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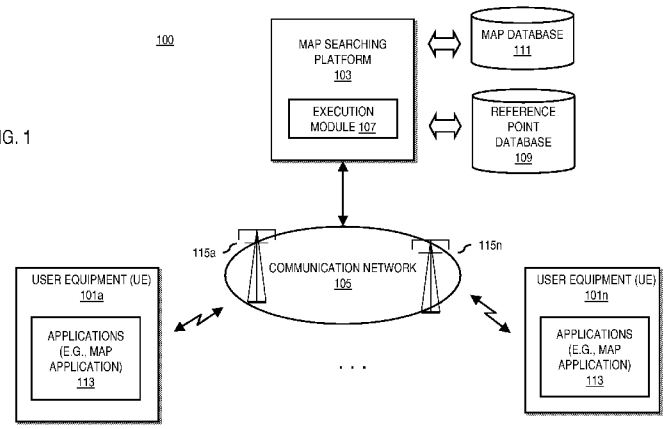
FIG. 1



(57) Abstract: A method and apparatus for location services are provided. The method comprises: receiving an input for specifying a first reference point, a second reference point, and a spatial relationship between the first reference point and the second reference point with respect to a device; causing, at least in part, a comparison of the first reference point, the second reference point and the relationship against a database of predetermined reference points; and causing, at least in part, a determination of location information of the device based, at least in part, on the comparison.

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METHOD AND APPARATUS FOR LOCATION SERVICES

BACKGROUND

[0001] Service providers and device manufacturers (e.g., wireless, cellular, etc.) are continually challenged to deliver value and convenience to consumers by, for example, providing compelling network services. These services may include location based services for the consumers, such as map services and/or navigation services. However, many location based services rely heavily on global positioning system technology and information to determine the location of a user to provide the location based services. Participation in these location based services by users, however may be limited because the user may not have access to a device capable of using such technology. A broad base of devices is currently in service that does not include such global positioning technology. Accordingly, service providers face significant challenges to bring location based services to these users of devices with limited positioning technology.

SOME EXAMPLE EMBODIMENTS

[0002] Therefore, there is a need for an approach for determining location information based on reference points and relationships.

[0003] According to one embodiment, a method comprises receiving an input for specifying a first reference point, a second reference point, and a spatial relationship between the first reference point and the second reference point with respect to a device. The method also comprises causing, at least in part, a comparison of the first reference point, the second reference point, and the relationship against a database of predetermined reference points. The method further comprises causing, at least in part, a determination of location information of the device based, at least in part, on the comparison.

[0004] According to another embodiment, an apparatus comprising at least one processor, and at least one memory including computer program code for one or more computer programs, the at least one memory and the computer program code configured to, with the at least one

processor, cause, at least in part, the apparatus to receive an input for specifying a first reference point, a second reference point, and a spatial relationship between the first reference point and the second reference point with respect to a device. The apparatus is also caused, at least in part, to initiate a comparison of the first reference point, the second reference point, and the relationship against a database of predetermined reference points. The apparatus is further caused, at least in part, to initiate a determination of location information of the device based, at least in part, on the comparison.

[0005] According to another embodiment, a computer-readable storage medium carrying one or more sequences of one or more instructions which, when executed by one or more processors, cause, at least in part, an apparatus to receive an input for specifying a first reference point, a second reference point, and a spatial relationship between the first reference point and the second reference point with respect to a device. The apparatus is also caused, at least in part, to initiate a comparison of the first reference point, the second reference point, and the relationship against a database of predetermined reference points. The apparatus is further caused, at least in part, to initiate a determination of location information of the device based, at least in part, on the comparison.

[0006] According to another embodiment, an apparatus comprises means for receiving an input for specifying a first reference point, a second reference point, and a spatial relationship between the first reference point and the second reference point with respect to a device. The apparatus also comprises means for causing, at least in part, a comparison of the first reference point, the second reference point, and the relationship against a database of predetermined reference points. The apparatus further comprises means for causing, at least in part, a determination of location information of the device based, at least in part, on the comparison.

[0007] Still other aspects, features, and advantages of the invention are readily apparent from the following detailed description, simply by illustrating a number of particular embodiments and implementations, including the best mode contemplated for carrying out the invention. The invention is also capable of other and different embodiments, and its several details can be modified in various obvious respects, all without departing from the spirit and scope of the

invention. Accordingly, the drawings and description are to be regarded as illustrative in nature, and not as restrictive.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The embodiments of the invention are illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings:

[0009] FIG. 1 is a diagram of a system capable of providing location based services using descriptions of reference points, according to one embodiment;

[0010] FIG. 2 is a diagram of the components of user equipment, according to one embodiment;

[0011] FIGs. 3A-3D are diagrams of user interfaces of user equipment, according to various embodiments;

[0012] FIG. 4 is a flowchart of a process for determining location information of a user equipment based on spatial relationships of reference points, according to one embodiment;

[0013] FIG. 5 is a flowchart of a process for determining location services based on spatial relationships of reference points, according to one embodiment;

[0014] FIG. 6 is a diagram of hardware that can be used to implement an embodiment of the invention;

[0015] FIG. 7 is a diagram of a chip set that can be used to implement an embodiment of the invention; and

[0016] FIG. 8 is a diagram of a mobile terminal (e.g., handset) that can be used to implement an embodiment of the invention.

DESCRIPTION OF SOME EMBODIMENTS

[0017] Examples of a method, apparatus, and computer program for providing location based services using descriptions of points-of-interest are disclosed. In the following description, for the purposes of explanation, numerous specific details are set forth in order to provide a

thorough understanding of the embodiments of the invention. It is apparent, however, to one skilled in the art that the embodiments of the invention may be practiced without these specific details or with an equivalent arrangement. In other instances, well-known structures and devices are shown in block diagram form in order to avoid unnecessarily obscuring the embodiments of the invention.

[0018] FIG. 1 is a diagram of a system capable of providing location based services using descriptions of reference points, according to one embodiment. Navigation and location based services are popular and widely used by consumers. Historically, many of these services rely on a global positioning system (GPS) or other similar sensors to pinpoint the location of the user. Other services attempt to pinpoint a general area of a user using other location information such as using cell identifiers (CellID). In general, it is often desirable to pinpoint a geographic location of a user with accuracy to provide these location based services. For example, pinpointing the geographic location of the user can be useful to provide directions to the user, avoid road congestion, direct the user to a nearby point-of-interest (POI) or service provider, etc.

[0019] However, some users may not wish to utilize GPS technology for one or more reasons such as cost, power consumption, availability, etc. In some cases, the technology is not available because the user's device may not have the capability or because the device is in an area with poor GPS reception. Further, GPS devices can require high processing and/or power consumption costs. In some scenarios, the device may include the capability to receive CellIDs and utilize cell of origin technology to receive location based services. CellIDs can be mapped to a location based on one or more databases. However, service providers that own cell towers may be unwilling to provide exact location information of the cell towers created third party databases of cell towers locations may be incomplete. As such, technologies using solely CellIDs to pinpoint the location of a device are limited. Without an accurate determination of the location of the user and/or the user's device, many location based services may be unavailable. For example, it is technically difficult to present a map to a user of the device of the location that the user is located unless an accurate location of the user is determined.

[0020] To address this problem, a system 100 of FIG. 1 introduces the capability to provide location based services using descriptions of reference points. User equipment (UEs) 101 can be used to query a map searching platform 103 specifying the descriptions of the reference points and one or more spatial relationships between the reference points. In certain embodiments, a reference point is an object that can be used as a parameter for determining the location of a user. Reference points can be physical objects that can be identified by the user. In some embodiments, the reference points include one or more signs or other visible text that may or may not be associated with a POI. The query can be sent to the map searching platform 103 via a communication network 105. An execution module 107 of the map searching platform 103 compares the reference points and spatial relationships in the reference point database 109. The execution module 107 can determine a location of the UE 101 based on the reference points and spatial relationship. If too many locations based on a set of reference points and/or relationships are found, the execution module 107 can request additional reference points and/or spatial information. The additional information can be used to fine tune the location of the UE 101. Once the location of the UE 101 is determined, the execution module 107 can request location based information such as map or point-of-interest (POI) information from a map database 111 associated with the location of the UE 101. The location based information is then caused to be transmitted to the UE 101 via the communication network 105.

[0021] A map application 113 of the UE 101 receives the location based information from the map searching platform 103. The map application 113 can then cause presentation of the location based information at the UE 101. The location based information may include a map image based on the determined location of the UE 101, one or more of the reference points, and/or other location based service information. For example, a presentation of a map image of the location of the UE 101 can include one or more of the reference points. Further, the presentation of the map image can include one or more search results for POIs via a local search. Information about POIs can be stored in the map database 111 and/or reference point database 109. A POI can be a specific point location that a person may, for instance, find interesting or useful. Examples of POIs can include an airport, a train station, a bus station, a shop, a bakery, a dam, a landmark, a restaurant, a hotel, or any point interesting, useful, or significant in some way.

[0022] In certain embodiments, the user can specify the reference points and spatial relationships between the reference points as further detailed in FIGs. 3A-3D. The map application 113 receives the specified input. The map application 113 then can cause, at least in part, a comparison of the reference points and spatial relationships to the reference point database 109 by generating a query message and causing transmission of the query message to the map searching platform 103. To facilitate input of the of the reference points and/or spatial relationships, the map application 113 can cause presentation of one or more templates corresponding to the user's position in relation to the position of the reference points. In this manner, the user can simply enter the locations of the reference points on an organized template including the user's location. In certain scenarios, the reference points are entered by the user into the map application 113 in the form of a text string. For example, the user may enter (reference point text) + [relationship] + (reference point text) + [relationship] + (reference point text), etc. The chain combination may be sent iteratively to the map searching platform 103. Further, the entry of input reference points into a template can be iteratively sent to the map searching platform 103.

[0023] In some embodiments, the map searching platform 103 receives the combination and checks each iteration with the reference point database 109. The reference point database 109 includes reference points as well as relationships between the reference points. In certain embodiments, the reference points can be associated with coordinates and/or directional values. For example, a reference point can be associated with a physical location. The physical location may have one or more signs facing in certain directions. As such, each sign may be considered a reference point. In other embodiments, the physical location (e.g., a POI) itself is considered the reference point. The reference point inputs received from the map application 113 are compared to these reference points. A relationship can be assigned to the reference points in the reference point database 109 based on location coordinates of the reference points. As such, relationships can be spatial placements of reference points in relation to each other. Examples of relationships include "next to," "to the left of," "to the right of," "above," "below," "behind," "across the street from," etc. Further, these relationships can include spatial distances (e.g., reference point A is 50 meters behind reference point B). In the reference point database 109, each reference point can be associated with a coordinate and/or a direction in

which the reference point faces. These coordinates can be used to determine the spatial relationships of the reference points in the reference point database 109. Further, relationships entered by the user may include ranges (e.g., reference point A is 50 to 100 meters to the right of reference point B). While searching the reference point database 109, more than one location may include the combination of reference points and relationships. In these situations, additional reference points and/or relationships can be utilized to filter and/or narrow down location possibilities.

[0024] Another method to filter and/or narrow down location possibilities is based on CellIDs. In some scenarios, the UEs 101 may include the capability to receive CellIDs and utilize cell of origin technology to receive location based services. CellIDs can be mapped to a location based on databases; however, service providers that own cell towers may be unwilling to provide location information of the cell towers 115a-115n and created third party databases of cell tower 115 locations may be incomplete. A UE 101 associated with a cell tower is able to determine an associated cell tower identifier. The reference point database 109 and/or a related database can include a mapping of CellIDs along with location coordinates. These mappings can be very broad and may encompass a broader location region than the largest range of the CellID (e.g., to compensate for a lack of location information associated with the cell towers 115). Further, location regions associated with CellIDs may overlap. In this manner, the map searching platform 103 receives a CellID associated with the input query received from the UE 101, the map searching platform 103 can narrow the possibilities for locations (e.g., coordinates) associated with the reference point and relationship combination. As such, the map searching platform 103 compares the reference point and relationship combination against a set of the reference point database 109 corresponding to the CellID region. In this manner, processing to determine the location can be facilitated by narrowing the possible locations the UE 101 can be located.

[0025] In certain embodiments, if a requested reference point and relationship combination is not found in the reference point database 109, the user may be provided the option to add the location. This can be accomplished by finding and using alternative reference points and/or other location determination mechanisms to determine the location of the UE 101. Then, one or

more reference points and/or relationships may be added in relation to found reference points in the location. Thus, the reference point database 109 can be updated through crowd sourcing. Further, additions to the reference point database 109 can additionally be monitored using quality control rules. For example, an addition to the reference point database 109 may be flagged for a time period or until another user confirms that the reference point exists. Moreover, another quality control system may include a ranking and/or credit system to increase awareness of options to update the reference point database 109 and/or increase submissions. As such, a reward can be provided (e.g., via a monetary credit) or recognition can be given to users that provide beneficial updates.

[0026] By way of example, the communication network 105 of system 100 includes one or more networks such as a data network (not shown), a wireless network (not shown), a telephony network (not shown), or any combination thereof. It is contemplated that the data network may be any local area network (LAN), metropolitan area network (MAN), wide area network (WAN), a public data network (e.g., the Internet), short range wireless network, or any other suitable packet-switched network, such as a commercially owned, proprietary packet-switched network, e.g., a proprietary cable or fiber-optic network, and the like, or any combination thereof. In addition, the wireless network may be, for example, a cellular network and may employ various technologies including enhanced data rates for global evolution (EDGE), general packet radio service (GPRS), global system for mobile communications (GSM), Internet protocol multimedia subsystem (IMS), universal mobile telecommunications system (UMTS), etc., as well as any other suitable wireless medium, e.g., worldwide interoperability for microwave access (WiMAX), Long Term Evolution (LTE) networks, code division multiple access (CDMA), wideband code division multiple access (WCDMA), wireless fidelity (WiFi), wireless LAN (WLAN), Bluetooth®, Internet Protocol (IP) data casting, satellite, mobile ad-hoc network (MANET), and the like, or any combination thereof.

[0027] Additionally, the communication network 105 can provide for short message service (SMS) messaging, multimedia messaging service (MMS) messaging capabilities, or the like. The communication network 105 may further include a telephony network (e.g., a cellular network). As part of a cellular network, UE 101 can communicate with a cellular tower 115 to

send and receive data including SMS messaging and MMS messaging. Cellular towers 115 communicate with a UE 101 via control channels so that the UE 101 is able to ascertain which cellular tower 115 to connect to. A control channel can also be utilized to deliver messages. A message can be sent to a UE 101 via a cellular tower 115 and a message services center (MSC). The MSC can be used as a medium between the cellular network and internet protocol networks designed to carry messaging traffic. The message can have information about the message and the destination such as the length of the message, a time stamp, the destination phone number, etc., which can be used to route the message to the destination. In one example, map searching platform 103 can send a message to the UE 101 via the communication network 105 by sending the message to the MSC via an internet protocol network. Then, the MSC can deliver the message to the UE 101 via the cellular tower control channel.

[0028] The UE 101 is any type of mobile terminal, fixed terminal, or portable terminal including a mobile handset, station, unit, device, navigation device, multimedia computer, multimedia tablet, Internet node, communicator, desktop computer, laptop computer, Personal Digital Assistants (PDAs), audio/video player, digital camera/camcorder, positioning device, television receiver, radio broadcast receiver, electronic book device, game device, or any combination thereof. It is also contemplated that the UE 101 can support any type of interface to the user (such as "wearable" circuitry, etc.).

[0029] By way of example, the UE 101, and map searching platform 103 communicate with each other and other components of the communication network 105 using well known, new or still developing protocols. In this context, a protocol includes a set of rules defining how the network nodes within the communication network 105 interact with each other based on information sent over the communication links. The protocols are effective at different layers of operation within each node, from generating and receiving physical signals of various types, to selecting a link for transferring those signals, to the format of information indicated by those signals, to identifying which software application executing on a computer system sends or receives the information. The conceptually different layers of protocols for exchanging information over a network are described in the Open Systems Interconnection (OSI) Reference Model.

[0030] Communications between the network nodes are typically effected by exchanging discrete packets of data. Each packet typically comprises (1) header information associated with a particular protocol, and (2) payload information that follows the header information and contains information that may be processed independently of that particular protocol. In some protocols, the packet includes (3) trailer information following the payload and indicating the end of the payload information. The header includes information such as the source of the packet, its destination, the length of the payload, and other properties used by the protocol. Often, the data in the payload for the particular protocol includes a header and payload for a different protocol associated with a different, higher layer of the OSI Reference Model. The header for a particular protocol typically indicates a type for the next protocol contained in its payload. The higher layer protocol is said to be encapsulated in the lower layer protocol. The headers included in a packet traversing multiple heterogeneous networks, such as the Internet, typically include a physical (layer 1) header, a data-link (layer 2) header, an internetwork (layer 3) header and a transport (layer 4) header, and various application headers (layer 5, layer 6 and layer 7) as defined by the OSI Reference Model.

[0031] In one embodiment, the map searching platform 103 may interact according to a client-server model with the map application 113. According to the client-server model, a client process sends a message including a request to a server process, and the server process responds by providing a service (e.g., maps and/or location based services). The server process may also return a message with a response to the client process. Often the client process and server process execute on different computer devices, called hosts, and communicate via a network using one or more protocols for network communications. The term “server” is conventionally used to refer to the process that provides the service, or the host computer on which the process operates. Similarly, the term “client” is conventionally used to refer to the process that makes the request, or the host computer on which the process operates. As used herein, the terms “client” and “server” refer to the processes, rather than the host computers, unless otherwise clear from the context. In addition, the process performed by a server can be broken up to run as multiple processes on multiple hosts (sometimes called tiers) for reasons that include reliability, scalability, and redundancy, among others.

[0032] FIG. 2 is a diagram of the components of user equipment, according to one embodiment. By way of example, the UE 101 includes one or more components for causing a determination of a location of the UE 101 based on reference points and corresponding spatial relationships. It is contemplated that the functions of these components may be combined in one or more components or performed by other components of equivalent functionality. In this embodiment, the UE 101 includes a communication interface 201, a power module 203, a runtime module 205, a location module 207, a map database 209, a memory 211, a user interface 213, and an image capture module 215.

[0033] In one embodiment, the communication interface 201 can be used to communicate with a map searching platform 103 or other UEs 101. Certain communications can be via methods such as an internet protocol, messaging (e.g., SMS, MMS, etc.), or any other communication method (e.g., via the communication network 105). In some examples, the UE 101 can send a query to the map searching platform 103 via the communication interface 201. The map searching platform 103 may then send a response back via the communication interface 201. In certain embodiments, the UE 101 sends SMS messages to the map searching platform 103 to request services and provide search parameters (e.g., reference points and/or relationships) and receive SMS or MMS messages including responses to queries. The SMS and MMS messages can be structured so that an advantageous number of transmissions can be made. A lower number of transmissions can improve bandwidth use for communications.

[0034] The power module 203 provides power to the UE 101. The power module 203 can include any type of power source (e.g., battery, plug-in, etc.). Additionally, the power module 203 can provide power to the components of the UE 101 including processors, memory, and transmitters. Various components of the UE 101 can receive power from the power module 203 and/or can have power supplies controlled by the power module 203. In general, GPS technology consumes much energy. An advantage of the disclosed approaches to determine the location of a UE 101 without need to use GPS technology is to save energy. Thus, the system 100 includes a means for determining a location based on a comparison of reference points and/or relationships.

[0035] The location module 207 can determine a user's location or determine information that can be used to help determine the user's location. In some embodiments, the user's location can be determined by a triangulation system such as GPS, Assisted-GPS (A-GPS), Cell of Origin, or other location extrapolation technologies. Standard GPS and A-GPS systems can use satellites to pinpoint the location of a UE 101. A Cell of Origin system can be used to determine the cellular tower that a cellular UE 101 is synchronized with. The location module 207 may also utilize multiple technologies to detect the location of the UE 101. Location coordinates can be determined using the location module 207. These location coordinates can be used by the runtime module 205 to display a user location on a map on a user interface 213 of the UE 101. Further, information associated with the current location of the UE 101 can be utilized in other navigational calculations (e.g., movement, readjusting search locations based on the location of the UE 101, etc.). In certain embodiments, the UE 101 includes some or all of the different types of technologies of the location module 207. An advantage of the disclosed approaches to determine the location of a UE 101 is that none of these technologies are required to be present in the UE 101 to determine the location of the UE 101 and to request and receive location based services.

[0036] Further, in some embodiments, the map database 209 can include some or all of the information contained in the databases associated with the map searching platform 103. Moreover, in certain embodiments, a query for the location of the UE 101 based on user input is sent to the map searching platform 103 via the communication interface 201. Then, the location and/or a map associated with the location are received via the communication interface 201. The runtime module 205 can then store the location in the memory 211 and/or use the location to provide location based services to the user. The location based services can additionally be requested and received from the map searching platform 103. Then, the user interface 213 can be caused, at least in part, to present a map and/or other location based services associated with the location.

[0037] The user interface 213 can include various methods of communication. For example, the user interface 213 can have outputs including a visual component (e.g., a screen), an audio component, a physical component (e.g., vibrations), and other methods of communication.

User inputs can include a touch-screen interface, a scroll-and-click interface, a button interface, a microphone, etc. Moreover, the user interface 213 may be used to display maps from the map database 209, POIs from the memory 211, maps and/or POIs received over the communication interface 201, etc. Moreover, the map database 209 can include visual indicators (e.g., icons, text, etc.) of the POIs. The user interface 213 may be used to input reference points and/or spatial relationships between reference points. The input can be via one or more methods such as voice input, textual input, typed input, typed touch-screen input, other touch-enabled input, etc. Exemplary user interfaces are detailed in FIGs. 3A-3D. Further, the user interface 213 can additionally be used to input search parameters including a keyword or other search, search locations, time parameters, search extent, etc.

[0038] Further, in certain embodiments, an image capture module 215 may be used to receive one or more inputs. The image capture module 215 can include optical sensors and circuitry that can convert optical images into a digital format. Examples of image capture modules include cameras, camcorders, etc.

[0039] FIG. 3A is a diagram of a user interface of user equipment, according to one embodiment. The user interface 300 shows areas to input reference points. In this embodiment, the reference points can be associated with sign. As such, the fields corresponding to the sign reference points 301 and 303 can be filled by the user. Further, the spatial relationship of the reference points 301 and 303 (e.g., reference point 301 is to the left of reference point 303, reference point 301 is to the right and below the reference 303, etc.) can be entered in a relationship field 305. A touch screen interface may be used to input such fields. As such, the user may tap on a field to activate entry of information. These fields can additionally have one or more disambiguation and/or recommendation capabilities. As such, when the user is inputting letters into a field, the UE 101 can recommend reference point names based on a subset of letters. Further, additional sign and/or relationship fields can be added and/or be available to add parameters to determine the location of the UE 101. Moreover, the user interface 300 can include one or more search fields 307 or other fields to request location based services. For example, the search field 307 can include a parameter to request location based services such as a search for one or more POIs. The search for the location of the UE

101 and/or for POIs may be conducted on the UE 101 and/or the input may be forwarded to a map searching platform 103 to perform the search to yield results.

[0040] FIG. 3B is a diagram of a user interface of user equipment, according to one embodiment. The user interface 320 includes presentation of results of a request for location based services. As such, sign names 321, 323 associated with the input reference points can optionally be displayed on the user interface 320. In certain embodiments, the reference points are described based on one or more signs associated with one or more POIs (e.g., shop signs). Additionally or alternatively, the user interface 320 may show a location 325 of the user. Further, the user interface 320 can include a map image associated with the location of the user. This may be one of the yielded results of causing a comparison of reference points and/or relationships to determine the location and/or location based information. In other words, the reference points and/or their relationships can form unique combinations that can then be used for comparison against a database of known reference points and their respective locations to determine location information. Further, the user interface 320 includes one or more search results 327, 329 associated with one or more parameters for location based services. Other optional types of location based services can include navigation directions to a location and/or updating a social networking site of presence information, etc.

[0041] FIGs. 3C and 3D are diagrams of user interfaces of user equipment, according to various embodiments. The user interfaces 340, 360 provide a mechanism for the user to input reference point information via an intuitive, easy to use system. FIG. 3C shows a user interface 340 that provides a street model template. The user's location 341 is set at a point in the template and the user may select fields 343a-343f of the template. In one embodiment, the relative positions of the fields 343a-343f in the template correspond to real world locations of reference points with respect to user's location. As the user selects the input fields 343, the user can add reference point information associated with the fields. With this approach, the user can enter reference point information without need to explicitly define relationships. The relationships are implicitly defined based on the template based on which field the user chooses to specify a particular reference point. The user interface 340 shows a street model or template of the location of the user. With this approach, an additional parameter that the reference points

(e.g., reference points corresponding to fields 343a and 343d) are across a street from each other can be specified to cause a determination of the user's location. For example, the system 100 then compares the input information (e.g., that two specific reference points are across the street from each other) against a database of known reference to identify at what location or locations the two specified reference inputs are across the street from each other. In one embodiment, if there is only one location that corresponds to area in which the two reference points are across the street from other (e.g., when the reference points and their spatial relationship are unique), the system 100 can suggest that location as the determined location. If there are more than two possible locations that correspond to such a spatial relationship of the two reference points, the system 100 can, for instance, present both locations and/or request additional reference points to further distinguish the locations.

[0042] User interface 360 additionally shows a hypothetical location 361 of the user and/or UE 101. Additionally, fields 363a-363j can be selected and filled to be used as parameters for defining reference points. Further, the relationships between the fields 363 can be determined based on the template. For example, field 363d can be considered to the left of field 363b. As such, the user can quickly and easily input fields 363 to receive a location of the user. The template can periodically generate and conduct a query to the map searching platform 103 to receive location services based on the filled template. When a unique location or a set of locations within a certain threshold are received, the location services can be presented to the user. The location services can include one or more map images of the location as well as provide results for POIs, navigation, etc.

[0043] In certain embodiments, an image capture device, such as a camera or video camcorder, can be used to input reference point information. For example, the user may select a template field 363 and then enter reference point information by capturing an image. The UE 101 may additionally parse textual information from the image. In one example, if the image is of a reference point associated with a sign, the sign can be parsed into textual information used to describe the reference point. Optical character recognition techniques may be used to determine the textual information. Further, an image of multiple reference points may be taken

and a relationship between two reference points (e.g., reference points determined by associating visible text to each reference point) can be determined from the user's prospective.

[0044] FIG. 4 is a flowchart of a process for determining location information of a user equipment based on spatial relationships of reference points, according to one embodiment. In one embodiment, the map application 113 (e.g., executing on the runtime module 205) performs the process 400 and is implemented in, for instance, a chip set including a processor and a memory as shown FIG. 7. As such, the map application 113 and/or the runtime module 205 can provide means for accomplishing various parts of the process 400 as well as means for accomplishing other processes in conjunction with other components of the UE 101 and/or map searching platform 103.

[0045] At step 401, the map application 113 receives an input for specifying a first reference point, a second reference point, and a spatial relationship between the first reference point and the second reference point with respect to a UE 101. Example input mechanisms are shown in the user interfaces of FIGs. 3A-3D. As noted previously, the map application 113 can cause, at least in part, presentation of an input template including one or more fields as shown in FIGs. 3C and 3D. The fields can represent the first and second reference points. Further, the spatial relationship between the reference points can be represented by the template positioning of the fields. Moreover, the specified spatial relationship can be received as input based, at least in part, on an associated template used to receive the input. Further, the presentation of the input template can be via a touch-enabled user interface. In this manner, the user can touch a screen of the UE 101 to input reference points.

[0046] Additionally or alternatively, a vocal component (e.g., via a microphone) may additionally be used to enter input. With this approach the reference point can be defined via audio input. The map application 113 and/or another application of the UE 101 can convert the audio into data (e.g., textual characters). In certain embodiments, the user can select a field of the user interface (e.g., a template field) and add a reference point description based, at least in part, on the audio input. Further, additional reference points and/or spatial relationships between the reference points can be received as input. Moreover, an image capture device (e.g., a camera) associated with the UE 101 can be used to input reference point information.

[0047] Next, at step 403, the map application 113 causes, at least in part, a comparison of the first reference point, the second reference point, and the relationship against a database of predetermined reference points. This comparison can occur in response to a query initiated by the map application 113. Further, if additional reference points and/or spatial relationships are added, the comparison can include the additional reference points and/or spatial relationships. Additionally or alternatively, the map application 113 can generate a query and output the query (e.g., by causing transmission of the query) to a map searching platform 103 to conduct the comparison. The query can include the reference points and spatial relationships. Further, the comparison can be local to the UE 101 comparing the reference points to a map database 209 and/or other databases in memory 211. The comparison can include searching the database of predetermined reference points for a combination of reference points, relationships, or a combination thereof.

[0048] Then, at step 405, the map application 113 causes, at least in part, a determination of location information of the UE 101 based, at least in part, on the comparison. This may additionally be performed by causing transmission of the query and/or by conducting the comparison and making the determination based on resources local to the UE 101. When the combination is compared to the database, results for location information are determined. The results can include a null set, one result, or more than one result. If there is a null set, the user may be presented an interface to modify the combination because one or more reference points were not found. The combination may be modified by altering one or more of the fields describing reference points and/or by modifying relationships.

[0049] The map application 113 additionally determines whether the location as specified by the first and second reference points is unique (step 407). If the location is unique (e.g., a single result), the UE 101 can cause presentation of the location information. If the location is not unique, the UE 101 the map application 113 can cause a presentation of a request for additional input and receive additional input (step 401) and/or present the plurality of location options for selection by the user.

[0050] Then, at step 409, the map application 113 causes presentation of location information associated with the UE 101. The location information may include a map of an

area around the determined location of the UE 101. Further, the location information may additionally include a response to a query received at the UE 101. For example, the query can be for location based services such as a local search for POIs, navigation information to a POI, map information such as street and/or terrain information associated with the location, etc. This information generated by the map application 113 using one or more local resources and memories or received as a response to a query to a map searching platform 103. The presentation of a map can further include the presentation of the reference points on the map. This can provide the user with contextual information of the user's orientation compared to the reference points.

[0051] FIG. 5 is a flowchart of a process for determining location services based on spatial relationships of reference points, according to one embodiment. In one embodiment, an execution module 107 of a map searching platform 103 performs the process 500 and is implemented in, for instance, a chip set including a processor and a memory as shown FIG. 7. As such, the execution module 107 can provide means for accomplishing various parts of the process 500 as well as means for accomplishing other processes in conjunction with other components of the map searching platform 103 and/or UE 101.

[0052] At step 501, the execution module 107 receives an inquiry about location based services. The inquiry can include input for specifying a first reference point, a second reference point, and a spatial relationship between the reference points with respect to a UE 101. The inquiry can be received from the UE 101. A message associated with the inquiry can further include additional reference points and/or relationships.

[0053] The execution module 107 then determines whether location information is available to be associated with the UE 101 (step 503). The location information may be a broad area, region, etc. For example, one or more cell identifiers can be associated with the UE 101 and be used to determine the location information. The location information may be used to load a coverage area or subset of a reference point database 109 associated with the cell identifier (step 505).

[0054] At step 507, a position of the user/UE 101 is determined based on the input inquiry. If there is no location information available, the position is determined based on a comparison of

the inquiry combination (e.g., a combination of reference points and the spatial relationships among them) to the reference point database 109. If location information is available (e.g., if the input combination of reference points and spatial relationships match one or more known combinations in the reference point database 109), a subset of the reference point database 109 is used based on the location information. In the scenario of cell identifiers, a set of data associated with the cell identifier(s) can be used to filter the reference point database 109 used for the comparison. As such, the location is determined by comparing the description of the reference points and spatial relationships between the reference points to the reference points and spatial relationships in the reference point database 109 and/or subset of the reference point database 109. Once the determination is made, the execution module 107 can determine one or more location services to provide to the UE 101. This may be based on a received query associated with the inquiry. In one example, the location service is to provide a map image of the location surrounding the UE 101. The execution module 107 can use the determined location to retrieve the map image from a map database 111. In another example, the location service may be for directions. The directions can be retrieved from another database associated with the map searching platform 103 using the determined location as a starting point. In a further example, the location service is a request for POIs. The search for POIs can use the determined location as a base and search for the POIs in another database. These location services (e.g., search results) can then be caused, at least in part, to be transmitted to the UE 101 (step 509).

[0055] With the above approaches, the location of a UE 101 can be determined accurately, efficiently, and across various types of devices including low cost devices. Many such devices may not include GPS capabilities. As such, this approach can be provided across different types of devices of various technology and cost levels. Further, various types of communications can be used to determine the location of the UE 101. For example, SMS or MMS communications can be used to retrieve location services. Many UEs 101 are compatible with such communications methods while limited in other more costly communications such as GPRS or other data-centric communication methods.

[0056] The processes described herein for determining location information based on reference points and relationships may be advantageously implemented via software, hardware, firmware or a combination of software and/or firmware and/or hardware. For example, the processes described herein, including for providing user interface navigation information associated with the availability of services, may be advantageously implemented via processor(s), Digital Signal Processing (DSP) chip, an Application Specific Integrated Circuit (ASIC), Field Programmable Gate Arrays (FPGAs), etc. Such exemplary hardware for performing the described functions is detailed below.

[0057] FIG. 6 illustrates a computer system 600 upon which an embodiment of the invention may be implemented. Although computer system 600 is depicted with respect to a particular device or equipment, it is contemplated that other devices or equipment (e.g., network elements, servers, etc.) within FIG. 6 can deploy the illustrated hardware and components of system 600. Computer system 600 is programmed (e.g., via computer program code or instructions) to determine location information based on reference points and relationships as described herein and includes a communication mechanism such as a bus 610 for passing information between other internal and external components of the computer system 600. Information (also called data) is represented as a physical expression of a measurable phenomenon, typically electric voltages, but including, in other embodiments, such phenomena as magnetic, electromagnetic, pressure, chemical, biological, molecular, atomic, sub-atomic and quantum interactions. For example, north and south magnetic fields, or a zero and non-zero electric voltage, represent two states (0, 1) of a binary digit (bit). Other phenomena can represent digits of a higher base. A superposition of multiple simultaneous quantum states before measurement represents a quantum bit (qubit). A sequence of one or more digits constitutes digital data that is used to represent a number or code for a character. In some embodiments, information called analog data is represented by a near continuum of measurable values within a particular range. Computer system 600, or a portion thereof, constitutes a means for performing one or more steps of determining location information based on reference points and relationships.

[0058] A bus 610 includes one or more parallel conductors of information so that information is transferred quickly among devices coupled to the bus 610. One or more processors 602 for processing information are coupled with the bus 610.

[0059] A processor (or multiple processors) 602 performs a set of operations on information as specified by computer program code related to determine location information based on reference points and relationships. The computer program code is a set of instructions or statements providing instructions for the operation of the processor and/or the computer system to perform specified functions. The code, for example, may be written in a computer programming language that is compiled into a native instruction set of the processor. The code may also be written directly using the native instruction set (e.g., machine language). The set of operations include bringing information in from the bus 610 and placing information on the bus 610. The set of operations also typically include comparing two or more units of information, shifting positions of units of information, and combining two or more units of information, such as by addition or multiplication or logical operations like OR, exclusive OR (XOR), and AND. Each operation of the set of operations that can be performed by the processor is represented to the processor by information called instructions, such as an operation code of one or more digits. A sequence of operations to be executed by the processor 602, such as a sequence of operation codes, constitute processor instructions, also called computer system instructions or, simply, computer instructions. Processors may be implemented as mechanical, electrical, magnetic, optical, chemical or quantum components, among others, alone or in combination.

[0060] Computer system 600 also includes a memory 604 coupled to bus 610. The memory 604, such as a random access memory (RAM) or other dynamic storage device, stores information including processor instructions for determining location information based on reference points and relationships. Dynamic memory allows information stored therein to be changed by the computer system 600. RAM allows a unit of information stored at a location called a memory address to be stored and retrieved independently of information at neighboring addresses. The memory 604 is also used by the processor 602 to store temporary values during execution of processor instructions. The computer system 600 also includes a read only

memory (ROM) 606 or other static storage device coupled to the bus 610 for storing static information, including instructions, that is not changed by the computer system 600. Some memory is composed of volatile storage that loses the information stored thereon when power is lost. Also coupled to bus 610 is a non-volatile (persistent) storage device 608, such as a magnetic disk, optical disk or flash card, for storing information, including instructions, that persists even when the computer system 600 is turned off or otherwise loses power.

[0061] Information, including instructions for determining location information based on reference points and relationships, is provided to the bus 610 for use by the processor from an external input device 612, such as a keyboard containing alphanumeric keys operated by a human user, or a sensor. A sensor detects conditions in its vicinity and transforms those detections into physical expression compatible with the measurable phenomenon used to represent information in computer system 600. Other external devices coupled to bus 610, used primarily for interacting with humans, include a display device 614, such as a cathode ray tube (CRT) or a liquid crystal display (LCD), or plasma screen or printer for presenting text or images, and a pointing device 616, such as a mouse or a trackball or cursor direction keys, or motion sensor, for controlling a position of a small cursor image presented on the display 614 and issuing commands associated with graphical elements presented on the display 614. In some embodiments, for example, in embodiments in which the computer system 600 performs all functions automatically without human input, one or more of external input device 612, display device 614 and pointing device 616 is omitted.

[0062] In the illustrated embodiment, special purpose hardware, such as an application specific integrated circuit (ASIC) 620, is coupled to bus 610. The special purpose hardware is configured to perform operations not performed by processor 602 quickly enough for special purposes. Examples of application specific ICs include graphics accelerator cards for generating images for display 614, cryptographic boards for encrypting and decrypting messages sent over a network, speech recognition, and interfaces to special external devices, such as robotic arms and medical scanning equipment that repeatedly perform some complex sequence of operations that are more efficiently implemented in hardware.

[0063] Computer system 600 also includes one or more instances of a communications interface 670 coupled to bus 610. Communication interface 670 provides a one-way or two-way communication coupling to a variety of external devices that operate with their own processors, such as printers, scanners and external disks. In general the coupling is with a network link 678 that is connected to a local network 680 to which a variety of external devices with their own processors are connected. For example, communication interface 670 may be a parallel port or a serial port or a universal serial bus (USB) port on a personal computer. In some embodiments, communications interface 670 is an integrated services digital network (ISDN) card or a digital subscriber line (DSL) card or a telephone modem that provides an information communication connection to a corresponding type of telephone line. In some embodiments, a communication interface 670 is a cable modem that converts signals on bus 610 into signals for a communication connection over a coaxial cable or into optical signals for a communication connection over a fiber optic cable. As another example, communications interface 670 may be a local area network (LAN) card to provide a data communication connection to a compatible LAN, such as Ethernet. Wireless links may also be implemented. For wireless links, the communications interface 670 sends or receives or both sends and receives electrical, acoustic or electromagnetic signals, including infrared and optical signals, that carry information streams, such as digital data. For example, in wireless handheld devices, such as mobile telephones like cell phones, the communications interface 670 includes a radio band electromagnetic transmitter and receiver called a radio transceiver. In certain embodiments, the communications interface 670 enables connection to the communication network 105 for to the UE 101.

[0064] The term "computer-readable medium" as used herein refers to any medium that participates in providing information to processor 602, including instructions for execution. Such a medium may take many forms, including, but not limited to computer-readable storage medium (e.g., non-volatile media, volatile media), and transmission media. Non-transitory media, such as non-volatile media, include, for example, optical or magnetic disks, such as storage device 608. Volatile media include, for example, dynamic memory 604. Transmission media include, for example, coaxial cables, copper wire, fiber optic cables, and carrier waves that travel through space without wires or cables, such as acoustic waves and

electromagnetic waves, including radio, optical and infrared waves. Signals include man-made transient variations in amplitude, frequency, phase, polarization or other physical properties transmitted through the transmission media. Common forms of computer-readable media include, for example, a floppy disk, a flexible disk, hard disk, magnetic tape, any other magnetic medium, a CD-ROM, CDRW, DVD, any other optical medium, punch cards, paper tape, optical mark sheets, any other physical medium with patterns of holes or other optically recognizable indicia, a RAM, a PROM, an EPROM, a FLASH-EPROM, any other memory chip or cartridge, a carrier wave, or any other medium from which a computer can read. The term computer-readable storage medium is used herein to refer to any computer-readable medium except transmission media.

[0065] Logic encoded in one or more tangible media includes one or both of processor instructions on a computer-readable storage media and special purpose hardware, such as ASIC 620.

[0066] Network link 678 typically provides information communication using transmission media through one or more networks to other devices that use or process the information. For example, network link 678 may provide a connection through local network 680 to a host computer 682 or to equipment 684 operated by an Internet Service Provider (ISP). ISP equipment 684 in turn provides data communication services through the public, world-wide packet-switching communication network of networks now commonly referred to as the Internet 690.

[0067] A computer called a server host 692 connected to the Internet hosts a process that provides a service in response to information received over the Internet. For example, server host 692 hosts a process that provides information representing video data for presentation at display 614. It is contemplated that the components of system 600 can be deployed in various configurations within other computer systems, e.g., host 682 and server 692.

[0068] At least some embodiments of the invention are related to the use of computer system 600 for implementing some or all of the techniques described herein. According to one embodiment of the invention, those techniques are performed by computer system 600 in response to processor 602 executing one or more sequences of one or more processor

instructions contained in memory 604. Such instructions, also called computer instructions, software and program code, may be read into memory 604 from another computer-readable medium such as storage device 608 or network link 678. Execution of the sequences of instructions contained in memory 604 causes processor 602 to perform one or more of the method steps described herein. In alternative embodiments, hardware, such as ASIC 620, may be used in place of or in combination with software to implement the invention. Thus, embodiments of the invention are not limited to any specific combination of hardware and software, unless otherwise explicitly stated herein.

[0069] The signals transmitted over network link 678 and other networks through communications interface 670, carry information to and from computer system 600. Computer system 600 can send and receive information, including program code, through the networks 680, 690 among others, through network link 678 and communications interface 670. In an example using the Internet 690, a server host 692 transmits program code for a particular application, requested by a message sent from computer 600, through Internet 690, ISP equipment 684, local network 680 and communications interface 670. The received code may be executed by processor 602 as it is received, or may be stored in memory 604 or in storage device 608 or other non-volatile storage for later execution, or both. In this manner, computer system 600 may obtain application program code in the form of signals on a carrier wave.

[0070] Various forms of computer readable media may be involved in carrying one or more sequence of instructions or data or both to processor 602 for execution. For example, instructions and data may initially be carried on a magnetic disk of a remote computer such as host 682. The remote computer loads the instructions and data into its dynamic memory and sends the instructions and data over a telephone line using a modem. A modem local to the computer system 600 receives the instructions and data on a telephone line and uses an infra-red transmitter to convert the instructions and data to a signal on an infra-red carrier wave serving as the network link 678. An infrared detector serving as communications interface 670 receives the instructions and data carried in the infrared signal and places information representing the instructions and data onto bus 610. Bus 610 carries the information to memory 604 from which processor 602 retrieves and executes the instructions using some of the data sent with the

instructions. The instructions and data received in memory 604 may optionally be stored on storage device 608, either before or after execution by the processor 602.

[0071] FIG. 7 illustrates a chip set or chip 700 upon which an embodiment of the invention may be implemented. Chip set 700 is programmed to determine location information based on reference points and relationships as described herein and includes, for instance, the processor and memory components described with respect to FIG. 6 incorporated in one or more physical packages (e.g., chips). By way of example, a physical package includes an arrangement of one or more materials, components, and/or wires on a structural assembly (e.g., a baseboard) to provide one or more characteristics such as physical strength, conservation of size, and/or limitation of electrical interaction. It is contemplated that in certain embodiments the chip set 700 can be implemented in a single chip. It is further contemplated that in certain embodiments the chip set or chip 700 can be implemented as a single "system on a chip." It is further contemplated that in certain embodiments a separate ASIC would not be used, for example, and that all relevant functions as disclosed herein would be performed by a processor or processors. Chip set or chip 700, or a portion thereof, constitutes a means for performing one or more steps of providing user interface navigation information associated with the availability of services. Chip set or chip 700, or a portion thereof, constitutes a means for performing one or more steps of determining location information based on reference points and relationships.

[0072] In one embodiment, the chip set or chip 700 includes a communication mechanism such as a bus 701 for passing information among the components of the chip set 700. A processor 703 has connectivity to the bus 701 to execute instructions and process information stored in, for example, a memory 705. The processor 703 may include one or more processing cores with each core configured to perform independently. A multi-core processor enables multiprocessing within a single physical package. Examples of a multi-core processor include two, four, eight, or greater numbers of processing cores. Alternatively or in addition, the processor 703 may include one or more microprocessors configured in tandem via the bus 701 to enable independent execution of instructions, pipelining, and multithreading. The processor 703 may also be accompanied with one or more specialized components to perform certain processing functions and tasks such as one or more digital signal processors (DSP) 707, or one

or more application-specific integrated circuits (ASIC) 709. A DSP 707 typically is configured to process real-world signals (e.g., sound) in real time independently of the processor 703. Similarly, an ASIC 709 can be configured to performed specialized functions not easily performed by a more general purpose processor. Other specialized components to aid in performing the inventive functions described herein may include one or more field programmable gate arrays (FPGA) (not shown), one or more controllers (not shown), or one or more other special-purpose computer chips.

[0073] In one embodiment, the chip set or chip 800 includes merely one or more processors and some software and/or firmware supporting and/or relating to and/or for the one or more processors.

[0074] The processor 703 and accompanying components have connectivity to the memory 705 via the bus 701. The memory 705 includes both dynamic memory (e.g., RAM, magnetic disk, writable optical disk, etc.) and static memory (e.g., ROM, CD-ROM, etc.) for storing executable instructions that when executed perform the inventive steps described herein to determine location information based on reference points and relationships. The memory 705 also stores the data associated with or generated by the execution of the inventive steps.

[0075] FIG. 8 is a diagram of exemplary components of a mobile terminal (e.g., handset) for communications, which is capable of operating in the system of FIG. 1, according to one embodiment. In some embodiments, mobile terminal 800, or a portion thereof, constitutes a means for performing one or more steps of determining location information based on reference points and relationships. Generally, a radio receiver is often defined in terms of front-end and back-end characteristics. The front-end of the receiver encompasses all of the Radio Frequency (RF) circuitry whereas the back-end encompasses all of the base-band processing circuitry. As used in this application, the term “circuitry” refers to both: (1) hardware-only implementations (such as implementations in only analog and/or digital circuitry), and (2) to combinations of circuitry and software (and/or firmware) (such as, if applicable to the particular context, to a combination of processor(s), including digital signal processor(s), software, and memory(ies) that work together to cause an apparatus, such as a mobile phone or server, to perform various functions). This definition of “circuitry” applies to all uses of this term in this application,

including in any claims. As a further example, as used in this application and if applicable to the particular context, the term "circuitry" would also cover an implementation of merely a processor (or multiple processors) and its (or their) accompanying software/or firmware. The term "circuitry" would also cover if applicable to the particular context, for example, a baseband integrated circuit or applications processor integrated circuit in a mobile phone or a similar integrated circuit in a cellular network device or other network devices.

[0076] Pertinent internal components of the telephone include a Main Control Unit (MCU) 803, a Digital Signal Processor (DSP) 805, and a receiver/transmitter unit including a microphone gain control unit and a speaker gain control unit. A main display unit 807 provides a display to the user in support of various applications and mobile terminal functions that perform or support the steps of determining location information based on reference points and relationships. The display 8 includes display circuitry configured to display at least a portion of a user interface of the mobile terminal (e.g., mobile telephone). Additionally, the display 807 and display circuitry are configured to facilitate user control of at least some functions of the mobile terminal. An audio function circuitry 809 includes a microphone 811 and microphone amplifier that amplifies the speech signal output from the microphone 811. The amplified speech signal output from the microphone 811 is fed to a coder/decoder (CODEC) 813.

[0077] A radio section 815 amplifies power and converts frequency in order to communicate with a base station, which is included in a mobile communication system, via antenna 817. The power amplifier (PA) 819 and the transmitter/modulation circuitry are operationally responsive to the MCU 803, with an output from the PA 819 coupled to the duplexer 821 or circulator or antenna switch, as known in the art. The PA 819 also couples to a battery interface and power control unit 820.

[0078] In use, a user of mobile terminal 801 speaks into the microphone 811 and his or her voice along with any detected background noise is converted into an analog voltage. The analog voltage is then converted into a digital signal through the Analog to Digital Converter (ADC) 823. The control unit 803 routes the digital signal into the DSP 805 for processing therein, such as speech encoding, channel encoding, encrypting, and interleaving. In one embodiment, the processed voice signals are encoded, by units not separately shown, using a

cellular transmission protocol such as global evolution (EDGE), general packet radio service (GPRS), global system for mobile communications (GSM), Internet protocol multimedia subsystem (IMS), universal mobile telecommunications system (UMTS), etc., as well as any other suitable wireless medium, e.g., microwave access (WiMAX), Long Term Evolution (LTE) networks, code division multiple access (CDMA), wideband code division multiple access (WCDMA), wireless fidelity (WiFi), satellite, and the like.

[0079] The encoded signals are then routed to an equalizer 825 for compensation of any frequency-dependent impairments that occur during transmission though the air such as phase and amplitude distortion. After equalizing the bit stream, the modulator 827 combines the signal with a RF signal generated in the RF interface 829. The modulator 827 generates a sine wave by way of frequency or phase modulation. In order to prepare the signal for transmission, an up-converter 831 combines the sine wave output from the modulator 827 with another sine wave generated by a synthesizer 833 to achieve the desired frequency of transmission. The signal is then sent through a PA 819 to increase the signal to an appropriate power level. In practical systems, the PA 819 acts as a variable gain amplifier whose gain is controlled by the DSP 805 from information received from a network base station. The signal is then filtered within the duplexer 821 and optionally sent to an antenna coupler 835 to match impedances to provide maximum power transfer. Finally, the signal is transmitted via antenna 817 to a local base station. An automatic gain control (AGC) can be supplied to control the gain of the final stages of the receiver. The signals may be forwarded from there to a remote telephone which may be another cellular telephone, other mobile phone or a land-line connected to a Public Switched Telephone Network (PSTN), or other telephony networks.

[0080] Voice signals transmitted to the mobile terminal 801 are received via antenna 817 and immediately amplified by a low noise amplifier (LNA) 837. A down-converter 839 lowers the carrier frequency while the demodulator 841 strips away the RF leaving only a digital bit stream. The signal then goes through the equalizer 825 and is processed by the DSP 805. A Digital to Analog Converter (DAC) 843 converts the signal and the resulting output is transmitted to the user through the speaker 845, all under control of a Main Control Unit (MCU) 803−which can be implemented as a Central Processing Unit (CPU) (not shown).

[0081] The MCU 803 receives various signals including input signals from the keyboard 847. The keyboard 847 and/or the MCU 803 in combination with other user input components (e.g., the microphone 811) comprise a user interface circuitry for managing user input. The MCU 803 runs a user interface software to facilitate user control of at least some functions of the mobile terminal 801 to determine location information based on reference points and relationships. The MCU 803 also delivers a display command and a switch command to the display 807 and to the speech output switching controller, respectively. Further, the MCU 803 exchanges information with the DSP 805 and can access an optionally incorporated SIM card 849 and a memory 851. In addition, the MCU 803 executes various control functions required of the terminal. The DSP 805 may, depending upon the implementation, perform any of a variety of conventional digital processing functions on the voice signals. Additionally, DSP 805 determines the background noise level of the local environment from the signals detected by microphone 811 and sets the gain of microphone 811 to a level selected to compensate for the natural tendency of the user of the mobile terminal 801.

[0082] The CODEC 813 includes the ADC 823 and DAC 843. The memory 851 stores various data including call incoming tone data and is capable of storing other data including music data received via, e.g., the global Internet. The software module could reside in RAM memory, flash memory, registers, or any other form of writable storage medium known in the art. The memory device 851 may be, but not limited to, a single memory, CD, DVD, ROM, RAM, EEPROM, optical storage, or any other non-volatile storage medium capable of storing digital data.

[0083] An optionally incorporated SIM card 849 carries, for instance, important information, such as the cellular phone number, the carrier supplying service, subscription details, and security information. The SIM card 849 serves primarily to identify the mobile terminal 801 on a radio network. The card 849 also contains a memory for storing a personal telephone number registry, text messages, and user specific mobile terminal settings.

[0084] While the invention has been described in connection with a number of embodiments and implementations, the invention is not so limited but covers various obvious modifications and equivalent arrangements, which fall within the purview of the appended claims. Although

features of the invention are expressed in certain combinations among the claims, it is contemplated that these features can be arranged in any combination and order.

CLAIMS

WHAT IS CLAIMED IS:

1. A method comprising:

receiving an input for specifying a first reference point, a second reference point, and a spatial relationship between the first reference point and the second reference point with respect to a device;

causing, at least in part, a comparison of the first reference point, the second reference point, and the relationship against a database of predetermined reference points; and

causing, at least in part, a determination of location information of the device based, at least in part, on the comparison.

2. A method of claim 1, further comprising:

receiving another input for specifying one or more third reference points and at least another spatial relationship between the first reference point, the second reference point, the third reference points, or a combination thereof,

wherein the determination of the location information is further based, at least in part, on the another input.

3. A method of claim 2, further comprising:

determining whether a combination of the first reference point, the second reference point, and the relationship is unique in the database; and

generating a request for the another input based, at least in part, on the determination.

4. A method according to any one of claims 1-3, further comprising:

causing, at least in part, presentation of the location information at the device,

wherein the presentation includes a map image of the location information, the first reference point, the second reference point, or a combination thereof.

5. A method of claim 4, further comprising:

determining whether a combination of the first reference point, the second reference point, and the relationship is unique in the database,

wherein the presentation of the location information is further based, at least in part, on the determination.

6. A method according to any one of claims 1-5, further comprising:

causing, at least in part, presentation of an input template including one or more fields, wherein the fields represent at least the first reference point and the second reference point, and the relationship is based, at least in part, on a spatial arrangement between the fields.

7. A method of claim 6, wherein the presentation of the input template is on a touch-enabled user interface.

8. A method according to any one of claims 1-7, further comprising:

determining a cell identifier associated with the device,

wherein the determination of the location information is further based, at least in part, on the cell identifier.

9. A method according to any one of claims 1-8, wherein the first reference point, the second reference point, or a combination thereof is visible text associated with a point of interest.

10. An apparatus comprising:

at least one processor; and

at least one memory including computer program code for one or more computer programs,

the at least one memory and the computer program code configured to, with the at least one processor, cause the apparatus to perform at least the following,

receive an input for specifying a first reference point, a second reference point, and a spatial relationship between the first reference point and the second reference point with respect to a device;

cause, at least in part, a comparison of the first reference point, the second reference point, and the relationship against a database of predetermined reference points; and

cause, at least in part, a determination of location information of the device based, at least in part, on the comparison.

11. An apparatus of claim 10, wherein the apparatus is further caused, at least in part, to:

receive another input for specifying one or more third reference points and at least another spatial relationship between the first reference point, the second reference point, the third reference points, or a combination thereof,

wherein the determination of the location information is further based, at least in part, on the another input.

12. An apparatus of claim 11, wherein the apparatus is further caused, at least in part, to:

determine whether a combination of the first reference point, the second reference point, and the relationship is unique in the database; and

generate a request for the another input based, at least in part, on the determination.

13. An apparatus according to any one of claims 10-12, wherein the apparatus is further caused, at least in part, to:

cause, at least in part, presentation of the location information at the device,

wherein the presentation includes a map image of the location information, the first reference point, the second reference point, or a combination thereof.

14. An apparatus of claim 13, wherein the apparatus is further caused, at least in part, to:

determine whether a combination of the first reference point, the second reference point, and the relationship is unique in the database,

wherein the presentation of the location information is further based, at least in part, on the determination.

15. An apparatus according to any one of claims 10-14, wherein the apparatus is further caused, at least in part, to:

cause, at least in part, presentation of an input template including one or more fields, wherein the fields represent at least the first reference point and the second reference point, and the relationship is based, at least in part, on a spatial arrangement between the fields.

16. An apparatus of claim 15, wherein the presentation of the input template is on a touch-enabled user interface.

17. An apparatus according to any one of claims 10-16, wherein the apparatus is further caused, at least in part, to:

determine a cell identifier associated with the device,

wherein the determination of the location information is further based, at least in part, on the cell identifier.

18. An apparatus according to any one of claims 10-17, wherein the first reference point, the second reference point, or a combination thereof is visible text associated with a point of interest.

19. A computer-readable storage medium carrying one or more sequences of one or more instructions which, when executed by one or more processors, cause an apparatus to at least perform the following steps:

receiving an input for specifying a first reference point, a second reference point, and a spatial relationship between the first reference point and the second reference point with respect to a device;

causing, at least in part, a comparison of the first reference point, the second reference point, and the relationship against a database of predetermined reference points; and

causing, at least in part, a determination of location information of the device based, at least in part, on the comparison.

20. A computer-readable storage medium of claim 19, wherein the apparatus is caused, at least in part, to further perform:

receiving another input for specifying one or more third reference points and at least another spatial relationship between the first reference point, the second reference point, the third reference points, or a combination thereof,

wherein the determination of the location information is further based, at least in part, on the another input.

21. A computer-readable storage medium of claim 20, wherein the apparatus is caused, at least in part, to further perform:

determining whether a combination of the first reference point, the second reference point, and the relationship is unique in the database; and

generating a request for the another input based, at least in part, on the determination.

22. A computer-readable storage medium according to any one of claim 19-21, wherein the apparatus is caused, at least in part, to further perform:

causing, at least in part, presentation of the location information at the device,

wherein the presentation includes a map image of the location information, the first reference point, the second reference point, or a combination thereof.

23. A computer-readable storage medium of claim 22, wherein the apparatus is caused, at least in part, to further perform:

determining whether a combination of the first reference point, the second reference point, and the relationship is unique in the database,

wherein the presentation of the location information is further based, at least in part, on the determination.

24. A computer-readable storage medium according to any one of claim 19-23, wherein the apparatus is caused, at least in part, to further perform:

causing, at least in part, presentation of an input template including one or more fields, wherein the fields represent at least the first reference point and the second reference point, and the relationship is based, at least in part, on a spatial arrangement between the fields.

25. A computer-readable storage medium of claim 24, wherein the presentation of the input template is on a touch-enabled user interface.

26. A computer-readable storage medium according to any one of claim 19-25, wherein the apparatus is caused, at least in part, to further perform:

determining a cell identifier associated with the device,

wherein the determination of the location information is further based, at least in part, on the cell identifier.

27. A computer-readable storage medium according to any one of claim 19-26, wherein the first reference point, the second reference point, or a combination thereof is visible text associated with a point of interest.

28. An apparatus comprising:

means for receiving an input for specifying a first reference point, a second reference point, and a spatial relationship between the first reference point and the second reference point with respect to a device;

means causing, at least in part, a comparison of the first reference point, the second reference point, and the relationship against a database of predetermined reference points; and

means for causing, at least in part, a determination of location information of the device based, at least in part, on the comparison.

29. An apparatus of claim 28, further comprising:

means for receiving another input for specifying one or more third reference points and at least another spatial relationship between the first reference point, the second reference point, the third reference points, or a combination thereof,

wherein the determination of the location information is further based, at least in part, on the another input.

30. An apparatus of claim 29, further comprising:

means for determining whether a combination of the first reference point, the second reference point, and the relationship is unique in the database; and

means for generating a request for the another input based, at least in part, on the determination.

31. An apparatus according to any one of claims 28-30, further comprising:

means for causing, at least in part, presentation of the location information at the device,

wherein the presentation includes a map image of the location information, the first reference point, the second reference point, or a combination thereof.

32. An apparatus of claim 31, further comprising:

means for determining whether a combination of the first reference point, the second reference point, and the relationship is unique in the database,

wherein the presentation of the location information is further based, at least in part, on the determination.

33. An apparatus according to any one of claims 28-32, further comprising:

means for causing, at least in part, presentation of an input template including one or more fields, wherein the fields represent at least the first reference point and the second reference point, and the relationship is based, at least in part, on a spatial arrangement between the fields.

34. An apparatus of claim 33, wherein the presentation of the input template is on a touch-enabled user interface.

35. An apparatus according to any one of claims 28-34, further comprising:

means for determining a cell identifier associated with the device,

wherein the determination of the location information is further based, at least in part, on the cell identifier.

36. An apparatus according to any one of claims 28-35, wherein the first reference point, the second reference point, or a combination thereof is visible text associated with a point of interest.

37. A computer program product including one or more sequences of one or more instructions which, when executed by one or more processors, cause an apparatus to at least perform the steps of a method of any one of claims 1-9.

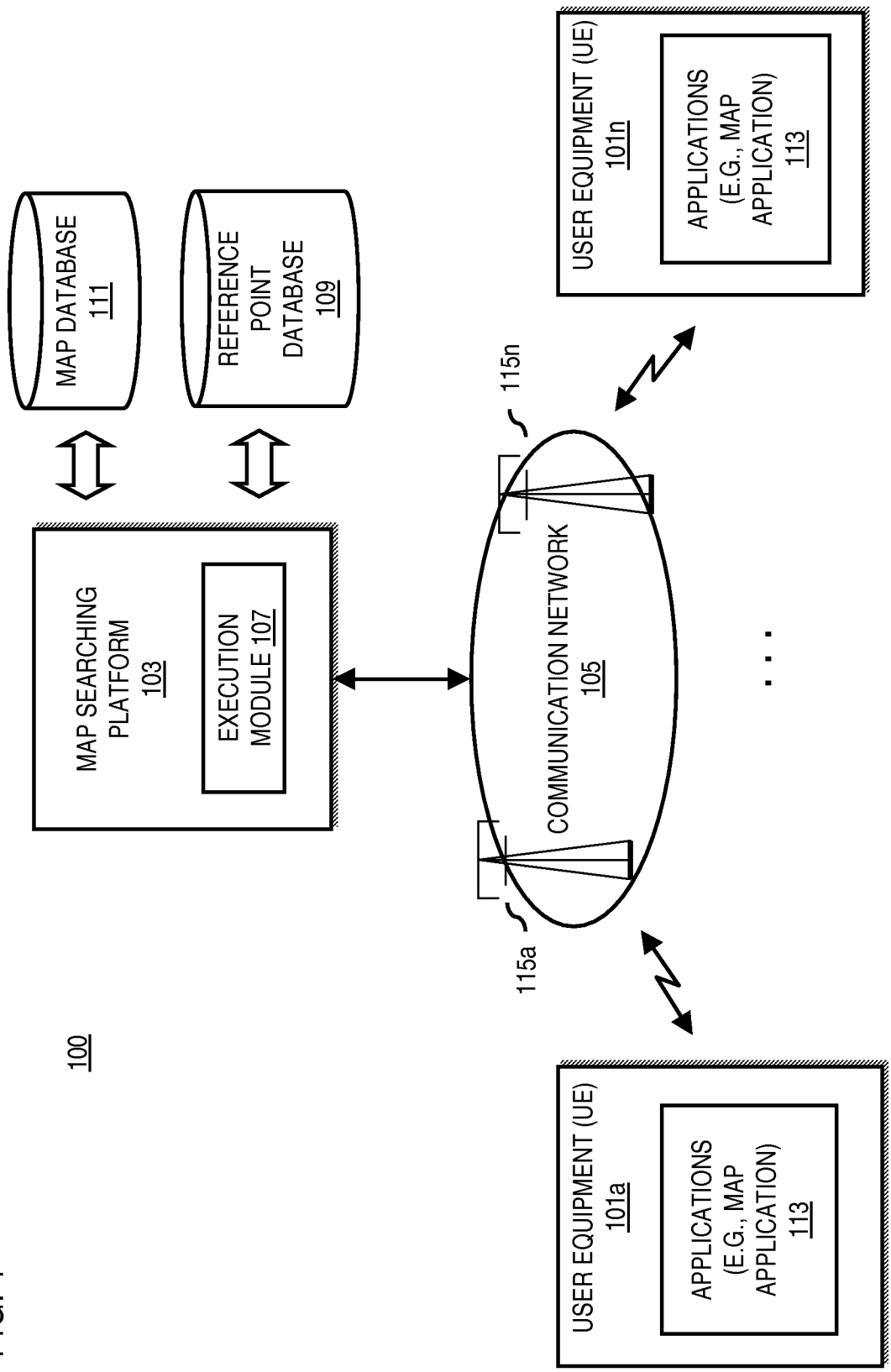

MAP DATABASE 111
REFERENCE POINT DATABASE 109
MAP SEARCHING PLATFORM 103
EXECUTION MODULE 107
100
COMMUNICATION NETWORK 105
115a
115n
USER EQUIPMENT (UE) 101a
APPLICATIONS (E.G., MAP APPLICATION) 113
USER EQUIPMENT (UE) 101n
APPLICATIONS (E.G., MAP APPLICATION) 113

FIG. 1

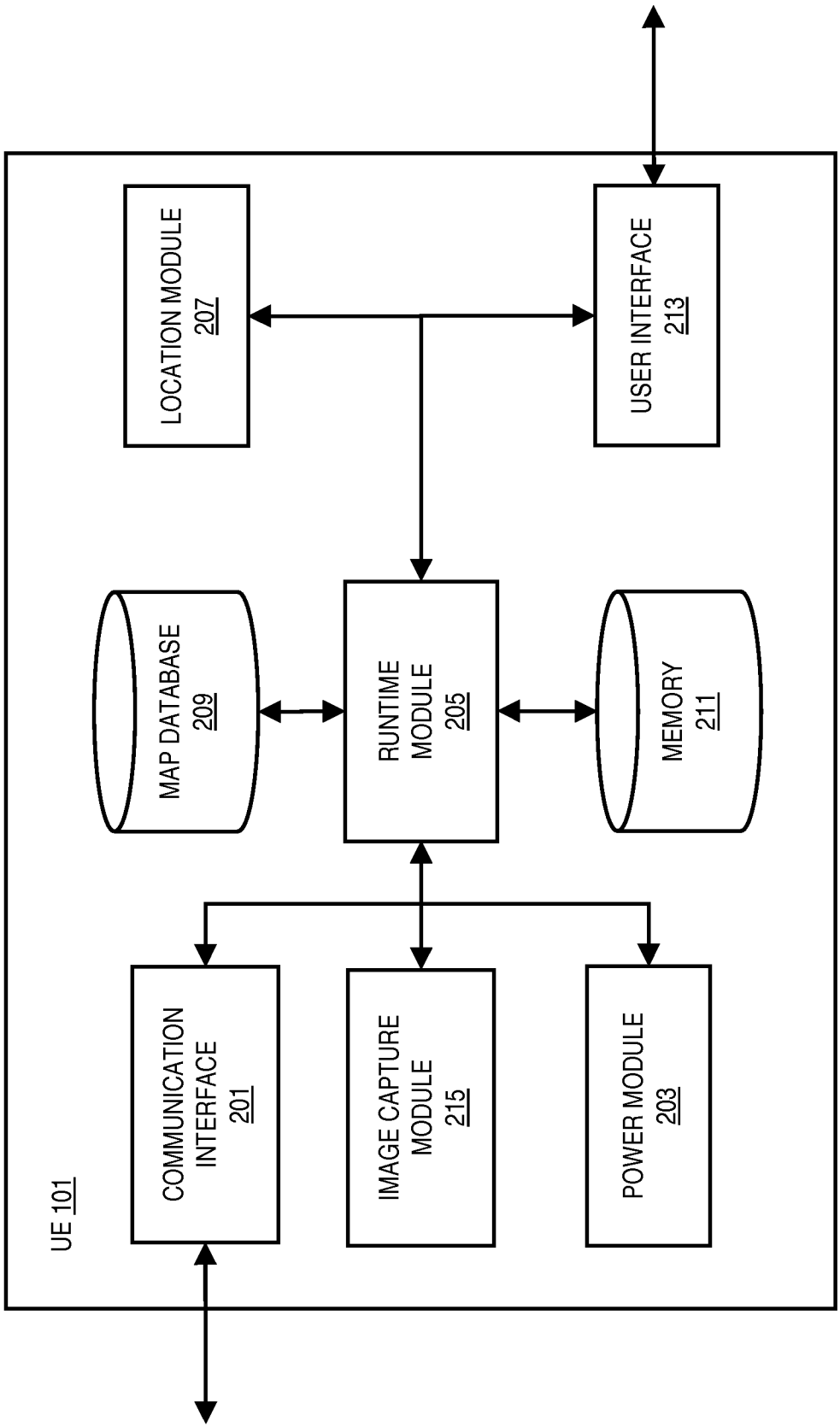

UE 101
LOCATION MODULE 207
USER INTERFACE 213
MAP DATABASE 209
RUNTIME MODULE 205
MEMORY 211
COMMUNICATION INTERFACE 201
IMAGE CAPTURE MODULE 215
POWER MODULE 203

FIG. 2

FIG. 3A

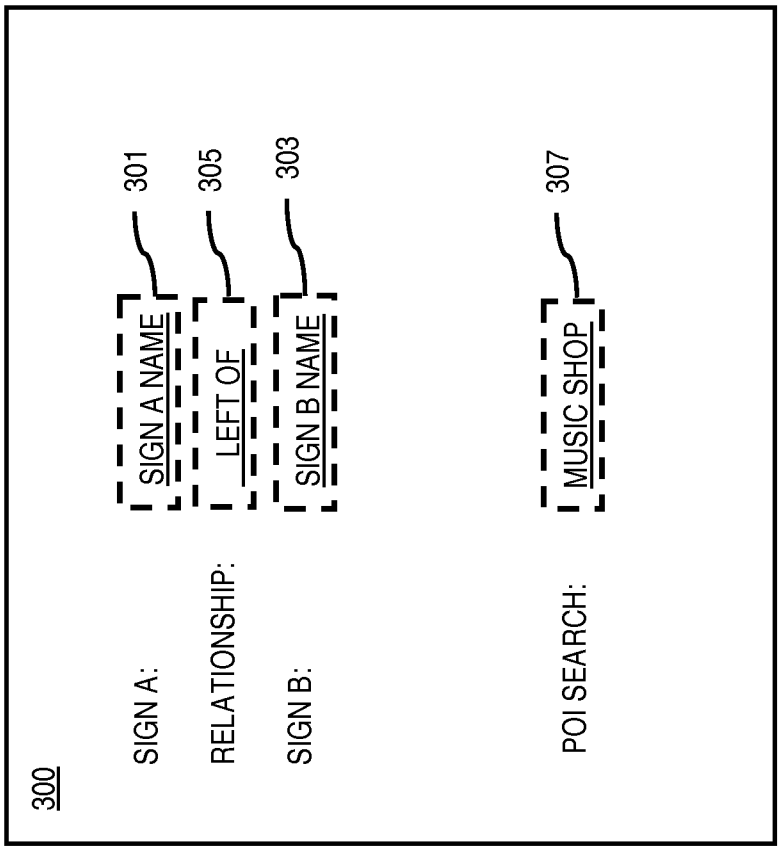
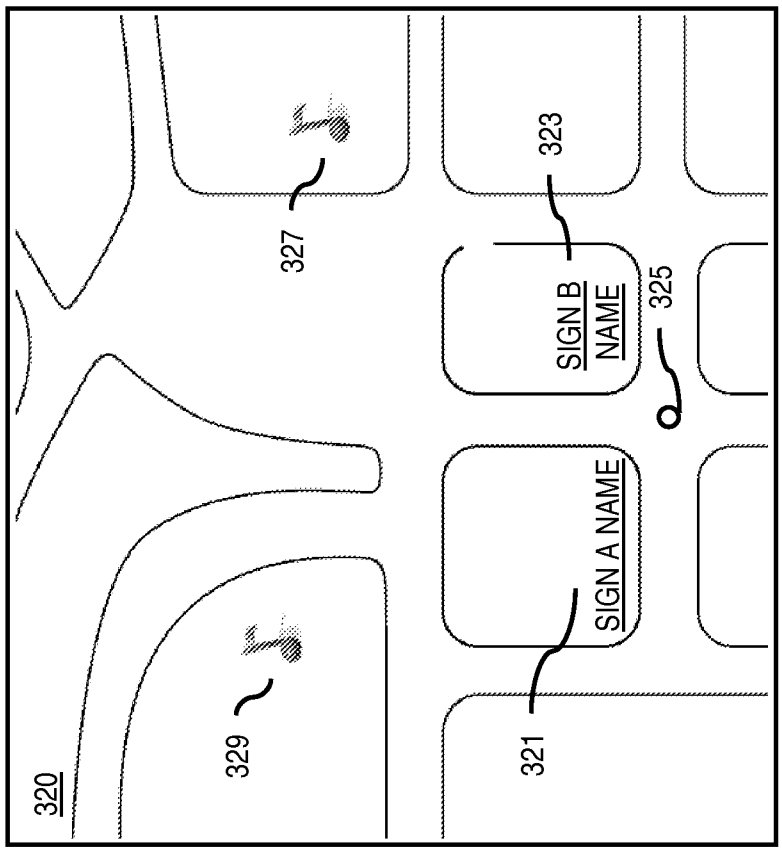

300
SIGN A:
SIGN A NAME
301
RELATIONSHIP:
LEFT OF
305
SIGN B:
SIGN B NAME
303
POI SEARCH:
MUSIC SHOP
307

FIG. 3B


320
329
327
321
SIGN A NAME
323
SIGN B NAME
325

Template 1
Street model

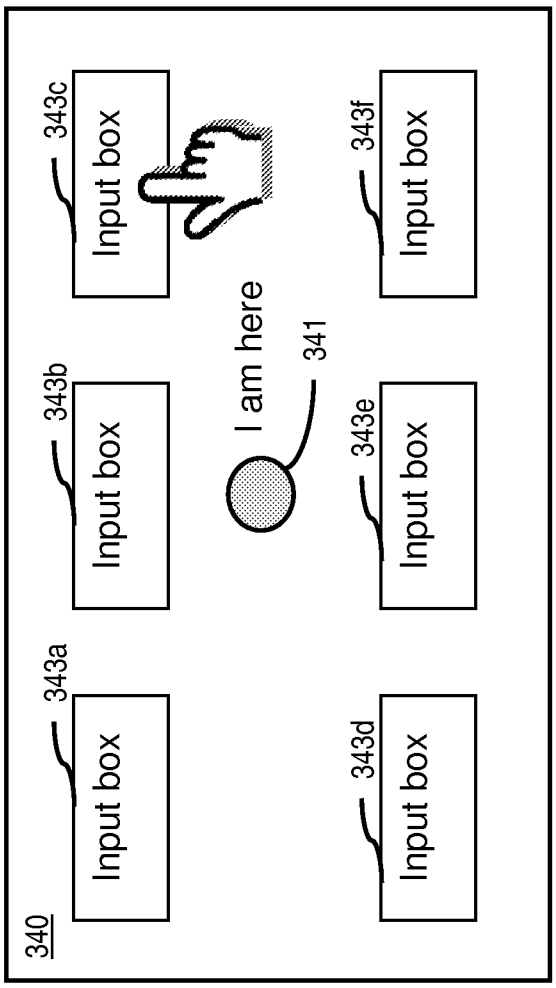


FIG. 3C

Template 2
Surrounding
model

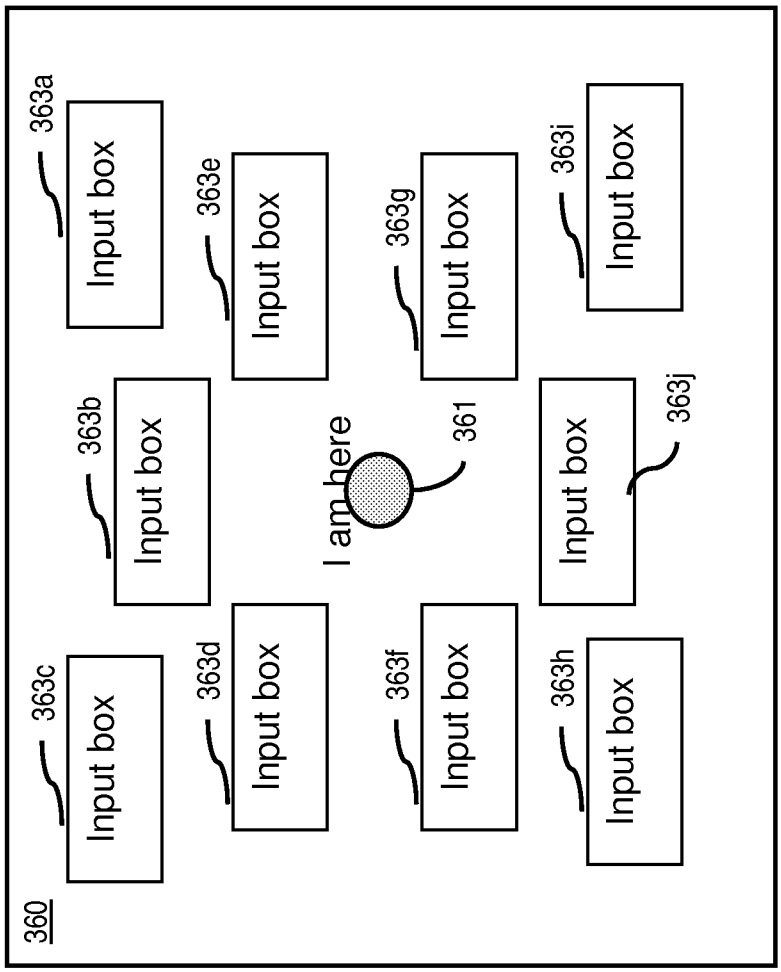


FIG. 3D

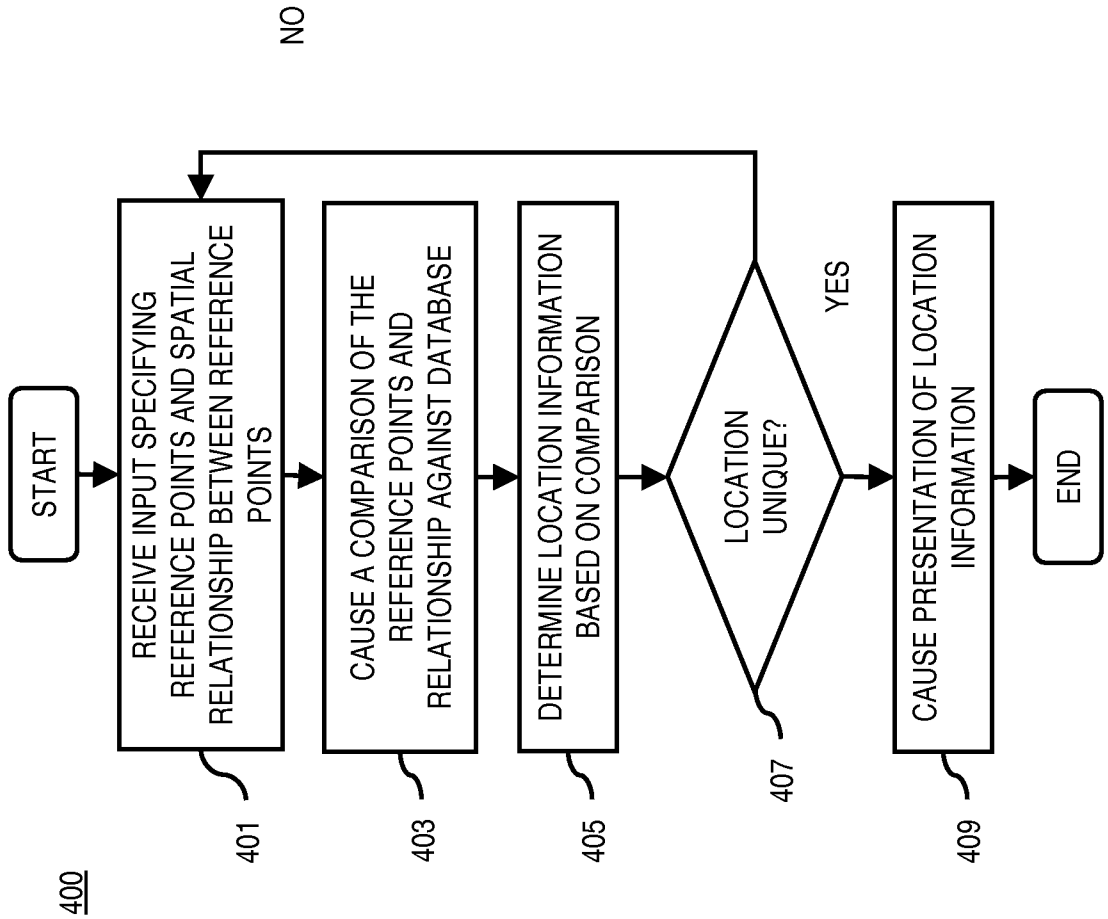

400
START
RECEIVE INPUT SPECIFYING REFERENCE POINTS AND SPATIAL RELATIONSHIP BETWEEN REFERENCE POINTS
401
CAUSE A COMPARISON OF THE REFERENCE POINTS AND RELATIONSHIP AGAINST DATABASE
403
DETERMINE LOCATION INFORMATION BASED ON COMPARISON
405
LOCATION UNIQUE?
407
NO
YES
CAUSE PRESENTATION OF LOCATION INFORMATION
409
END

FIG. 4

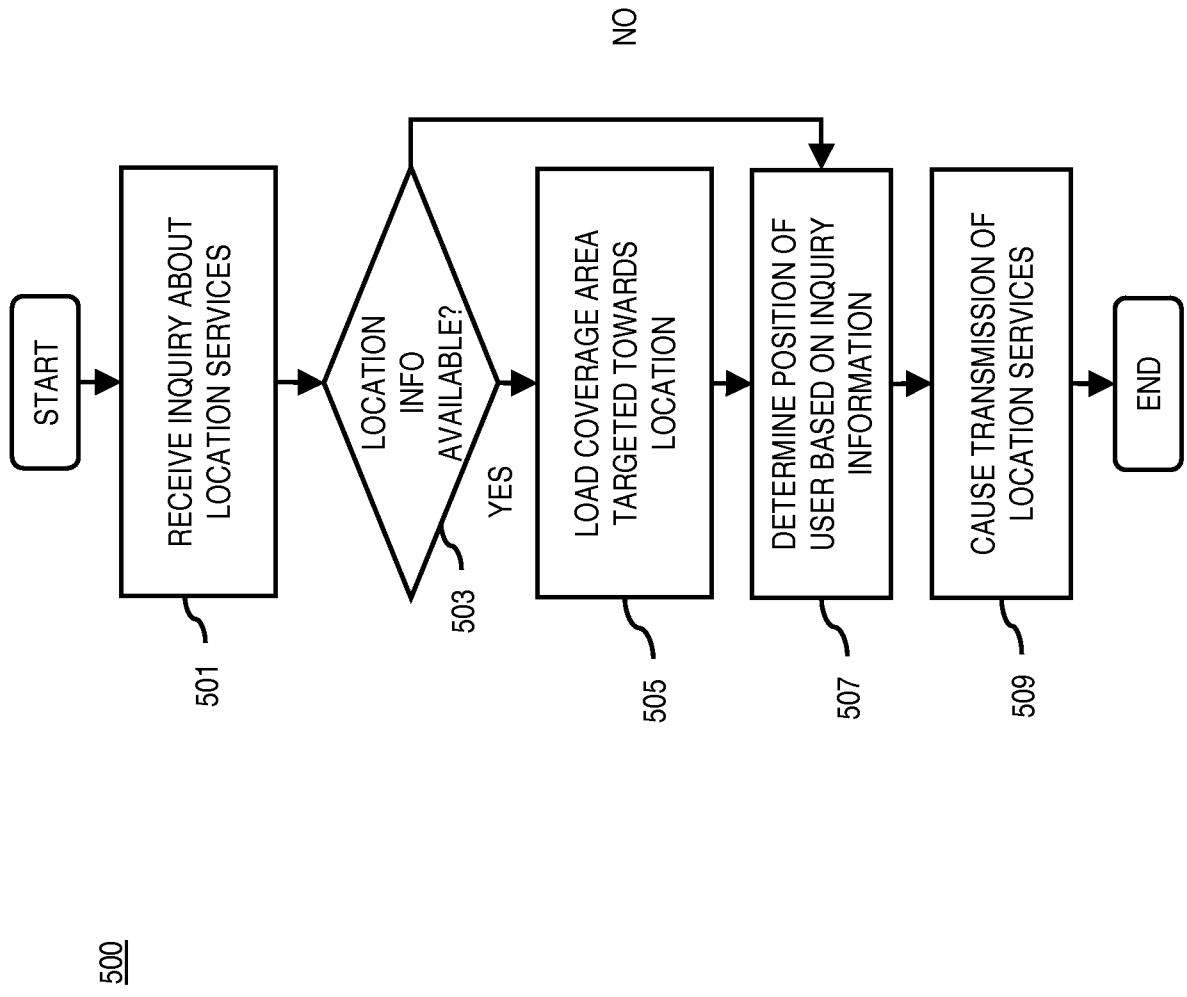

500
START
RECEIVE INQUIRY ABOUT LOCATION SERVICES
501
LOCATION INFO AVAILABLE?
503
YES
NO
LOAD COVERAGE AREA TARGETED TOWARDS LOCATION
505
DETERMINE POSITION OF USER BASED ON INQUIRY INFORMATION
507
CAUSE TRANSMISSION OF LOCATION SERVICES
509
END

FIG. 5

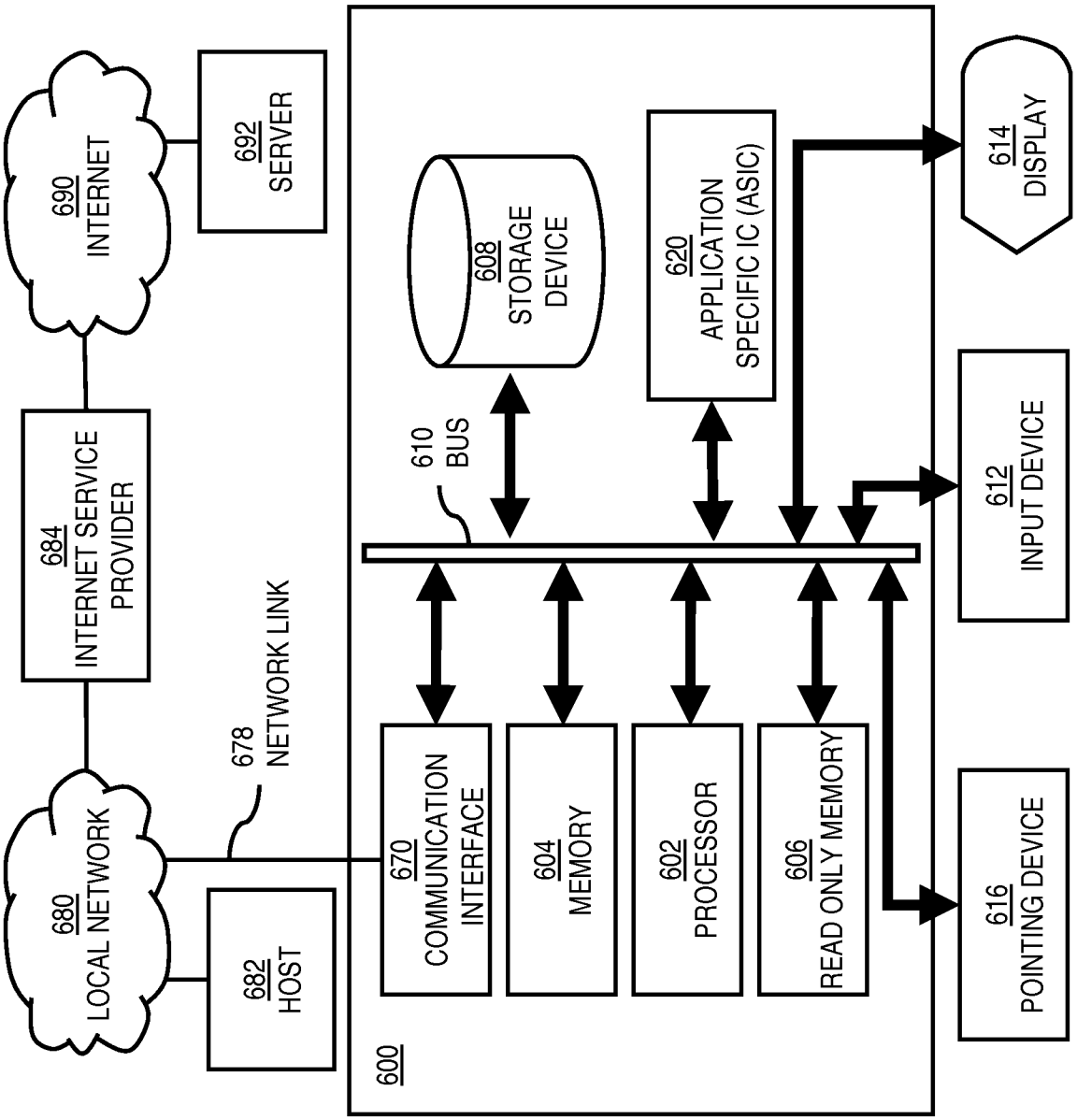

690 INTERNET
692 SERVER
684 INTERNET SERVICE PROVIDER
678 NETWORK LINK
680 LOCAL NETWORK
682 HOST
600
670 COMMUNICATION INTERFACE
604 MEMORY
602 PROCESSOR
606 READ ONLY MEMORY
610 BUS
608 STORAGE DEVICE
620 APPLICATION SPECIFIC IC (ASIC)
614 DISPLAY
612 INPUT DEVICE
616 POINTING DEVICE

FIG. 6

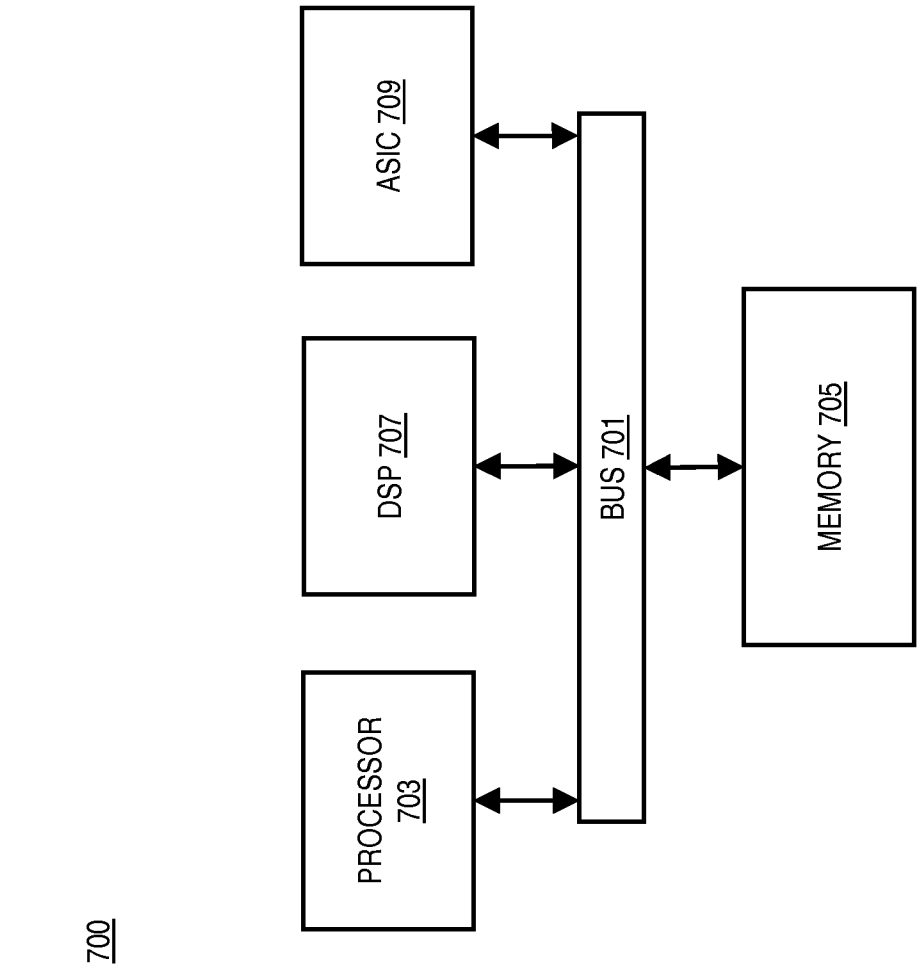
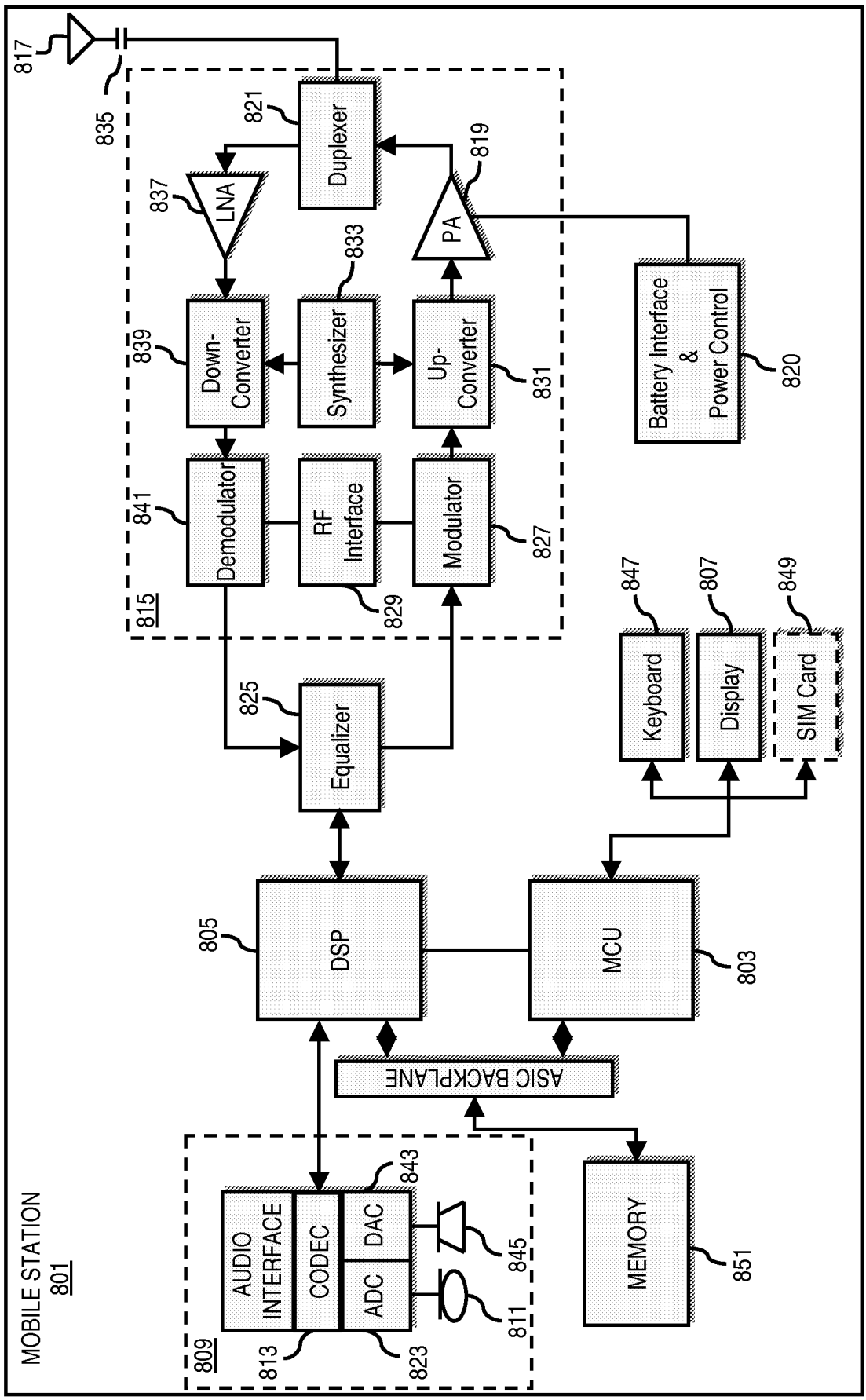


FIG. 7

FIG. 8


MOBILE STATION
801
817
835
821
Duplexer
819
837
LNA
PA
833
839
Down-
Converter
Synthesizer
Up-
Converter
831
Battery Interface
&
Power Control
820
841
Demodulator
RF
Interface
Modulator
827
829
815
825
Equalizer
847
Keyboard
807
Display
849
SIM Card
805
DSP
MCU
803
ASIC BACKPLANE
809
AUDIO
INTERFACE
CODEC
DAC
ADC
843
845
811
813
823
MEMORY
851

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2010/071790

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

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: G01S, G01C, G06F

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

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

CPRS & CNKI& WPI & EPODOC

Reference point, spatial relationship, compar+, database, locat+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US2009/0082992 A1（LEICA GEOSYSTEMS AG.）, 26 Mar.2009 (26.03.2009)，paragraphs [0005]-[0041] of the description	1-18, 28-36
A	US6272457 B1（DATRIA SYSTEMS, INC.）, 07 Aug.2001 (07.08.2001)，column 1 lines 60-column 15 lines 15 of the description, figs.1-9	1-18, 28-36
A	CN101566481 A（OKWAP SHANGHAI TECHNOLOGY CO., LTD.）, 28 Oct. 2009（28.10.2009）, the whole document	1-18, 28-36
A	CN1705861 A（NAVITIME JAPAN CO., LTD.）, 07 Dec. 2005（07.12.2005）, the whole document	1-18, 28-36

☐ Further documents are listed in the continuation of Box C. ☒ See patent family 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 application or patent 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
30 Dec. 2010（30.12.2010）	**20 Jan. 2011 (20.01.2011)**
Name and mailing address of the ISA/CN The State Intellectual Property Office, the P.R.China 6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088 Facsimile No. 86-10-62019451	Authorized officer ZHAO,Jinghuan Telephone No. (86-10)62085706

Form PCT/ISA /210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2010/071790

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☒ Claims Nos.: 19-27,37
because they relate to subject matter not required to be searched by this Authority, namely:

the subject matter of claims 19-27 solely relates to a computer readable storage medium, which is characterized solely by the content of the information recorded on the medium, which would be excluded under Rules 39(1)(v) and 67(v).

the subject matter of claim 37 solely relates to a computer program, which would be excluded under Rules 39(1)(vi) and 67(vi).

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2010/071790

A. CLASSIFICATION OF SUBJECT MATTER:

G01C 21/26 (2006.01) i

G01S 5/02 (2010.01) i

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2010/071790

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
US2009/0082992 A1	26.03.2009	EP2040030A1	25.03.2009
		US7647199B2	12.01.2010
		WO2009039929A1	02.04.2009
		CA2699665A1	02.04.2009
		AU2008303962A1	02.04.2009
		EP2193333A	09.06.2010
		CN101809407A	18.08.2010
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		US7003443B2	21.02.2006
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		US6711535B2	23.03.2004
CN101566481 A	28.10.2009	None	
CN1705861 A	07.12.2005	WO2004076974A1	10.09.2004
		EP1586859A1	19.10.2005
		CN100470198C	18.03.2009
		US2006025922A1	02.02.2006
		US7337062B2	26.02.2008
		JP4297904B2	15.07.2009