixed location the user can roam to for data.

As per **claim 31**, Liu teaches claim 29, **but is silent on** an information request identifies said info-fueling station.

Liu does teach a predictive mobility algorithm that can determine where the mobile is likely to be.

Bruggemann teaches roadway transponders that can provide pinpoint accuracy as to the location of the user [C3, L50-67 to C4, L1-2]. While Bruggemann teaches a passive transponder that must be driven over, one skilled in the art would also use an information request and/or a GPS query for location information).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that an information request is used to identify the info-fueling station, to provide means for manual (and/or automatic) determination of a station.

As per **claim 32**, Liu teaches claim 29, **but is silent on** the wireless network identifies said info-fueling station.

Liu does teach a predictive mobility algorithm that can determine where the mobile is likely to be.

Bruggemann teaches roadway transponders that can provide pinpoint accuracy as to the location of the user AND fixed objects such as traffic speed signs, etc. and one skilled in the art would also provide means for identifying any other object (eg. info-fueling station) [C3, L50-67 to C4, L1-2].

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that the wireless network identifies the info-fueling station, to provide manual (or automatic) determination of the location/identity of said info-fueling station via the wireless network.

As per **claim 33**, Liu teaches claim 29, **but is silent on** the wireless device being coupled to an on-board communication network in said vehicle.

Bruggemann teaches an on-board communication network/system in a vehicle (abstract and figure 2).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that the wireless device is onboard a vehicle, to provide a system for use within a car/vehicle.

As per **claim 36**, Liu teaches claim 29 **but is silent on** a movable info-fueling station.

Andersson teaches base stations can be fixed or mobile (C20, L61-65) as can be wireless LAN systems if mounted on a mobile object.

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that the info-fueling station is movable, to provide means for the station to be moved/relocated as needed for optimal RF communications.

Claim 22 rejected under 35 U.S.C. 103(a) as being unpatentable over Liu, Jones, Bruggemann and Andersson and further in view of Mueller et al. US 6,185,413 (hereafter Mueller).

As per **claim 22**, Liu teaches claim 21 **but is silent on** determining cost of each wireless system.

Mueller teaches a mobile station with memory device in which a number of available applications are stored which can relate to different "carriers," i.e., mobile radio network systems or service providers within a single mobile radio network. A selection device of the mobile station calculates expected charges for a desired connection for each of these applications which are being considered for the transmission connection. Based upon the calculations, the most cost-efficient application for the desired transmission is selected. The actual transmission of the communication data for the base station is then carried out on the basis of this application (Abstract).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that cost is determined for each system, to provide means for the user to know the cost associated with each system it can connect with.

Claim 24 rejected under 35 U.S.C. 103(a) as being unpatentable over Liu in view of Mueller and Wieczorek.

As per **claim 24**, Liu teaches a method of providing a uniform content access layer application program interface for application programs that use mobile communications provided by a mobile device (abstract and figures 18-25b) **but is silent on** comprising the steps of:

a) providing a database accessible by the application program at the mobile device

b) storing in the database information concerning wireless options that are available for use by the mobile communication device as it traverses a route

c) the application program deciding its requirements for data transfer via wireless communication based on the information about wireless communications stored in the database and wherein the information about options stored in the database includes information concerning cost and performance of the options.

Mueller teaches a mobile station having a number of applications that chooses a wireless network based on least cost and a database (abstract and figure 1, #18). **Wieczorek** teaches a method for optimizing resource allocation that chooses a wireless network based on loading conditions/data transfer capability (abstract). One skilled in the art would provide for Mueller's program to also decide based on system loading.

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that an application program can access a database and decide requirements for communication, to provide means for the application to determine which network(s) can provide the optimal data transfer.

Claim 34 rejected under 35 U.S.C. 103(a) as being unpatentable over Liu, Jones, Bruggemann and Andersson and further in view of Bottomley.

As per **claim 34**, Liu teaches claim 29 and the ability to pre-arrange for communications when a mobile user roams freely (abstract) which reads on the entire claim except for the fact of **being silent on** signal strength.

Bottomley teaches measuring signal strength for determining a hand-off condition which can be used on several access technologies/systems (ie. FDMA, TDMA and CDMA) [title and abstract].

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that signal strength is used, to provide means of knowing when a handoff will occur based on signal strength.

Claim 35 rejected under 35 U.S.C. 103(a) as being unpatentable over Lie, Jones, Bruggemann and Andersson and further in view of Baker US 6,505,046 (hereafter Baker).

As per **claim 35**, Liu teaches claim 29 **but is silent on** the wireless network routes previously stored requests for information to said vehicle through said info-fueling station.

Baker teaches a short message service center is a specialized computer system that accepts short message requests from various network entities. The message requests are stored and forwarded to various subscribers when they become available in the network (i.e., they turn their phone on) [C6, L56-61].

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that previously stored requests are routed, to provide means for storing (and not deleting) requests that cannot be delivered.

Allowable Subject Matter

Claims 11-16 and 19-20 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

In the examiner's opinion, these claims recite highly specific design details not found in the prior art cited.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Stephen M. D'Agosta whose telephone number is 703-306-5426. The examiner can normally be reached on M-F, 8am to 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bill Trost can be reached on 703-308-5318. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Stephen D'Agosta
4-22-04



OIPE JC25 AUG 13 2004 PATENT & TRADEMARK OFFICE

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41

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: XI JIANG

Serial No.: 09/718,007

Filed: NOVEMBER 21, 2000

Title: **ROUTE-BASED COMMUNICATION PLANNING ARCHITECTURE AND METHOD FOR WIRELESS COMMUNICATION**

Customer No. 23911

RESPONSE PURSUANT TO 37 C.F.R. § 1.111

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Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

The following amendments and remarks are provided in response to the Office Action mailed April 29, 2004, for which the response due date, with a one-month extension of time, is August 29, 2004.

A Petition for Extension of Time begins on page 2 of this paper.

Amendments to the Claims begin on page 3 of this paper.

Remarks begin on page 14 of this paper.

08/16/2004 JADD01 00000044 09718007
01 FC:1251 110.00 OP

IN THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1-6. (canceled)

7. (previously presented) A method of selecting which of a plurality of wireless communication options will be used by a mobile communication device, comprising the steps of

(a) storing in a database information indicative of coverage areas for the wireless communication options along a route that the mobile communication device will be traversing, including storing boundary locations of the coverage areas for the wireless communication options along the route where the boundary locations stored are limited to boundary locations that are on streets of the route;

(b) determining at the mobile communication device where on the route that the mobile communication device is at as it traverses the route;

(c) accessing the database to obtain information regarding the communication options available along the route,

(d) determining whether to switch from a first one of the wireless communication options presently being used to a second one of the wireless communication options when the mobile communication device approaches a boundary of a coverage area of one of the wireless communication options based

on the wireless communication options available once the boundary is crossed and those that will be available further along the route; and

(e) switching from the first one of the wireless communication options to the second one of the wireless communication options if the determination was made to switch to that second one of the wireless communication options,

wherein one of the plurality of wireless communication options is not using any wireless communication.

8. (original) The method of Claim 7 wherein the step of switching from the first one of the wireless communication options to the second one of the wireless communication options comprises establishing a connection with the second one of the wireless communication options and dropping a connection to the first one of the wireless communication options only after the connection with the second one of the wireless communication options has been established.

9. (canceled)

10. (previously presented) The method of Claim 7 and further including the step of obtaining updated information concerning the coverage areas of the wireless communication options and updating the database with the updated information.

11. (original) The method of Claim 10 wherein the step of obtaining updated information concerning the coverage areas of the wireless communication options 10 includes obtaining this information from providers of the wireless communication options.

12. (original) The method of Claim 10, wherein the step of obtaining updated information concerning the coverage areas of the wireless communication options includes the mobile communication device monitoring signal strengths of the wireless communication options as it passes through the coverage areas for the wireless communication options and developing updated information concerning coverage areas for the wireless communication options based on the monitored signal strengths of the wireless communication options.

13. (original) The method of Claim 12 wherein the step of updating the database with the updated information includes determining whether the updated information is for a location presently in the database,

(a) if the updated information is for a location not presently in the database, then storing the updated information in the database for the location;

(b) if the updated information is for a location presently in the database, comparing the updated information with the information stored in the database for the location and updating the stored information if updated information is different from the stored information.

14. (original) The method of Claim 10 wherein the step of updating the database with the updated information includes determining whether the updated information is for a location for which information is presently stored in the database,

(a) if the updated information is for a location not presently in the database, then storing the updated information in the database for the location;

(b) if the updated information is for a location presently in the database, comparing the updated information with the information stored in the database for the location and updating the stored information if updated information is different from the stored information.

15. (original) The method of claim 14, wherein the step of updating stored information comprises shifting the stored information toward the updated information by a parameter and replacing the stored information with the shifted stored information.

16. (original) The method of claim 15 wherein the step of updating the stored information comprises doing so with a running average method wherein the stored information is the running average of initial information and subsequent update information.

17. (previously presented) A method of storing data in a database that is indicative of coverage areas for wireless communication options along a route that a mobile communication device is traversing, comprising the steps of

(a) storing boundary locations of the coverage areas for the wireless communication options along the route in the database where the boundary locations are boundary locations on streets of the route;

(b) periodically obtaining updated information at the location of the mobile communication device concerning the coverage areas of the wireless communication options as the mobile communication device traverses the route; and

(c) updating the database with the updated information.

18. (original) The method of Claim 17 wherein the step of updating the database with the updated information includes determining whether the updated information is for a location for which information is presently stored in the database,

(a) if the updated information is for a location not presently in the database, then storing the updated information in the database for the location;

(b) if the updated information is for a location presently in the database, comparing the updated information with the information stored in the database for the location and updating the stored information if updated information is different from the stored information.

19. (original) The method of claim 18, wherein the step of updating stored information comprises shifting the stored information toward the updated information by a parameter and replacing the stored information with the shifted stored information.

20. (original) The method of claim 18 wherein the step of updating the stored information comprises doing so with a running average method wherein the stored information is the running average of initial information and subsequent update information.

21. (previously presented) A method of determining which of a plurality of wireless communication options to use for data transmission with a mobile wireless communication device that is traversing a route, comprising the steps of determining at the mobile communication device where the mobile wireless communication device is on the route, determining which wireless communication option to use for the data communications and when to use it based upon the location of the mobile wireless communication device on the route and the availability of the wireless communication options at the location where the mobile wireless communication device is at on the route and locations on the route where the mobile wireless communication device will subsequently be at as it travels the route,

wherein the step of determining which wireless communication option to use and when to use it includes making the determination based upon the cost

to use and performance level of each wireless communication option, and

wherein one of the plurality of wireless communication options is not using any wireless communication.

22. (original) The method of claim 21, wherein the step of determining which wireless communication to use and when to use it includes making the determination based upon the cost to use each wireless communication option.

23. (canceled)

24. (previously presented) A method of providing a uniform content access layer application program interface for application programs that use mobile communication provided by a mobile communication device, comprising the steps of

(a) providing a database accessible by the application program at the mobile communication device;

(b) storing in the database information concerning any wireless ~~to~~ communication options that are available for use by the mobile communication device as it traverses a route;

(c) the application program deciding its requirements for data transfer via wireless communication based on the information about the wireless communication options stored in the database,

wherein the information about the wireless communication options stored in the database includes information concerning cost and performance of the wireless communication options.

25-27. (canceled).

28. (previously presented) A method of wireless transmission of data to mobile data communication devices using wireless communication technology that has high bandwidth but low geographic coverage, comprising the steps of.

(a) providing multiple wireless communication base stations along roads, each base station having a high bandwidth and low geographic coverage;

(b) storing in the mobile data communication device route information that is indicative of the route that the mobile communication device will be traversing;

(c) storing in the mobile communication device information indicative of coverage areas for each base station located along the route that the mobile communication device will be traversing;

(d) determining at the mobile communication device which base station to use to send data to the mobile data communication device based on the location of the mobile data communication device on the route that it is travelling;

(e) transferring data to be sent to the mobile data communication device from a content provider to the base station that it was determined to use

to send the data to the mobile data communication device; and

(f) the base station to which the data was transferred transmitting the data to the mobile data communication device when the mobile data communication device enters that base station's coverage area.

29. (original) A method of fueling a vehicle with information through a wireless communication device in said vehicle, comprising the steps of.

(a) determining a predicted time when said vehicle will be able to communicate with an info-fueling station having a predictable geographic position;

(b) sending a request for information from said vehicle through said wireless communication device to at least one wireless communication network;

(c) routing said information from an information source in communication with said wireless communication network to said info-fueling station; and

(d) downloading said requested information to said vehicle through said info-fueling station during the time that said wireless communication device in said vehicle is in communication range of said info-fueling station.

30. (original) The method according to Claim 29, wherein said info-fueling station has a fixed position relative to vehicles.

31. (original) The method according to Claim 29, wherein said information request identifies said info-fueling station.

32. (original) The method according to Claim 29, wherein said wireless communication network identifies said info-fueling station.

33. (original) The method according to Claim 29, wherein said wireless communication device is coupled to an on-board communication network in said vehicle.

34. (original) The method according to Claim 29, wherein said downloading of information commences once the detected signal strength of communication between said wireless communication device in said vehicle with said info-fueling station reaches a predetermined level.

35. (original) The method according to Claim 29, wherein said wireless communication network also routes previously stored requests for information to said vehicle through said info-fueling station.

36. (original) The method according to Claim 29, wherein said info-fueling station is mobile.

37. (original) The method according to Claim 36, and further including the steps of moving each mobile info-fueling station to a location to optimize performance of info-fueling communication.

38. (canceled)

REMARKS

Claims 7-8, 10-22, 24 and 28-37 are currently pending in the present Application.

The Applicant wishes to thank the Examiner for the indication that claims 11-16 and 19-20 recite patentable subject matter. For the reasons set forth below, the Applicant believes these claims' base and intervening claims are allowable. Accordingly, the Applicant respectfully declines the invitation to place claims 11-16 and 19-20 into independent form at this time.

Rejections under 35 U.S.C. § 103(a) include:

- Claims 7-8 and 10 as unpatentable over U.S. Patent No. 5,825,759 to Liu ("Liu") in view of U.S. Patent No. 6,363,323 to Jones ("Jones") and U.S. Patent No. 5493,291 to Brüggemann ("Brüggemann "), in further view of U.S. Patent No. 6,282,412 to Lyons ("Lyons");
- Claims 17-18, 21, 28-33 and 36-37 as unpatentable over Liu and Jones or Brüggemann and U.S. Patent No. 5,530,917 to Andersson, *et al.* ("Andersson") or U.S. Patent No. 6,185,413 to Mueller, *et al.* ("Mueller");
- Claim 22 as unpatentable over Liu, Jones, Brüggemann and Andersson in further view of Mueller; and
- Claim 24 as unpatentable over Liu in view of Mueller and U.S. Patent No. 6,125,278 to Wieczorek, *et al.* ("Wieczorek").

The following addresses the pending rejections.

1. **The Combination of Liu, Jones and Brüggemann Is Improper.**

As a threshold matter, the Applicant traverses the pending § 103(a) rejections based on the combination of Liu, Jones and Brüggemann, on the grounds that one of ordinary skill in the art, seeking to solve the problems addressed by the present invention, would not have discerned any suggestion or any motivation to combine such widely disparate references. Instead, the pending rejections appear to be based on impermissible hindsight, where, instead of determining whether the prior art suggested or provided a motivation to combine the references to obtain the present invention, the present claims appear to have been used in a "checklist" manner to compile a list of references and claim limitations.

The present invention is directed to efficient and cost-effective management of mobile communications *at* a *mobile* communications device in a vehicle as it traverses a planned travel route. Rather than merely shifting to the next available wireless signal when passing between wireless sources, the present invention evaluates the availability of upcoming communications options at the mobile communications device location, and determines whether to switch to a different communications option based on a variety of factors, including an evaluation as to whether shifting to the next available communications option is desirable considering what other options may subsequently will be available.[1]

[1] The Applicant notes that the present specification and figures makes plain that "communications options" are different wireless communications systems, such as wide area networks, satellite networks, local area networks. Based on the content of the specification and drawings, as well as the prosecution record in this case, there should
(Footnote continued...)

The cited references contain no teaching, suggestion or motivation, express or implied, for combination to obtain this invention:

The Liu reference describes how a *service provider* can arrange non-mobile *facilities* to make services available *to* a mobile communications user.

The Jones reference describes a *vehicle location reporting system*, with reports automatically sent from the vehicle over a cellular phone link.

The Brüggemann reference describes *fixed transmitters* buried in a road which pass information to passing vehicles.

None of these references would be considered by one of ordinary skill attempting to address *selection of a preferred communications option by a mobile communications device.* For instance, because Liu focuses on arrangement of service *provider* resources, one of ordinary skill would not have looked to this reference in the first place as a basis for providing techniques for *mobile device* selection between various communications options along a route. Nor is there any suggestion or motivation to combine this service provider-oriented reference with a one-way position reporting system (Jones) which teaches nothing about mobile device communications options selection.

Jones is cited as teaching a database having route data, including predetermined location and time data which allows the Jones system to determine whether to send out a report that the vehicle is off-schedule. There is

---

(...continued)
be no question that merely "handing off" of a communications link within the same wireless communications system -- such as a handing-off a call between cellular towers in the same cellular communications option -- is not a selection of a different "option."

no suggestion in either Jones or Liu to insert Jones' route/schedule database into Liu to provide a communications option selection database; indeed, these references are so fundamentally inapposite that one of ordinary skill would not have seen anything in either reference to suggest Liu's service *provider*-side resource deployment system could even be modified to provide a *mobile device-based* solution to the problems addressed by the present invention.

Similarly, one of ordinary skill, attempting to optimize communications options selection by a *mobile device* would have had no suggestion or motivation to combine Brüggemann with Liu. Brüggemann teaches embedding transponders in a road, and as a vehicle passes over the transponders, passing information to the vehicle (*e.g.*, street names, speed limits, etc.) – all within the same wireless system shared by all the transponders. Even if combined with Liu, Brüggemann thus offers nothing other than a means to transfer information to a passing vehicle, *i.e.*, even if combined with Liu, there would still be no hint in the modified Liu system of the present invention's *mobile device* communications option selection system.

In view of the lack of any teaching, suggestion, or motivation to combine or modify such disparate references, and the failure to obtain the present invention mobile-device communications option selection system even if the references were combined, the Applicant respectfully submits that a *prima facie* case of obviousness has not been established under § 103(a). Reconsideration and withdrawal of the pending § 103(a) rejections is therefore respectfully requested.

2. The Liu Reference Fails to Teach the Features For Which It Is Cited

The Applicant respectfully traverses the pending rejections based on Liu on the grounds that this reference fails to teach or suggest all the features of the present invention for which it is cited.

In the April 8, 2004 Preliminary Amendment, the Applicant amended the claims to more specifically recite features of the present invention. Among the amendments were limitations which require: that the determination of where the mobile communication device is on its route be performed at the mobile communications device; and that the determination as to whether to switch from a first wireless communication option to a second is based not only on the communications options to be available at the next boundary, but also on the wireless communications options that will be available further along the route. Claim 7. Similar limitations are present in independent claims 21 and 28.

The Liu reference is cited as teaching limitation (b) of claim 7, "determining at the mobile communications device where on the route that the mobile communications device is at as it traverses the route." April 29, 2004 Office Action at 2 (citing Liu Abstract). The Liu Abstract discusses an algorithm for predicting where a mobile user may be located. The detailed description in Liu confirms that the execution of the algorithm is performed on the service provider's side of the wireless network, and is used to deploy the service provider's network resources so that they will be available to the mobile user when the mobile user reaches the predicted location. Thus, the cited portion of Liu fails to disclose or suggest "determining *at the mobile communications device*

where on the route" the mobile device is located.

Liu is also cited as disclosing determining whether to switch from a first one of the wireless communications options presently being used to a second one when the device approaches a boundary of a coverage area. Limitation (d) of claim 7 includes additional features beyond those noted in the Office Action. The full text of limitations (d) reads: "determining whether to switch from a first one of the wireless communication options presently being used to a second one of the wireless communication options when the mobile communication device approaches a boundary of a coverage area of one of the wireless communication options *based on the wireless communication options available once the boundary is crossed and those that will be available further along the route.*" Liu fails to disclose the features recited in limitation (d) for at least two reasons.

First, Liu does not disclose determining whether to switch between communications options. The Abstract is cited as teaching this feature, but there is nothing in the Abstract discussing selection of different communications options. The Liu detailed disclosure similarly does not disclose such a selection. While the existence of different communications link types are noted (*e.g.*, Fig. 23 shows "TDMA/CDMA RADIO" adjacent to the link between a mobile terminal and the network), there is no discussion of *switching* between these communications types.[2] In other words, the listing of different links in Liu

[2] As discussed above, to the extent Liu suggests conventional switching between cells of the same communications option, this is not a suggestion of switching between different communications options.

represents nothing more than the well-known fact that mobile devices can use a variety of communications links, where the typical mobile device uses only one type of communications link (*e.g.*, cellular, satellite, WAN). Thus. Liu does not disclose either switching between different communications options, or doing so at the mobile device.

Another reason Liu fails to support the pending rejections is there is nothing in Liu contains nothing which discloses or suggests the latter portion of limitation (d) where the determination of whether to switch from one wireless communication option to another is "*based on the wireless communication options available once the boundary is crossed and those that will be available further along the route.*" Liu is simply silent on this feature of the present invention.

In view of the foregoing, the Applicant respectfully submits that the pending § 103(a) rejections. Reconsideration and withdrawal of the pending § 103(a) rejections of claims 7-8, 10, 17-18, 21-22, 24 and 28-37 is respectfully requested.

CONCLUSION

In view of the foregoing remarks, the Applicant respectfully submits that claims 7-8, 10-22, 24 and 28-37 are allowable over the cited references. Early and favorable consideration and issuance of a Notice of Allowance for these claims is respectfully requested.

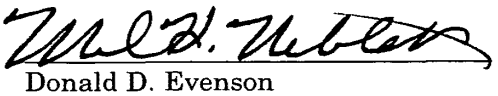
If there are any questions regarding this amendment or the application in general, a telephone call to the undersigned would be appreciated since this

should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket #1844/50414MI).

Respectfully submitted,

August 13, 2004



Donald D. Evenson
Registration No. 26,160
Mark H. Neblett
Registration No. 42,028

CROWELL & MORING, LLP
P.O. Box 14300
Washington, DC 20044-4300
Telephone No.: (202) 624-2500
Facsimile No.: (202) 628-8844

Petition for Extension of Time

It is respectfully requested that this paper be considered as a Petition for an Extension of Time sufficient to effect a timely response (calculated as one month). The Commissioner is authorized to charge the deposit account in the amount of $110.00 for the one month petition fee. The Office is authorized to charge any deficiency in fees or credit any overpayments to the Deposit Account of Crowell & Moring LLP, Account No. 05-1323 (Docket No. 037118.50414MI).

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PATENT APPLICATION FEE DETERMINATION RECORD
Effective October 1, 2000

Application or Docket Number: 09718007

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS	38	
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	38 minus 20=	* 18
INDEPENDENT CLAIMS	10 minus 3 =	* 7
MULTIPLE DEPENDENT CLAIM PRESENT		☐

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

SMALL ENTITY TYPE ☐			OTHER THAN SMALL ENTITY	
RATE	FEE	OR	RATE	FEE
BASIC FEE	355.00	OR	BASIC FEE	710.00
X$ 9=		OR	X$18=	324
X40=		OR	X80=	560
+135=		OR	+270=	
TOTAL		OR	TOTAL	1594

RCE

CLAIMS AS AMENDED - PART II

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 26	Minus	** 38	=
Independent	* 6	Minus	*** 10	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

SMALL ENTITY			OTHER THAN SMALL ENTITY	
RATE	ADDITIONAL FEE	OR	RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

C

8-13-04

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 26	Minus	** 38	=
Independent	* 6	Minus	*** 10	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE	OR	RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE	OR	RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. 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.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/718,007	11/21/2000	Xi Jiang	705835US1RAF	9318

7590 10/19/2004

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EXAMINER	
D AGOSTA, STEPHEN M	

ART UNIT	PAPER NUMBER
2683	

DATE MAILED: 10/19/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)	
	09/718,007	JIANG, XI	
	Examiner	Art Unit	
	Stephen M. D'Agosta	2683	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 August 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *7,8,10-22,24 and 28-37* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *7-8, 10, 17, 18, 21-22, 24 and 28-37* is/are rejected.

7)☒ Claim(s) *11-16,19 and 20* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

Applicant's arguments filed 8-13-2004 have been fully considered but they are not persuasive.

1. In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the examiner shows that LIU teaches steps B, D and E while being silent on steps A and C – Lyons remedies storing predetermined stations/data for specific coverage areas, Jones teaches tracking a vehicle on a predetermined route and Bruggeman teaches route navigation as well. All the art cited deals with mobile RF communications. The prior art is combined to overcome Liu's deficiencies while enhancing his overall "core teachings", hence the motivation to combine is valid. Lastly, Lyons teaches "processing" at the mobile unit (see figure 3 which shows a database #12 and processor #112).

2. In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

3. The applicant argues none of the references in total teach the claims – the examiner disagrees. Firstly, the applicant continues to dismiss Liu's teachings whereby quality of service is provided to the user as he/she roams (C5, L6-16) thereby disclosing the ability to provide a suitable (eg. preferred) communications link. Liu teaches processing in the network and Lyons teaches processing in the mobile, hence one skilled can provide processing at either location. Secondly, the references are not "fundamentally inappropriate" since Lyons teaches keeping a database of listener-preferred stations (C1, L54 to C2, L6) which reads on selecting an appropriate station/comm. link while Liu discloses use of QoS which inherently provides the user with the most preferred link possible.

4. The applicant argues that Bruggeman does not remedy deficiencies (page 17). The examiner disagrees since Bruggeman teaches motor vehicle information as does Jones. Hence, one skilled would use the disclosures cited to remedy Liu's deficiencies (eg. Bruggeman's predetermined route and Jones' route tracking via GPS with cellular systems).

5. The applicant argues that Liu fails to teach the features for which it is cited. The examiner disagrees – Liu teaches QoS service which provides an "appropriate link" to a user as they roam (C5, L6-16) and Lyons teaches processing on a mobile "device". Also, both Bruggeman and Jones teaches vehicle navigation assistance which reads on use of a preferred/predetermined route (and Lyons teaches preferred/predetermined station presets).

6. The applicant argues that Liu does not teach switching between communication options. The examiner disagrees since Liu provides QoS (C5, L6-16) which inherently provides suitable/preferred communication links/options to a user (eg. QoS can provide both a link, eg. at 1Mbps, as well as high priority throughput of this data stream over other users) which reads on the claim. The applicant again dismisses Liu's teaching, of ATM for example C4, L60-67, which provides both data rate and class of service thereby reading on "communication options". Lastly, since Liu discloses a cellular/wireless system, boundaries will be crossed whereby a user may lose their current link/class of service and will be required to chose from the newly available ones (which overcomes the applicant's argument on page 20).

7. The objected to material has been pointed out by the examiner and the previous rejection is included for informational purposes only.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 7-8 and 10 rejected under 35 U.S.C. 103(a) as being unpatentable over Liu, Jones and Bruggemann and further in view of Lyons US 6,282,412.

As per **claim 7**, Liu teaches a mobile device with method for selecting which in a plurality of wireless communication options will be used by the mobile device comprising the steps of:

B. determining at the mobile where on the route the mobile device is as it traverses the route (abstract)

D. determining whether to switch from a first one of the wireless communication options presently being used to a second one when the device approaches a boundary of a coverage area (abstract)

E. switching from the first wireless option to a second one when the mobile crosses the boundary if the determination was made to switch to the second option (abstract and figures 20-23, 25a/25b show options).

But is silent on

c. accessing a database to obtain information regarding the communication options available along the route

A. storing in a database mobile information indicative of coverage areas for each of the plurality of wireless options along the route the mobile will traverse including storing boundary locations of the coverage areas for the wireless options along the route where the boundary locations stored are limited to boundary locations that are on streets of the route;

wherein one of the plurality of wireless options is not using any wireless communication.

Liu does teach the system having knowledge of the coverage areas the mobile is near (C1, L58-67 to C2, L10). **Lyons** teachs a receiver with memory card to store information concerning a determined number of broadcast stations that serve at least a portion of a user-designated geographic area, and which have a program style that suits a designated user preference. Information corresponding to each station's operating or carrier frequency and an associated service coverage area, is stored by the card (C2, L33-44). If a preference isn't found, the user always has the option of not using wireless communications or a specific option requested.

Jones teaches tracking a vehicle on a predetermined schedule/route based on GPS tracking and cellular system (abstract and figure 1) while **Bruggemann** teaches

transponders suitable for a navigation system for motor vehicles in which a predetermined route, or desired destination, is stored in a navigation apparatus of each vehicle by means of an input device. In the respective transponders, in this case, directional information and/or street names, can be stored which are read by navigational apparatus of vehicles and compared with desired data C5, L61-67 to C6, L1-2).

Liu teaches knowledge of network services and resources (eg. coverage areas) the mobile user is near or moving toward (abstract) **but is silent on** a database. **Jones** teaches the storage device (eg. database) includes historical travel data pertaining to the vehicle schedule along the route. The historical travel data comprises a plurality of predetermined location values corresponding respectively with a plurality of locations along a predetermined route of travel of the mobile vehicle. The predetermined location values are respectively associated with time values stored in the storage device. The processor uses one of the plurality of predetermined location values (along with its associated time value), a current time, and a current location value received from the sensor to determine whether the vehicle is off schedule. If the vehicle is off schedule by at least a predefined amount, the processor causes the communications device to transmit a message to a remote computer, associated with a tracking system or an advance notification system, indicating that the vehicle is off schedule by a specified time and/or distance (C3, L7-32).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that route/coverage data is stored in the mobile AND a database is used, to provide means for storing all possible data regarding route/coverage information for a trip route.

As per **claim 8**, Liu teaches claim 7 and a "soft data structure handover" (abstract) which reads on the claimed limitation (connection to second system before dropping connection to first system).

As per **claim 10**, Liu teaches claim 7 **but is silent on** further including obtaining updated information concerning the coverage areas of the wireless communication options and updating the database with updated information.

Liu teaches a cellular system which inherently is aware of it's own coverage areas/cells.

Bruggemann teaches transponders that are set in pavement for vehicle navigation (abstract and figures). One skilled in the art knows that as new pavement transponders are added to new pavement locations, the system will receive this new data and update it's database.

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that updated data can be received and stored, to provide means for newly received data to be stored in the device/system as the user roams.

Claims 17-18, 21, 28-33 and 36-37 rejected under 35 U.S.C. 103(a) as being unpatentable over Liu US 5,825,759 and further in view of Jones US 6,363,323 or Bruggemann US 5,493,291 and Andersson et al. US 5,530,917 or Mueller (hereafter Liu, Anderson and Jones or Bruggemann or Mueller (claim 21)).

As per **claim 17**, Liu teaches a method of storing data in a database that is indicative of coverage areas for wireless communication options along a route that a mobile communication device is traversing, comprising the steps of:

a) storing boundary locations of the coverage areas for the wireless communication options along the route in the database

b) periodically obtaining updated information at the location of the mobile concerning the coverage areas of the wireless options as the mobile device traverses the route (abstract).

but is silent on

c) updating the database with updated information AND where the boundary locations are boundary locations on streets of the route

Jones teaches the storage device (eg. database) includes historical travel data pertaining to the vehicle schedule along the route. The historical travel data comprises a plurality of predetermined location values corresponding respectively with a plurality of locations along a predetermined route of travel of the mobile vehicle (C3, L7-32).

Bruggemann teaches described transponders can be set in the roadway pavement for a navigation system for motor vehicles in which a predetermined route, or desired destination, is stored in a navigation apparatus of each vehicle by means of an input device. In the respective transponders, in this case, directional information and/or **street names**, can be stored which are read by navigational apparatus of vehicles passing over and compared with desired data (C5, L61-67 to C6, L1-2).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that the database is updated with boundary/street locations, to provide means for the user to know when they are approaching a boundary/handoff and the street name associated with said boundary.

As per **claim 18**, Liu teaches claim 17 wherein the step of updating includes determining whether the updated information is for a present location,

a) if the updated information is for a present location, then storing the updated information

b) if the updated information is for a present location, comparing the updated information updating the stored information if updated information is different from the stored information (abstract and C2, L11-43 teaches knowledge of multiple networks).

But is silent on a database.

Jones teaches the storage device (eg. database) includes historical travel data pertaining to the vehicle schedule along the route. The historical travel data comprises a plurality of predetermined location values corresponding respectively with a plurality of

locations along a predetermined route of travel of the mobile vehicle. The predetermined location values are respectively associated with time values stored in the storage device. The processor uses one of the plurality of predetermined location values (along with its associated time value), a current time, and a current location value received from the sensor to determine whether the vehicle is off schedule. If the vehicle is off schedule by at least a predefined amount, the processor causes the communications device to transmit a message to a remote computer, associated with a tracking system or an advance notification system, indicating that the vehicle is off schedule by a specified time and/or distance (C3, L7-32).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that a database is used, to provide means to store all pertinent route/option data in a commercial database software package.

As per **claims 21, 28-29**, Liu teaches a method of selecting which of a plurality of wireless communication options will be used by a mobile device, comprising the step of selecting which wireless communication option to use based on a location of the mobile communication device on a route and the availability for use of each of the plurality of wireless communication options along the route (abstract) – periodically obtaining updated information at the location of the mobile device (abstract).

But is silent on the route (eg. being known beforehand).

Jones teaches tracking a vehicle on a predetermined schedule/route based on GPS tracking and cellular system (abstract and figure 1) while **Bruggemann** teaches transponders suitable for a navigation system for motor vehicles in which a predetermined route, or desired destination, is stored in a navigation apparatus of each vehicle by means of an input device. In the respective transponders, in this case, directional information and/or street names, can be stored which are read by navigational apparatus of vehicles and compared with desired data (C5, L61-67 to C6, L1-2).

With further regard to claim 21, Lie **is silent on** determining which option to use and when to use it includes making determination based upon the cost to use and performance level of each option AND wherein one option is not using any wireless communcations. Mueller teaches a mobile station with memory device in which a number of available applications are stored which can relate to different "carriers," i.e., mobile radio network systems or service providers within a single mobile radio network. A selection device of the mobile station calculates expected charges for a desired connection for each of these applications which are being considered for the transmission connection. Based upon the calculations, the most cost-efficient application for the desired transmission is selected. The actual transmission of the communication data for the base station is then carried out on the basis of this application (Abstract).

With further regard to claim 28, Liu teaches cellular networks which are known in the art to have cell base stations/towers near roadways and highways (Liu also discloses data connectivity to the Internet, figure 18, which can be via wireless LAN technology (IEEE 802.11) which provides high bandwidth and limited geographical

coverage). Since Liu teaches mobile data networking and connectivity to the Internet (figure 18), the content provider would respond back to the mobile user via an appropriate base station for full duplex communication via the TCP/IP protocol.

With further regard to claim 29, Liu teaches a system that uses a predictive mobility algorithm to determine where a mobile user is likely to be (which reads on determining a predicted time when the vehicle will be able to communicate with an info-fueling station* having a known/predictable position) [abstract].

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that the route is known beforehand, to provide means for inputting the route a user is to take so the device can track progress and inform the user if they are off course.

Andersson teaches base stations can be fixed or mobile (C20, L61-65) as can be wireless LAN systems if mounted on a mobile object.

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that the info-fueling station/base station is movable, to provide means for the station to be moved/relocated as needed for optimal RF communications.

*the examiner interprets an "info-fueling station" as a generic server that is connected to a localized high-speed wireless network (such as an IEEE802.11 network).

As per **claim 30**, Liu teaches claim 29 **but is silent on** wherein said info-fueling station has a fixed position relative to vehicles.

Bruggemann teaches roadway transponders that can allow the vehicle to determine it's location and the location of fixed objects (eg. traffic speed sign of figure 2, a transponder is built into a roadway pavement near a speed limit traffic sign. Information corresponding to that of the traffic sign 17 is stored in the memory 8 of the transponder 1. If a vehicle 13 with a coil antenna 14 drives over the transponder 1 then energy is transferred to the transponder 1 via the coil antenna 14 so that it, the transponder, is activated and sends out its stored, or memorized, information as a digital code signal. This energy transfer can be caused by a changing magnetic field at the transponder. The transponder information is received by the coil antenna 14 so that, via the read-out device 4 and the analyzing circuit 15, the information of the traffic sign 17 is shown on the indicating device) [C3, L50-67 to C4, L1-2].

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that an info-fueling station has a fixed position, to provide means for the station to always be at a known, fixed location the user can roam to for data.

As per **claim 31**, Liu teaches claim 29, **but is silent on** an information request identifies said info-fueling station.

Liu does teach a predictive mobility algorithm that can determine where the mobile is likely to be.

Bruggemann teaches roadway transponders that can provide pinpoint accuracy as to the location of the user [C3, L50-67 to C4, L1-2]. While Bruggemann teaches a passive transponder that must be driven over, one skilled in the art would also use an information request and/or a GPS query for location information).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that an information request is used to identify the info-fueling station, to provide means for manual (and/or automatic) determination of a station.

As per **claim 32**, Liu teaches claim 29, **but is silent on** the wireless network identifies said info-fueling station.

Liu does teach a predictive mobility algorithm that can determine where the mobile is likely to be.

Bruggemann teaches roadway transponders that can provide pinpoint accuracy as to the location of the user AND fixed objects such as traffic speed signs, etc. and one skilled in the art would also provide means for identifying any other object (eg. info-fueling station) [C3, L50-67 to C4, L1-2].

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that the wireless network identifies the info-fueling station, to provide manual (or automatic) determination of the location/identity of said info-fueling station via the wireless network.

As per **claim 33**, Liu teaches claim 29, **but is silent on** the wireless device being coupled to an on-board communication network in said vehicle.

Bruggemann teaches an on-board communication network/system in a vehicle (abstract and figure 2).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that the wireless device is onboard a vehicle, to provide a system for use within a car/vehicle.

As per **claim 36**, Liu teaches claim 29 **but is silent on** a movable info-fueling station.

Andersson teaches base stations can be fixed or mobile (C20, L61-65) as can be wireless LAN systems if mounted on a mobile object.

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that the info-fueling station is movable, to provide means for the station to be moved/relocated as needed for optimal RF communications.

Claim 22 rejected under 35 U.S.C. 103(a) as being unpatentable over Liu, Jones, Bruggemann and Andersson and further in view of Mueller et al. US 6,185,413 (hereafter Mueller).

As per **claim 22**, Liu teaches claim 21 **but is silent on** determining cost of each wireless system.

Mueller teaches a mobile station with memory device in which a number of available applications are stored which can relate to different "carriers," i.e., mobile radio network systems or service providers within a single mobile radio network. A selection device of the mobile station calculates expected charges for a desired connection for each of these applications which are being considered for the transmission connection. Based upon the calculations, the most cost-efficient

application for the desired transmission is selected. The actual transmission of the communication data for the base station is then carried out on the basis of this application (Abstract).

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that cost is determined for each system, to provide means for the user to know the cost associated with each system it can connect with.

Claim 24 rejected under 35 U.S.C. 103(a) as being unpatentable over Liu in view of Mueller and Wieczorek.

As per **claim 24**, Liu teaches a method of providing a uniform content access layer application program interface for application programs that use mobile communications provided by a mobile device (abstract and figures 18-25b) **but is silent on** comprising the steps of:

a) providing a database accessible by the application program at the mobile device

b) storing in the database information concerning wireless options that are available for use by the mobile communication device as it traverses a route

c) the application program deciding its requirements for data transfer via wireless communication based on the information about wireless communications stored in the database and wherein the information about options stored in the database includes information concerning cost and performance of the options.

Mueller teaches a mobile station having a number of applications that chooses a wireless network based on least cost and a database (abstract and figure 1, #18). **Wieczorek** teaches a method for optimizing resource allocation that chooses a wireless network based on loading conditions/data transfer capability (abstract). One skilled in the art would provide for Mueller's program to also decide based on system loading.

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that an application program can access a database and decide requirements for communication, to provide means for the application to determine which network(s) can provide the optimal data transfer.

Claim 34 rejected under 35 U.S.C. 103(a) as being unpatentable over Liu, Jones, Bruggemann and Andersson and further in view of Bottomley.

As per **claim 34**, Liu teaches claim 29 and the ability to pre-arrange for communications when a mobile user roams freely (abstract) which reads on the entire claim except for the fact of **being silent on** signal strength.

Bottomley teaches measuring signal strength for determining a hand-off condition which can be used on several access technologies/systems (ie. FDMA, TDMA and CDMA) [title and abstract].

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that signal strength is used, to provide means of knowing when a handoff will occur based on signal strength.

Claim 35 rejected under 35 U.S.C. 103(a) as being unpatentable over Lie, Jones, Bruggemann and Andersson and further in view of Baker US 6,505,046 (hereafter Baker).

As per **claim 35**, Liu teaches claim 29 **but is silent on** the wireless network routes previously stored requests for information to said vehicle through said info-fueling station.

Baker teaches a short message service center is a specialized computer system that accepts short message requests from various network entities. The message requests are stored and forwarded to various subscribers when they become available in the network (i.e., they turn their phone on) [C6, L56-61].

It would have been obvious to one skilled in the art at the time of the invention to modify Liu, such that previously stored requests are routed, to provide means for storing (and not deleting) requests that cannot be delivered.

Allowable Subject Matter

Claims 11-16 and 19-20 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

In the examiner's opinion, these claims recite highly specific design details not found in the prior art cited.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the

shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Stephen M. D'Agosta whose telephone number is 703-306-5426. The examiner can normally be reached on M-F, 8am to 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bill Trost can be reached on 703-308-5318. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Stephen D'Agosta

WILLIAM TROST
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600

Index of Claims

Application No.	Applicant(s)
09/718,007	JIANG, XI
Examiner	**Art Unit**
Stephen M. D'Agosta	2683

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

Claim		Date
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App. Ser. No. 09/718,007
Atty. Dkt. No.: 037188/50414MI
PATENT

Reply Under 37 C.F.R. § 1.116
Expedited Procedure
Technology Center 2683

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	XI JIANG	Conf. No.	9318
Serial No.:	09/718,007	Group Art Unit:	2683
Filed:	NOVEMBER 21, 2000	Examiner:	STEPHEN D'AGOSTA

Title: **ROUTE-BASED COMMUNICATION PLANNING ARCHITECTURE AND METHOD FOR WIRELESS COMMUNICATION**

Customer No. 23911

AFTER-FINAL AMENDMENT
PURSUANT TO 37 C.F.R. § 1.116

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Entry of the following amendments and consideration of the following remarks in response to the Final Office Action mailed October 19, 2004, for which the three month response due date is January 19, 2004, is respectfully requested.

Requested Amendments to the Claims begin on page 2 of this paper.

Remarks begin on page 10 of this paper.

IN THE CLAIMS:

Entry of the following amendments is respectfully requested in order to place the present Application in condition for allowance:

1-10. (canceled)

11. (currently amended) ~~The method of Claim 10~~ A method of selecting which of a plurality of wireless communication options will be used by a mobile communication device, comprising the steps of:

(a) storing in a database information indicative of coverage areas for the wireless communication options along a route that the mobile communication device will be traversing, including storing boundary locations of the coverage areas for the wireless communication options along the route where the boundary locations stored are limited to boundary locations that are on streets of the route;

(b) determining at the mobile communication device where on the route that the mobile communication device is at as it traverses the route;

(c) accessing the database to obtain information regarding the communication options available along the route,

(d) determining whether to switch from a first one of the wireless communication options presently being used to a second one of the wireless communication options when the mobile communication device approaches a boundary of a coverage area of one of the wireless communication options based on the wireless communication options available once the boundary is crossed and those that will be available further along the route;

(e) switching from the first one of the wireless communication options to the second one of the wireless communication options if the determination was made to switch to that second one of the wireless communication options; and

(f) obtaining updated information concerning the coverage areas of the wireless communication options and updating the database with the updated information,

wherein one of the plurality of wireless communication options is not using any wireless communication, and

wherein the step of obtaining updated information concerning the coverage areas of the wireless communication options ~~10~~ includes obtaining this information from providers of the wireless communication options.

12. (currently amended) ~~The method of Claim 10~~ A method of selecting which of a plurality of wireless communication options will be used by a mobile communication device, comprising the steps of:

(a) storing in a database information indicative of coverage areas for the wireless communication options along a route that the mobile communication device will be traversing, including storing boundary locations of the coverage areas for the wireless communication options along the route where the boundary locations stored are limited to boundary locations that are on streets of the route;

(b) determining at the mobile communication device where on the

route that the mobile communication device is at as it traverses the route;

(c) accessing the database to obtain information regarding the communication options available along the route,

(d) determining whether to switch from a first one of the wireless communication options presently being used to a second one of the wireless communication options when the mobile communication device approaches a boundary of a coverage area of one of the wireless communication options based on the wireless communication options available once the boundary is crossed and those that will be available further along the route;

(e) switching from the first one of the wireless communication options to the second one of the wireless communication options if the determination was made to switch to that second one of the wireless communication options; and

(f) obtaining updated information concerning the coverage areas of the wireless communication options and updating the database with the updated information,

wherein one of the plurality of wireless communication options is not using any wireless communication, and

wherein the step of obtaining updated information concerning the coverage areas of the wireless communication options includes the mobile communication device monitoring signal strengths of the wireless communication options as it passes through the coverage areas for the wireless communication options and developing updated information concerning

coverage areas for the wireless communication options based on the monitored signal strengths of the wireless communication options.

13. (original) The method of Claim 12 wherein the step of updating the database with the updated information includes determining whether the updated information is for a location presently in the database,

(a) if the updated information is for a location not presently in the database, then storing the updated information in the database for the location;

(b) if the updated information is for a location presently in the database, comparing the updated information with the information stored in the database for the location and updating the stored information if updated information is different from the stored information.

14. (currently amended) ~~The method of Claim 10~~ A method of selecting which of a plurality of wireless communication options will be used by a mobile communication device, comprising the steps of:

(a) storing in a database information indicative of coverage areas for the wireless communication options along a route that the mobile communication device will be traversing, including storing boundary locations of the coverage areas for the wireless communication options along the route where the boundary locations stored are limited to boundary locations that are on streets of the route;

(b) determining at the mobile communication device where on the

route that the mobile communication device is at as it traverses the route;

(c) accessing the database to obtain information regarding the communication options available along the route,

(d) determining whether to switch from a first one of the wireless communication options presently being used to a second one of the wireless communication options when the mobile communication device approaches a boundary of a coverage area of one of the wireless communication options based on the wireless communication options available once the boundary is crossed and those that will be available further along the route;

(e) switching from the first one of the wireless communication options to the second one of the wireless communication options if the determination was made to switch to that second one of the wireless communication options; and

(f) obtaining updated information concerning the coverage areas of the wireless communication options and updating the database with the updated information,

wherein one of the plurality of wireless communication options is not using any wireless communication, and

wherein the step of updating the database with the updated information includes determining whether the updated information is for a location for which information is presently stored in the database,

(a) if the updated information is for a location not presently in the database, then storing the updated information in the database for the location;

(b) if the updated information is for a location presently in the database, comparing the updated information with the information stored in the database for the location and updating the stored information if updated information is different from the stored information.

15. (original) The method of claim 14, wherein the step of updating stored information comprises shifting the stored information toward the updated information by a parameter and replacing the stored information with the shifted stored information.

16. (original) The method of claim 15 wherein the step of updating the stored information comprises doing so with a running average method wherein the stored information is the running average of initial information and subsequent update information.

17-18. (canceled)

19. (currently amended) ~~The method of claim 18,~~ A method of storing data in a database that is indicative of coverage areas for wireless communication options along a route that a mobile communication device is traversing, comprising the steps of

(a) storing boundary locations of the coverage areas for the wireless communication options along the route in the database where the boundary

locations are boundary locations on streets of the route;

(b) periodically obtaining updated information at the location of the mobile communication device concerning the coverage areas of the wireless communication options as the mobile communication device traverses the route; and

(c) updating the database with the updated information,

wherein the step of updating the database with the updated information includes determining whether the updated information is for a location for which information is presently stored in the database,

(a) if the updated information is for a location not presently in the database, then storing the updated information in the database for the location;

(b) if the updated information is for a location presently in the database, comparing the updated information with the information stored in the database for the location and updating the stored information if updated information is different from the stored information, and

wherein the step of updating stored information comprises shifting the stored information toward the updated information by a parameter and replacing the stored information with the shifted stored information.

20. (currently amended) ~~The method of claim 18,~~ A method of storing data in a database that is indicative of coverage areas for wireless communication options along a route that a mobile communication device is traversing, comprising the steps of

(a) storing boundary locations of the coverage areas for the wireless communication options along the route in the database where the boundary locations are boundary locations on streets of the route;

(b) periodically obtaining updated information at the location of the mobile communication device concerning the coverage areas of the wireless communication options as the mobile communication device traverses the route; and

(c) updating the database with the updated information,

wherein the step of updating the database with the updated information includes determining whether the updated information is for a location for which information is presently stored in the database,

(a) if the updated information is for a location not presently in the database, then storing the updated information in the database for the location;

(b) if the updated information is for a location presently in the database, comparing the updated information with the information stored in the database for the location and updating the stored information if updated information is different from the stored information, and

wherein the step of updating the stored information comprises doing so with a running average method wherein the stored information is the running average of initial information and subsequent update information.

21-38. (canceled)

REMARKS

Claims 11-16 and 19-20 currently stand objected to, but allowable if amended into independent form incorporating the limitations of their respective independent and intervening claims. In order to advance this application to allowance, the Applicants are requesting amendment of the pending claims to place claims 11-16 and 19-20 into allowable form, and to cancel the remaining pending claims, without prejudice to the subject matter therein.

CONCLUSION

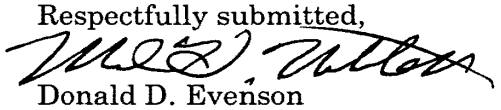
The Applicants respectfully request entry of the requested amendments and issuance of a Notice of Allowance for claims 11-16 and 19-20.

If there are any questions regarding this amendment or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket #037188.50414MI).

December 16, 2004

Respectfully submitted,



Donald D. Evenson
Registration No. 26,160
Mark H. Neblett
Registration No. 42,028

CROWELL & MORING, LLP
P.O. Box 14300
Washington, DC 20044-4300
Telephone No.: (202) 624-2500
Facsimile No.: (202) 628-8844

UNITED STATES PATENT AND TRADEMARK OFFICE

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NOTICE OF ALLOWANCE AND FEE(S) DUE

7590 01/13/2005

Crowell & Moring LLP
Intellectual Property Group
PO Box 14300
Washington, DC 20044-2500

EXAMINER	
D AGOSTA, STEPHEN M	
ART UNIT	**PAPER NUMBER**
2683	

DATE MAILED: 01/13/2005

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/718,007	11/21/2000	Xi Jiang	705835US1RAF	9318

TITLE OF INVENTION: ROUTE-BASED COMMUNICATION PLANNING ARCHITECTURE AND METHOD FOR WIRELESS COMMUNICATION

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1400	$0	$1400	04/13/2005

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE REFLECTS A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE APPLIED IN THIS APPLICATION. THE PTOL-85B (OR AN EQUIVALENT) MUST BE RETURNED WITHIN THIS PERIOD EVEN IF NO FEE IS DUE OR THE APPLICATION WILL BE REGARDED AS ABANDONED.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL should be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). Even if the fee(s) have already been paid, Part B - Fee(s) Transmittal should be completed and returned. If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PTOL-85 (Rev. 12/04) Approved for use through 04/30/2007.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (703) 746-4000

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

7590 01/13/2005

Crowell & Moring LLP
Intellectual Property Group
PO Box 14300
Washington, DC 20044-2500

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission
I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (703) 746-4000, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/718,007	11/21/2000	Xi Jiang	705835US1RAF	9318

TITLE OF INVENTION: ROUTE-BASED COMMUNICATION PLANNING ARCHITECTURE AND METHOD FOR WIRELESS COMMUNICATION

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1400	$0	$1400	04/13/2005

EXAMINER	ART UNIT	CLASS-SUBCLASS
D AGOSTA, STEPHEN M	2683	455-456000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are enclosed:
☐ Issue Fee
☐ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies _____

4b. Payment of Fee(s):
☐ A check in the amount of the fee(s) is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
☐ The Director is hereby authorized by charge the required fee(s), or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27. ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

The Director of the USPTO is requested to apply the Issue Fee and Publication Fee (if any) or to re-apply any previously paid issue fee to the application identified above.
NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/718,007	11/21/2000	Xi Jiang	705835US1RAF	9318

7590 01/13/2005

Crowell & Moring LLP
Intellectual Property Group
PO Box 14300
Washington, DC 20044-2500

EXAMINER	
D AGOSTA, STEPHEN M	

ART UNIT	PAPER NUMBER
2683	

DATE MAILED: 01/13/2005

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 580 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 580 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571) 272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at (703) 305-8283.

PTOL-85 (Rev. 12/04) Approved for use through 04/30/2007.

Notice of Allowability	Application No.	Applicant(s)	
	09/718,007	JIANG, XI	
	Examiner	Art Unit	
	Stephen M. D'Agosta	2683	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *amendment received 12-16-04*.

2. ☒ The allowed claim(s) is/are *11-16,19 and 20*.

3. ☒ The drawings filed on *11-24-03* are accepted by the Examiner.

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

DETAILED ACTION

Response to Arguments

The applicant's amendment received 12-16-04 overcomes the examiner's prior art rejection. **Claims 11-16 and 19-20 are allowed.**

Allowable Subject Matter

The following is an examiner's statement of reasons for allowance:

1. The applicant has amended per the examiner's direction, hence the claims are novel over the prior art of rejection in the examiner's opinion.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Stephen M. D'Agosta whose telephone number is 703-306-5426. The examiner can normally be reached on M-F, 8am to 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bill Trost can be reached on 703-308-5318. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Stephen D'Agosta
1-03-05

WILLIAM TROST
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600

Issue Classification	Application No.	Applicant(s)	
	09/718,007	JIANG, XI	
	Examiner	Art Unit	
	Stephen M. D'Agosta	2683	

ISSUE CLASSIFICATION

ORIGINAL			CROSS REFERENCE(S)						
CLASS	SUBCLASS	CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)						
455	456.1	455	414.2	432.1	552.1	553.1			
INTERNATIONAL CLASSIFICATION		370	310.2	331	338				
H04Q	7/20								
	/								
	/								
	/								
	/								

1-3-05
(Assistant Examiner) (Date)

(Legal Instruments Examiner) (Date)

WILLIAM TROST 1-5-05
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600
(Primary Examiner)

Total Claims Allowed: 8

O.G. Print Claim(s)	O.G. Print Fig.
1	2

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
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	2		32		62		92		122		152		182
	3		33		63		93		123		153		183
	4		34		64		94		124		154		184
	5		35		65		95		125		155		185
	6		36		66		96		126		156		186
	7		37		67		97		127		157		187
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	27		57		87		117		147		177		207
	28		58		88		118		148		178		208
	29		59		89		119		149		179		209
	30		60		90		120		150		180		210

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Corres. and Mail
BOX AF

IDW AF

App. Ser. No. 09/718,007
Atty. Dkt. No.: 037188/50414MI
PATENT

Reply Under 37 C.F.R. § 1.116
Expedited Procedure
Technology Center 2683

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	XI JIANG	Conf. No.	9318
Serial No.:	09/718,007	Group Art Unit:	2683
Filed:	NOVEMBER 21, 2000	Examiner:	STEPHEN D'AGOSTA

Title: **ROUTE-BASED COMMUNICATION PLANNING ARCHITECTURE AND METHOD FOR WIRELESS COMMUNICATION**

OK TO ENTER
1-3-05

Customer No. 23911

AFTER-FINAL AMENDMENT
PURSUANT TO 37 C.F.R. § 1.116

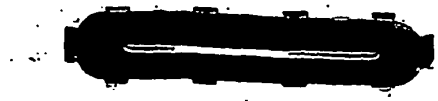
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Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Entry of the following amendments and consideration of the following remarks in response to the Final Office Action mailed October 19, 2004, for which the three month response due date is January 19, 2004, is respectfully requested.

Requested Amendments to the Claims begin on page 2 of this paper.

Remarks begin on page 10 of this paper.



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SEARCHED

Class	Sub.	Date	Exmr.
455	414.1	5-13-03	RO
	422		
	432.1		
	440		
	456		
	457		
	553.1		
370	310.2		
	331		
	338		
UPDATED SEARCH AS ABOVE		4-22-04	RO
455	552.1	1-3-05	RO
	414.2		

INTERFERENCE SEARCHED

Class	Sub.	Date	Exmr.
AS ABOVE		1-3-05	RO

SEARCH NOTES
(INCLUDING SEARCH STRATEGY)

	Date	Exmr.
Inventor Search + EAST + IDS Acr		

(RIGHT OUTSIDE)

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
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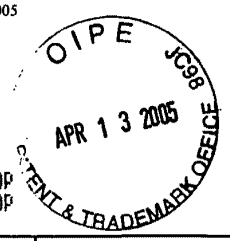
CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

7590 01/13/2005

Crowell & Moring LLP
Intellectual Property Group
PO Box 14300
Washington, DC 20044-2500

04/14/2005 MBEYENE2 00000132 09718007

01 FC:1501 1400.00 OP
02 FC:8001 15.00 OP



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I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (703) 746-4000, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/718,007	11/21/2000	Xi Jiang	705835US1RAF	9318

TITLE OF INVENTION: ROUTE-BASED COMMUNICATION PLANNING ARCHITECTURE AND METHOD FOR WIRELESS COMMUNICATION

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1400	$0	$1400	04/13/2005

EXAMINER	ART UNIT	CLASS-SUBCLASS
D AGOSTA, STEPHEN M	2683	455-456000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Crowell & Moring LLP
2
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: DaimlerChrysler Research and Technology North America, Inc.

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Palo Alto, California

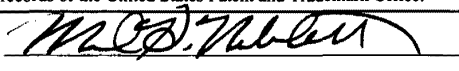
Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are enclosed:
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- ☐ Publication Fee (No small entity discount permitted)
- ☒ Advance Order - # of Copies 3

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- ☒ A check in the amount of the fee(s) is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☒ The Director is hereby authorized by charge the required fee(s), or credit any overpayment, to Deposit Account Number 05-1323 (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.
- ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

The Director of the USPTO is requested to apply the Issue Fee and Publication Fee (if any) or to re-apply any previously paid issue fee to the application identified above.
NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature  Date April 13, 2005

Typed or printed name Mark H. Neblett Registration No. 42,028

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	: 09/718,007	Confirmation No. :	9318
First Named Inventor	: Xi JIANG		
Filed	: November 21, 2000		
TC/A.U.	: 2683		
Examiner	: Stephen Dagosta		
Docket No.	: 705835US1RAF (037188.50414MI)		
Customer No.	: 23911		
Title	: Route-Based Communication Planning Architecture and Method for Wireless Communication		

SUBMISSION OF FORMAL DRAWINGS

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Sir:

Ten sheets of Formal drawings (showing Figs. 1-10) meeting the requirements of 37 C.F.R.§ 1.84 are hereby submitted.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any such fee or any deficiency in fees or credit any overpayment of fees to Deposit Account No. 05-1323, Docket No.: 037188.50414MI.

Respectfully submitted,

April 13, 2005

Jeffrey D. Sanok
Registration No. 32,169
Mark H. Neblett
Registration No. 42,028

CROWELL & MORING LLP
Intellectual Property Group
P.O. Box 14300
Washington, DC 20044-4300
Telephone No.: (202) 624-2500
Facsimile No.: (202) 628-8844
JDS:MHN:jjh

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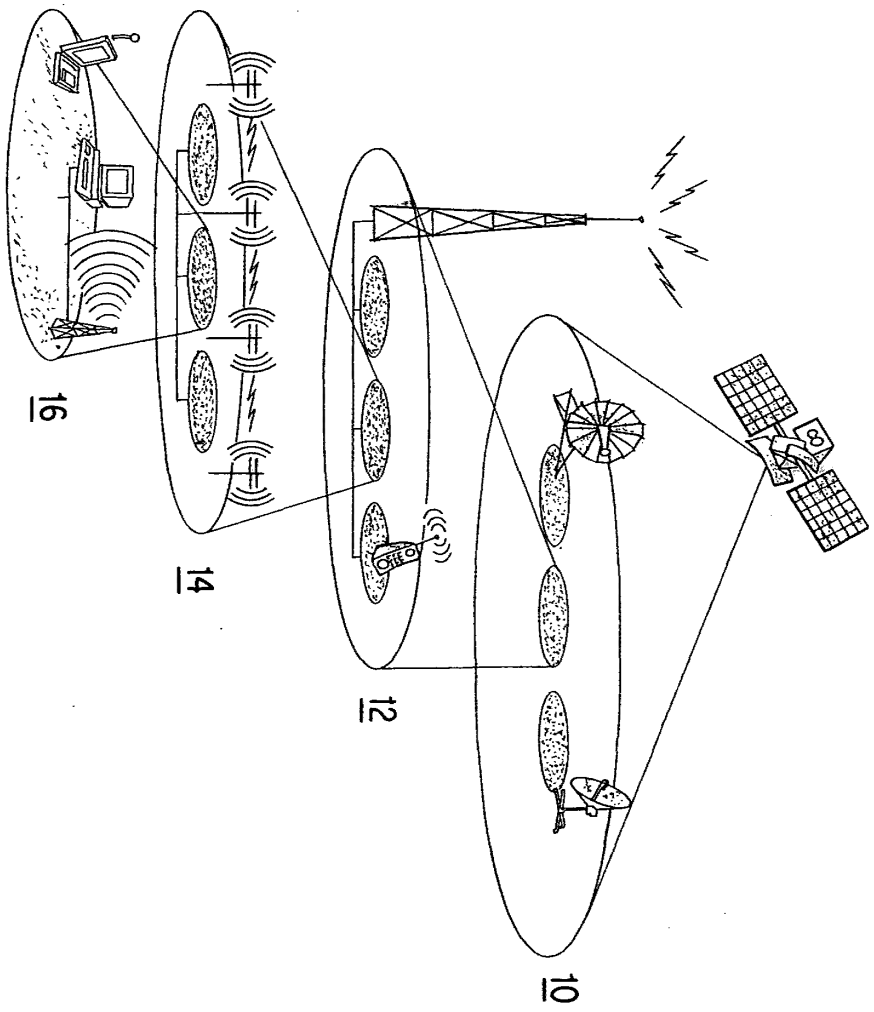


FIG. 1
Prior Art

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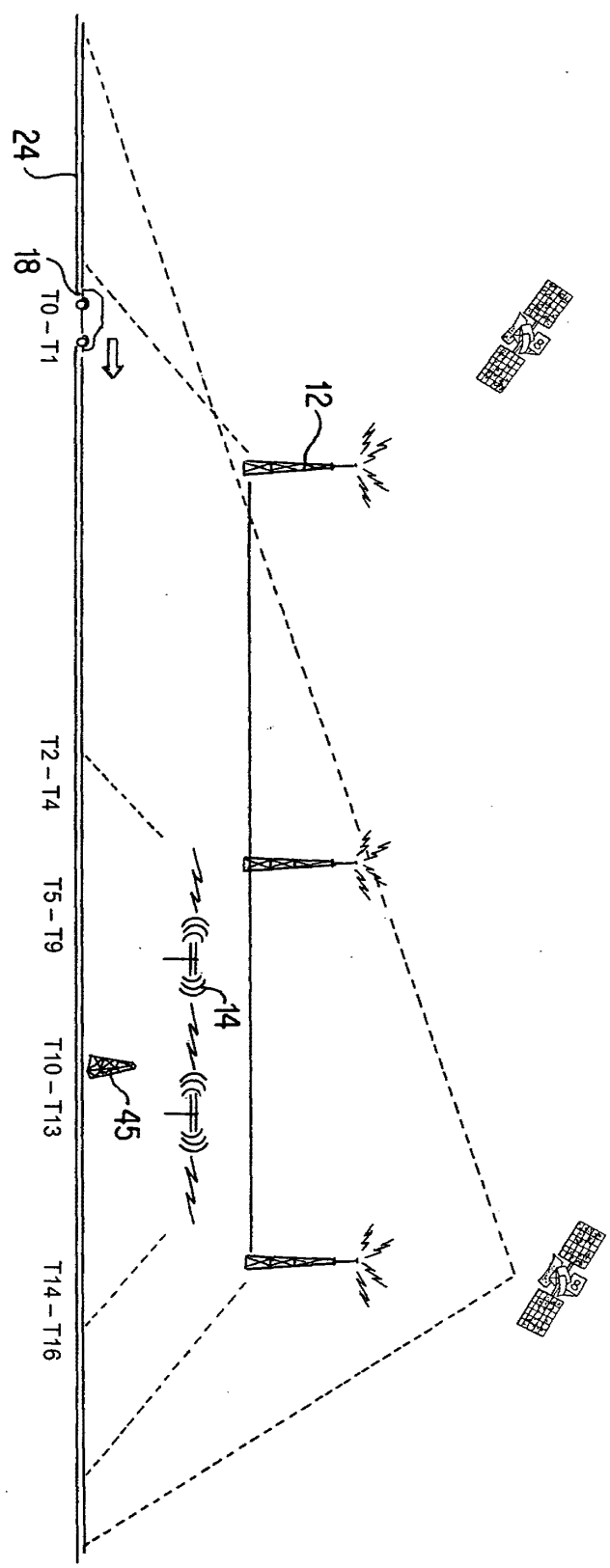


FIG. 2

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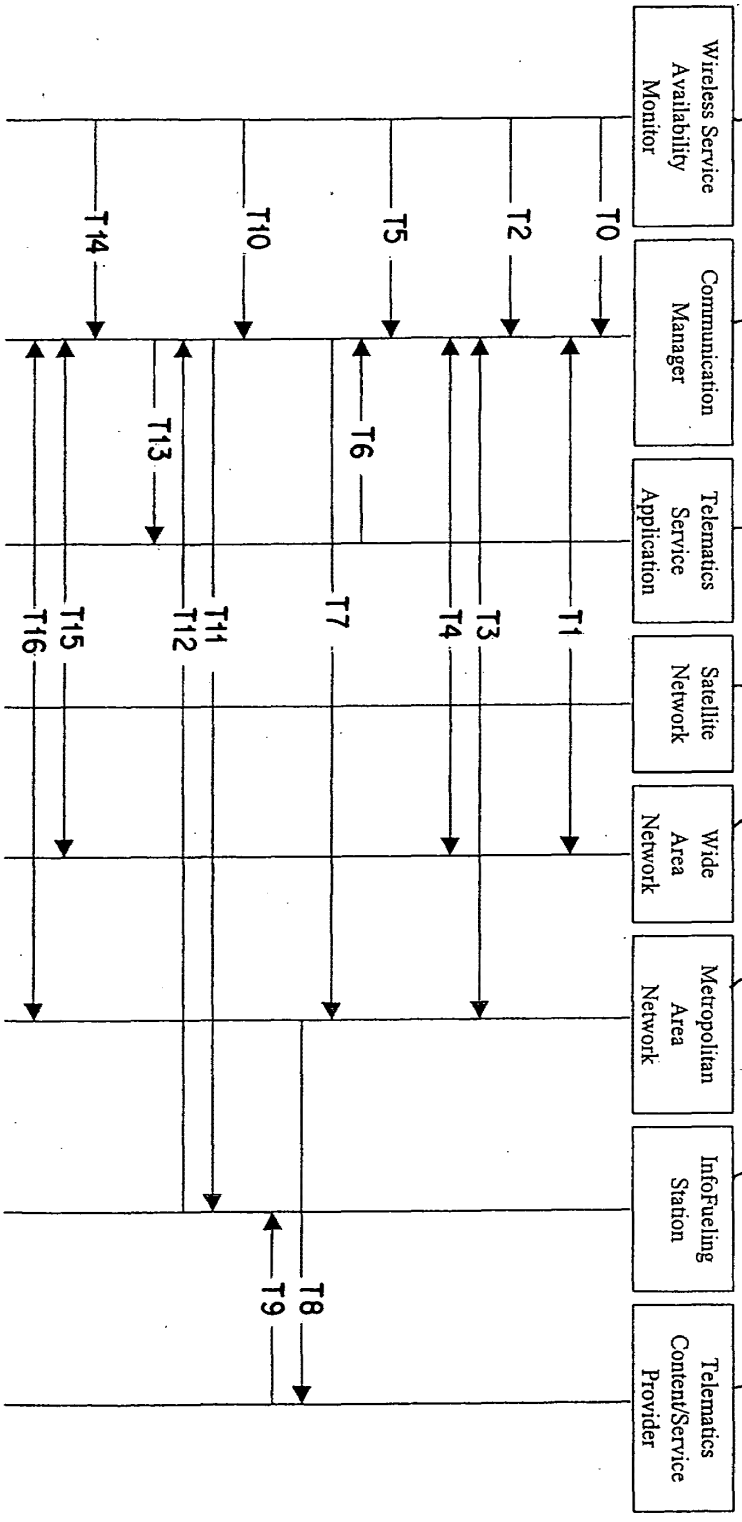


FIG. 3

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22

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<HW280, (x8,y8), MAN boundary>
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FIG. 4

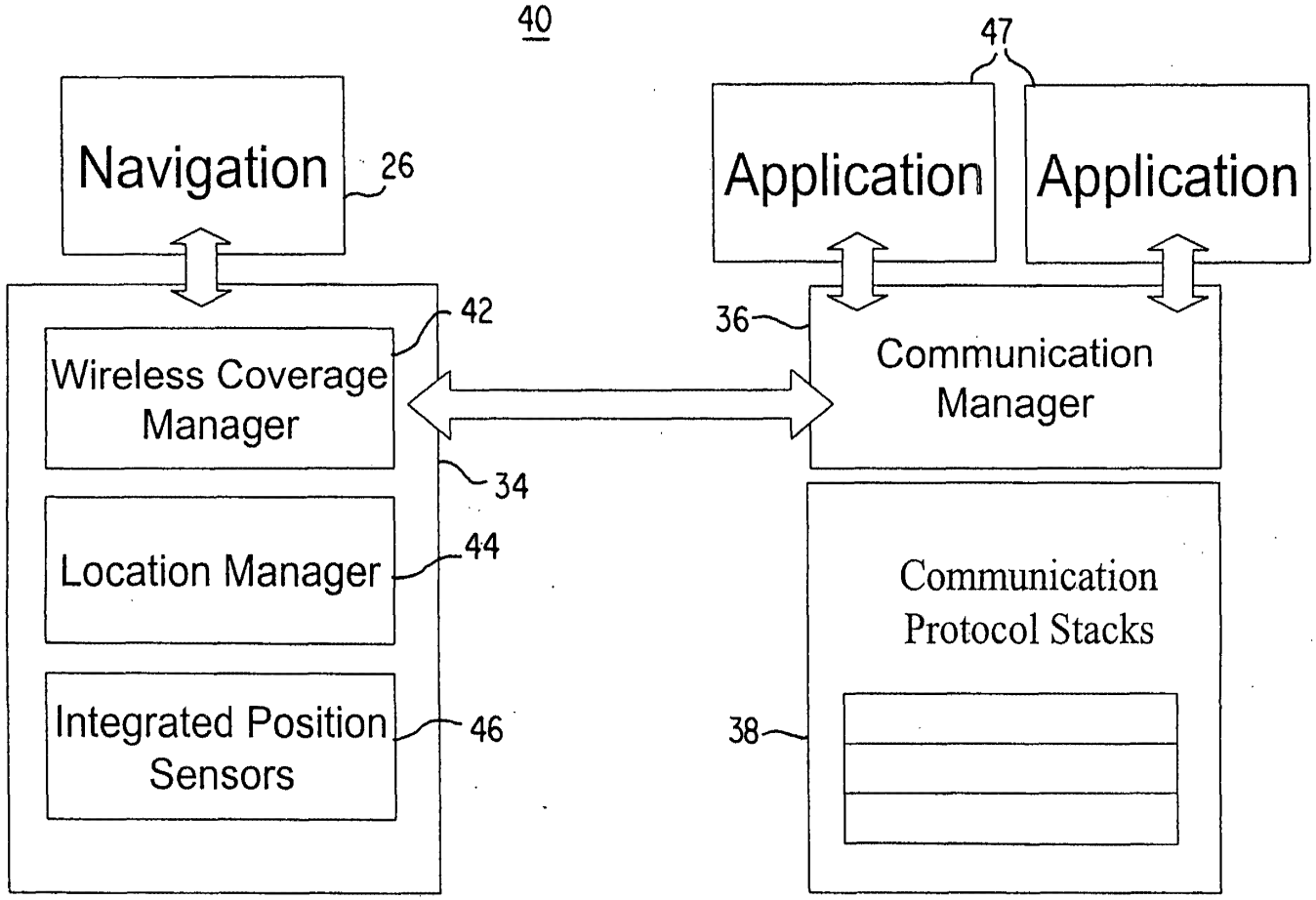


FIG. 5

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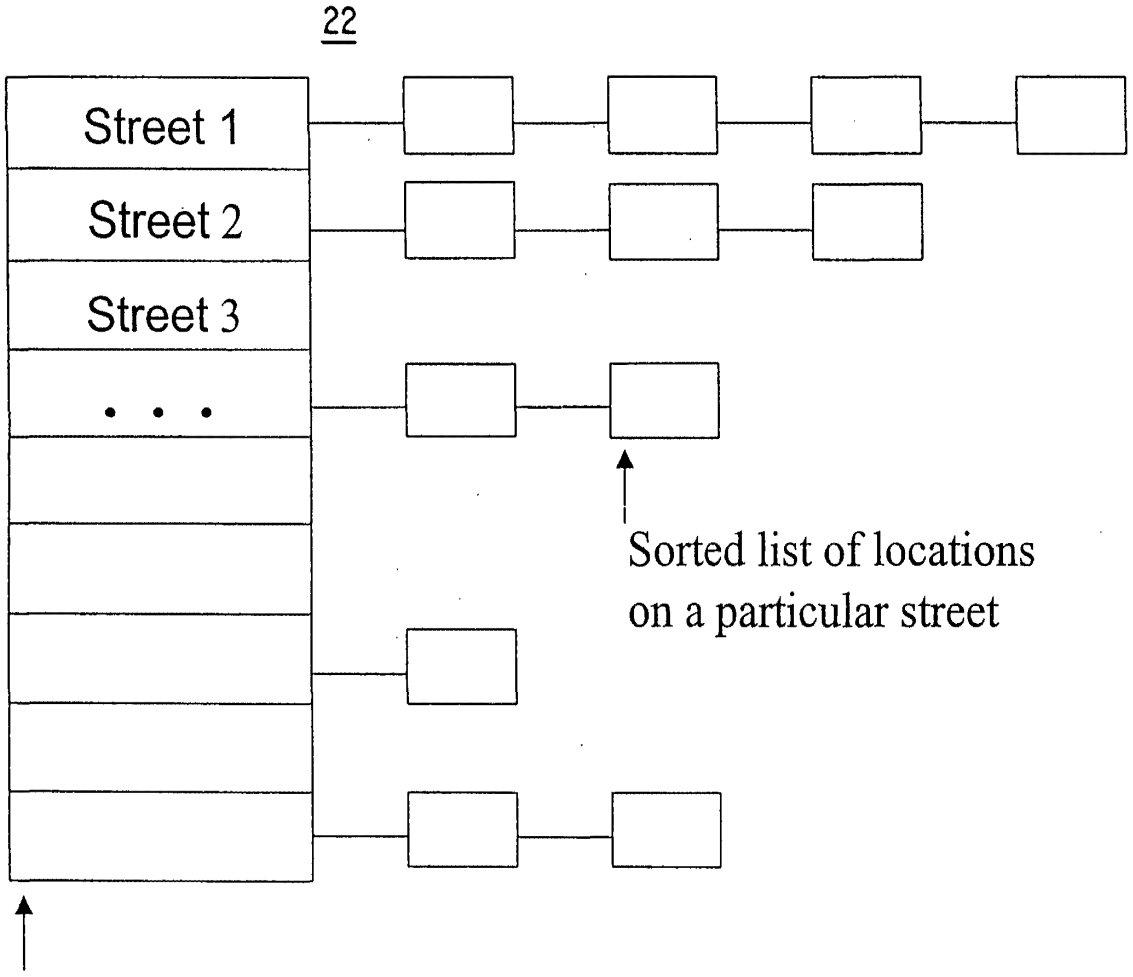


FIG. 6

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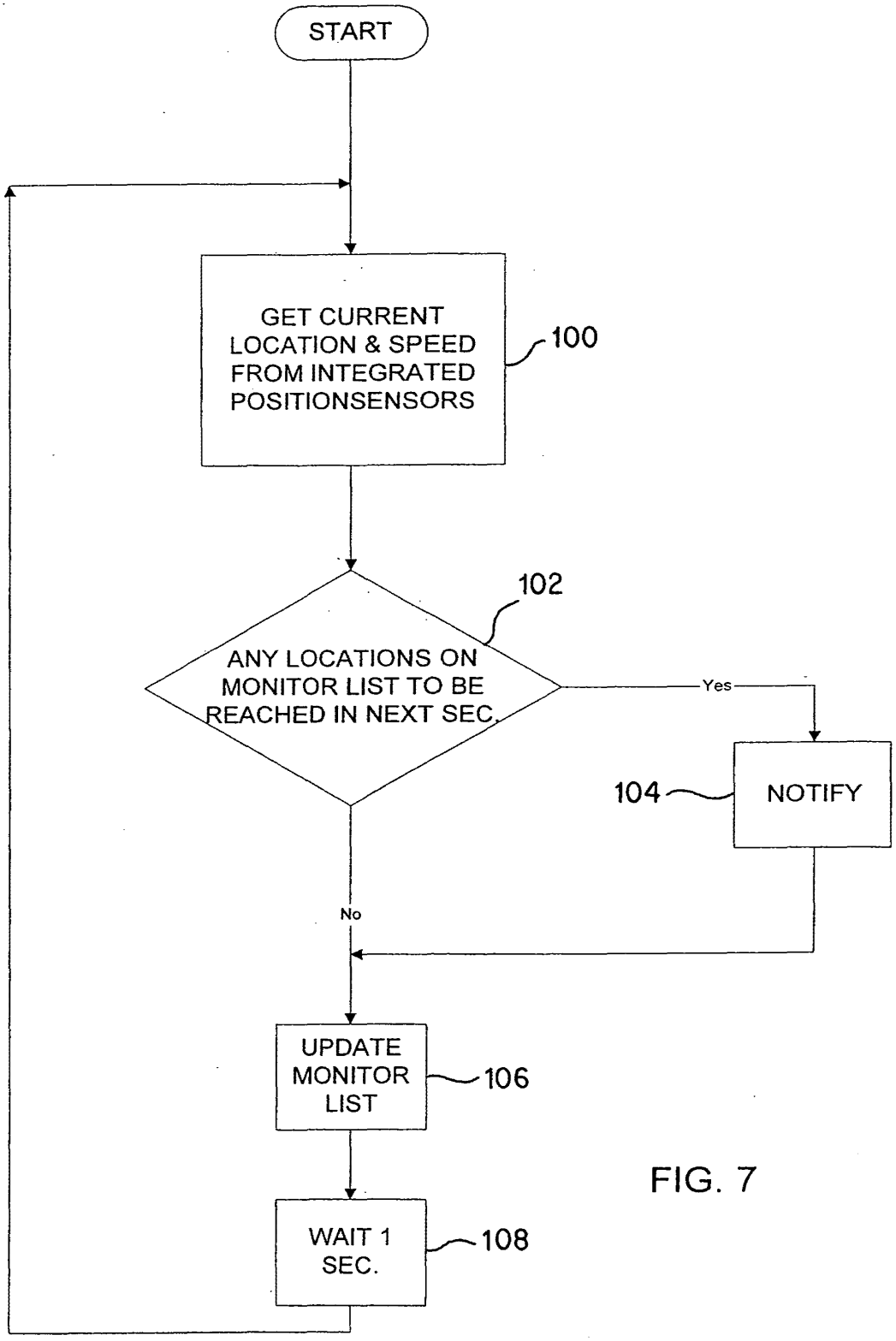


FIG. 7

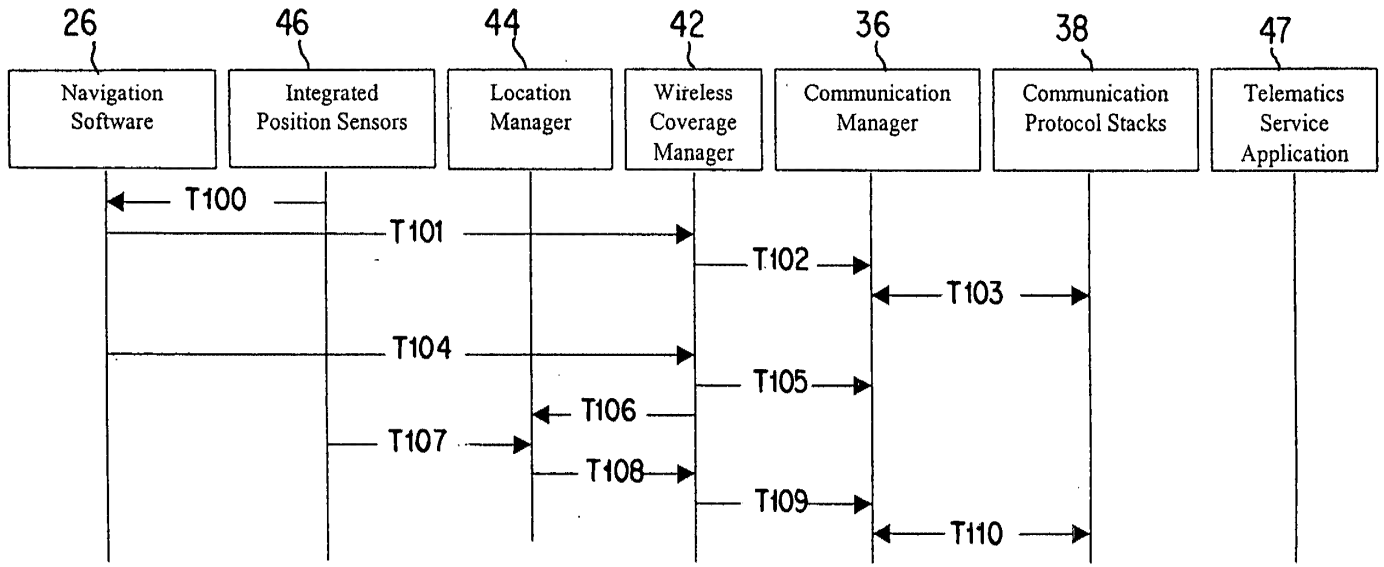


FIG. 8

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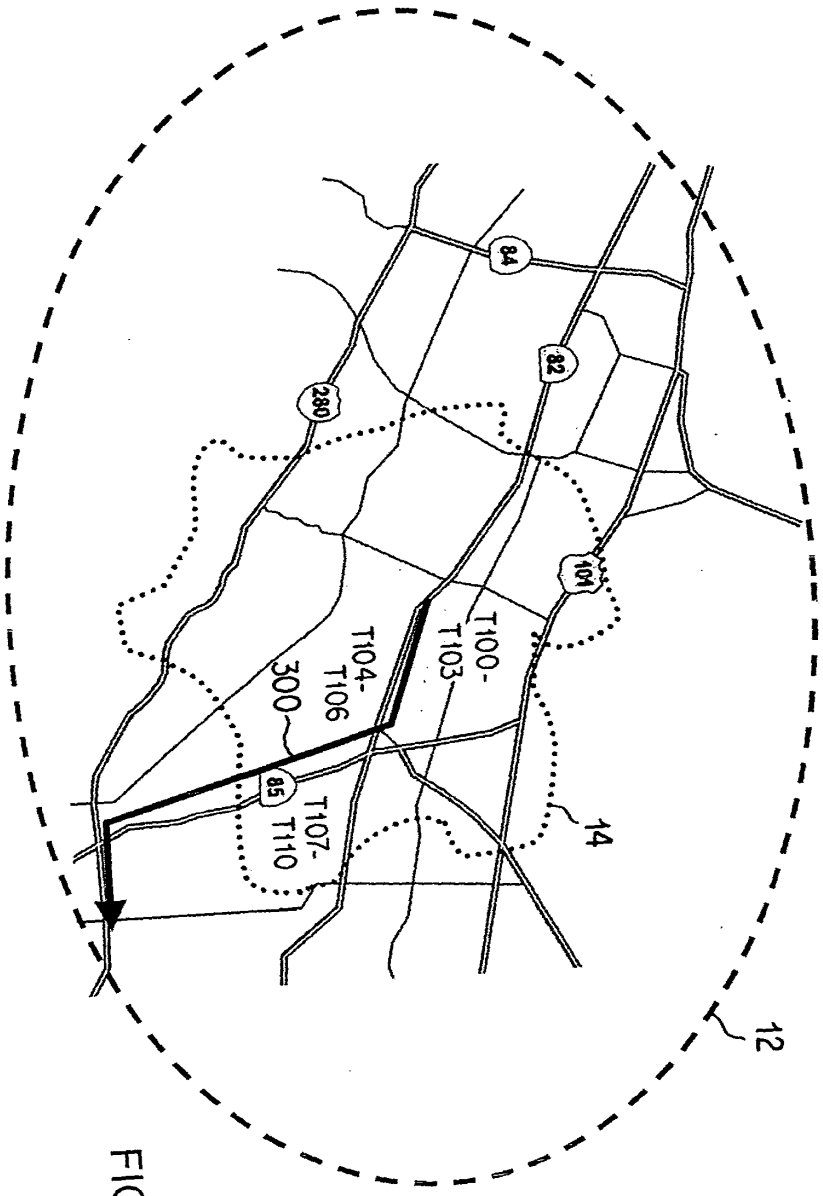


FIG. 9

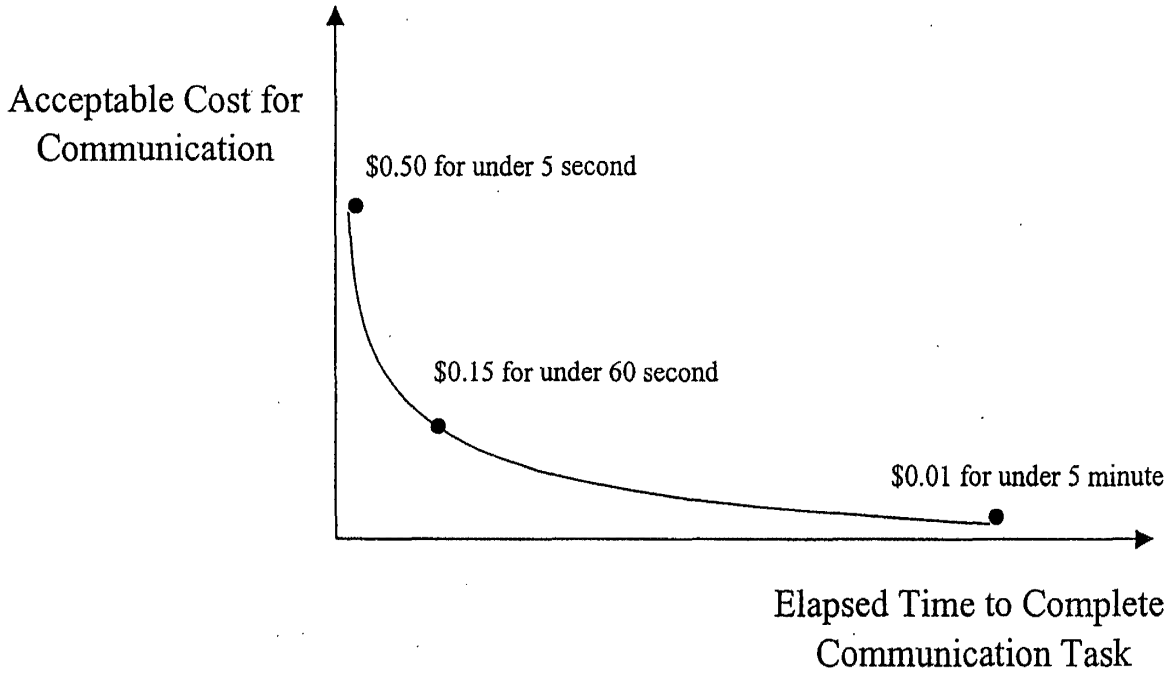


FIG. 10

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PTO/SB/80 (11-06)
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POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(b).

I hereby appoint:

☑ Practitioners associated with the Customer Number: 35690

OR

☐ Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used).

Name	Registration Number	Name	Registration Number

as attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(b).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(b) to:

☑ The address associated with Customer Number: 35690

OR

☐ Firm or Individual Name			
Address			
City		State	Zip
Country			
Telephone		Email	

Assignee Name and Address:

Burani Consulting Limited Liability Company
2711 Centerville Rd, Suite 400
Wilmington, Delaware U.S.A. 19808

A copy of this form, together with a statement under 37 CFR 3.73(b) (Form PTO/SB/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(b) may be completed by one of the practitioners appointed in this form if the appointed practitioner is authorized to act on behalf of the assignee, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

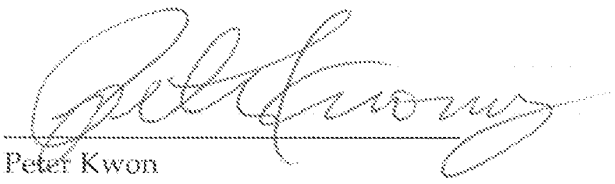
Signature		Date	1/3/2012
Name	Peter Kwon	Telephone	
Title	Authorized Person for Burani Consulting Limited Liability Company		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. 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 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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DECLARATION REGARDING AUTHORITY TO SIGN
ON BEHALF OF A LEGAL ENTITY
37 C.F.R. 3.73(b)(2)(i)

I, Peter Kwon (whose title is supplied below), hereby declare that I am authorized to sign documents on behalf of Burani Consulting Limited Liability Company.



Peter Kwon
Authorized Person for Burani Consulting Limited Liability Company

1/3/2013
Date

Electronic Acknowledgement Receipt	
EFS ID:	12297645
Application Number:	09718007
International Application Number:	
Confirmation Number:	9318
Title of Invention:	ROUTE-BASED COMMUNICATION PLANNING ARCHITECTURE AND METHOD FOR WIRELESS COMMUNICATION
First Named Inventor/Applicant Name:	Xi Jiang
Correspondence Address:	Crowell & Moring LLP Intellectual Property Group PO Box 14300 - Washington DC 20044-2500 US 202-624-2500 -
Filer:	Dean M. Munyon/Dawn DeLuca
Filer Authorized By:	Dean M. Munyon
Attorney Docket Number:	705835US1RAF
Receipt Date:	13-MAR-2012
Filing Date:	21-NOV-2000
Time Stamp:	22:00:49
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	Assignee showing of ownership per 37 CFR 3.73(b).	373b_combined.pdf	40339 1424de2a0ac2c4f5e07e7631892894a959e6eae4	no	3
Warnings:					
Information:					
2	Power of Attorney	POA_Drats.pdf	1077663 e9a6133225b81133a831365d7bb5e3aaeb74e5c5	no	2
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		Total Files Size (in bytes):	1118002		

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
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PTO/SB/96 (07-09)
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STATEMENT UNDER 37 CFR 3.73(b)

Applicant/Patent Owner: BURANI CONSULTING LIMITED LIABILITY COMPANY

Application No./Patent No.: 6898432 Filed/Issue Date: 05/24/2005

Titled: ROUTE-BASED COMMUNICATION PLANNING ARCHITECTURE AND METHOD FOR WIRELESS COMMUNICATION

BURANI CONSULTING LIMITED LIABILITY CO, a Limited Liability Company

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.

states that it is:

1. ☒ the assignee of the entire right, title, and interest in;

2. ☐ an assignee of less than the entire right, title, and interest in (The extent (by percentage) of its ownership interest is _____ %); or

3. ☐ the assignee of an undivided interest in the entirety of (a complete assignment from one of the joint inventors was made)

the patent application/patent identified above, by virtue of either:

A. ☐ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy therefore is attached.

OR

B. ☒ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: Xi Jiang To: Daimlerchrysler Research and Technology N

The document was recorded in the United States Patent and Trademark Office at
Reel 011640, Frame 0066, or for which a copy thereof is attached.

2. From: Daimlerchrysler Research and Technology N To: Daimlerchrysler Research, Engineering and D

The document was recorded in the United States Patent and Trademark Office at
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3. From: Daimlerchrysler Research, Engineering and D To: Mercedes-Benz Research & Development N

The document was recorded in the United States Patent and Trademark Office at
Reel 027390, Frame 0294, or for which a copy thereof is attached.

☒ Additional documents in the chain of title are listed on a supplemental sheet(s).

☒ As required by 37 CFR 3.73(b)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (*i.e.*, a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

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

/Dean M. Munyon/ March 13, 2012

Signature Date

Dean M. Munyon Attorney (Reg. No. 42,914)

Printed or Typed Name Title

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Supplemental Sheet

A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee continues as follows:

4. From: Mercedes-Benz Research & Development North America, Inc. To: Daimler AG

The document was recorded in the United States Patent and Trademark Office at Reel 027398, Frame 0637, or for which a copy thereof is attached.

5. From: Daimler AG To: Burani Consulting Limited Liability Company

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
09/718,007	11/21/2000	Xi Jiang	705835US1RAF

CONFIRMATION NO. 9318

35690
MEYERTONS, HOOD, KIVLIN, KOWERT & GOETZEL, P.C.
P.O. BOX 398
AUSTIN, TX 78767-0398

POA ACCEPTANCE LETTER

OC000000053224345

Date Mailed: 03/22/2012

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 03/13/2012.

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.

/snguyen/

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

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09/718,007	11/21/2000	Xi Jiang	705835US1RAF

CONFIRMATION NO. 9318

Crowell & Moring LLP
Intellectual Property Group
PO Box 14300
Washington, DC 20044-2500

POWER OF ATTORNEY NOTICE

OC000000053224279

Date Mailed: 03/22/2012

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 03/13/2012.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

/snguyen/

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

AO 120 (Rev. 08 10)

TO:	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
Mail Stop 8 **Director of the U.S. Patent and Trademark Office** **P.O. Box 1450** **Alexandria, VA 22313-1450**	

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court for the Eastern District of Texas, Marshall Division on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
2:22-cv-00495	12/23/2022	for the Eastern District of Texas, Marshall Division

PLAINTIFF	DEFENDANT
NorthStar Systems LLC	Hyundai Motor Group, Hyundai Motor Company, and Kia Motors Corporation

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	6,898,432	5/24/2005	NorthStar Systems LLC
2	8,014,943	9/6/2011	NorthStar Systems LLC
3	8,032,297	10/4/2011	NorthStar Systems LLC
4	8,805,416	8/12/2014	NorthStar Systems LLC
5	8,478,527	7/2/2013	NorthStar Systems LLC

In the above—entitled case, the following patent(s) trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
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In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE

Copy 1—Upon initiation of action, mail this copy to Director **Copy 3—Upon termination of action, mail this copy to Director**
Copy 2—Upon filing document adding patent(s), mail this copy to Director **Copy 4—Case file copy**

AO 120 (Rev. 08/10)

TO:	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
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In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court for the Eastern District of Texas, Marshall Division on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
2:22-cv-00486	12/22/2022	for the Eastern District of Texas, Marshall Division

PLAINTIFF	DEFENDANT
NorthStar Systems LLC	Volkswagen AG

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	6,898,432	5/24/2005	NorthStar Systems LLC
2	8,014,943	9/6/2011	NorthStar Systems LLC
3	8,032,297	10/4/2011	NorthStar Systems LLC
4	8,805,416	8/12/2014	NorthStar Systems LLC
5	8,478,527	7/2/2013	NorthStar Systems LLC

In the above—entitled case, the following patent(s) trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
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DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE

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Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

AO 120 (Rev. 08/10)

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☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
2:22-cv-00496	12/27/2022	for the Eastern District of Texas, Marshall Division

PLAINTIFF	DEFENDANT
NorthStar Systems LLC	Bayerische Motoren Werke AG

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	6,898,432	5/24/2005	NorthStar Systems LLC
2	8,014,943	9/6/2011	NorthStar Systems LLC
3	8,032,297	10/4/2011	NorthStar Systems LLC
4	8,805,416	8/12/2014	NorthStar Systems LLC
5	8,478,527	7/2/2013	NorthStar Systems LLC

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Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy