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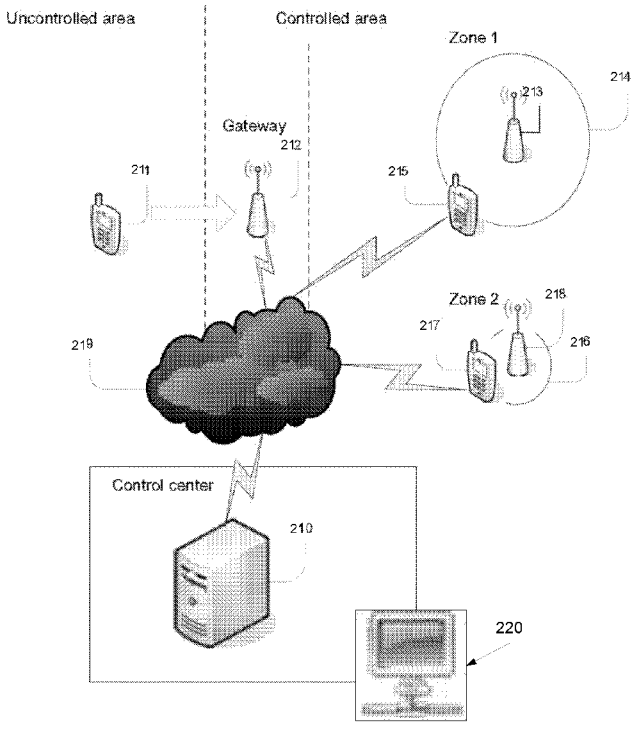

FIG. 2B

(57) Abstract: A computerized method of identifying a location of mobile client terminals. The method comprises providing to a mobile client terminal a mapping dataset which defines a plurality of physical locations of a plurality of beacon devices, receiving at the mobile client terminal at least one distinct signal transmitted from at least one of the plurality of beacon devices, extracting from each of the at least one distinct signal an identifier of a beacon device of the plurality of beacon devices, matching between the identifier and one of the plurality of physical locations using the mapping dataset, and identifying a location of the mobile client according to the matching.

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POSITIONING SYSTEMS AND METHODS AND LOCATION BASED MODIFICATION OF COMPUTING DEVICE APPLICATIONS

FIELD AND BACKGROUND OF THE INVENTION

The present invention, in some embodiments thereof, relates to computing device applications and, more particularly, but not exclusively, to positioning system and methods and to location-based functionality modification of computing device applications at runtime.

Since the accession of the global positioning system (GPS) for popular position-locating purposes, various positioning technologies have prospered in the consumer market. The positioning technology has rapidly developed and is widely used and applied to a variety of fields besides the primary military applications. For example, in the ground transport such as the railway transportation, the positioning technology is adapted for positioning and controlling operations of trains to prevent trains from colliding with each other and further increase the system transportation capacity and efficiency. In the automobile navigation, positioning technologies are used to provide vehicle drivers with an automatic navigation function for locating the shortest route to a destination. In air transport, the positioning and navigation functions of the GPS technology are used to assist and facilitate the automatic navigation system of the airplanes during landing and flying.

During the last years, various location based applications which use positioning technologies have been developed. Location-based approaches to computing device applications are becoming increasingly popular, especially on mobile client terminals.

In location-based applications, momentary location data is collected by a positioning module, such as a GPS receiver, serving as an input device. The data received from a space-based satellite navigation system is correlated with static outlines of street arrangements as depicted in street maps, to provide navigation instructions or location related data to a user of the mobile electronic device in real time.

SUMMARY OF THE INVENTION

According to some embodiments of the present invention there is provided a computerized method of identifying a location of mobile client terminals. The method comprises providing to a mobile client terminal a mapping dataset which defines a plurality of physical locations of a plurality of beacon devices, receiving at the mobile client terminal at least one distinct signal transmitted from at least one of the plurality of beacon devices, extracting from each of the at least one distinct signal an identifier of a beacon device of the plurality of beacon devices, matching between the identifier and one of the plurality of physical locations using the mapping dataset, and identifying a location of the mobile client according to the matching.

Optionally, the computerized method further comprises measuring signal strength of each the at least one distinct signal, and wherein identifying a location of the mobile client further comprises calculating a physical distance from each of the plurality of physical locations according to the signal strength.

Optionally, the physical distance is less than 3 meters.

More optionally, the physical distance is less than 1 meter.

Optionally, the computerized method further comprises outputting the location of the mobile client.

Optionally, the plurality of physical locations are within the boundaries of a confined space.

More optionally, the mapping dataset is defined according to a grid of coordinates within the confined space and wherein the physical locations are provided according to the grid of coordinates.

According to some embodiments of the present invention there is provided a computerized method for modification of input component operation on mobile client terminals. The method comprises providing a policy specifying a plurality of operations for at least one input component of a mobile client terminal each the operation mode is associated with at least one of a plurality of geographical areas, receiving a current location data of the mobile client terminal, and electing one of the plurality of operations to the at least one input component according a match between one of the plurality of geographical areas and the current location data.

Optionally, the plurality of operations comprises a member of a group consisting of: filtering an output of the at least one input component, deactivating the at least one input component, encrypting an output of the at least one input component, rerouting the output of the at least one input component.

Optionally, the at least one input component comprises a camera.

Optionally, the at least one input component is an auxiliary device connected to the mobile client terminal via a port located on the mobile client terminal.

Optionally, the at least one input component includes a sensor selected from a group consisting of an audible input sensor, a visual input sensor, a tactile input sensor and a mechanical input sensor.

Optionally, the at least one input component comprises a microphone.

Optionally, the at least one input component comprises a positioning unit.

Optionally, the computerized method further comprises monitoring at least one application executed on the mobile client terminal according to input data received from the at least one input component and operating the at least one application according to the current location data.

Optionally, the location data refers to an area within boundaries of a confined space, and wherein the policy is restricted to the boundaries.

According to some embodiments of the present invention there is provided a computerized method of providing a platform for tracking mobile client terminals' locations. The method comprises positioning a plurality of beacon devices in a plurality of physical locations, providing a mapping dataset which maps each of the plurality of beacon devices to a respective physical location selected from the plurality of physical locations, and transmitting the mapping dataset to a mobile client terminal.

Optionally, the plurality of physical locations are defined according to a virtual grid of coordinates and wherein the physical locations are provided according to the grid of coordinates.

Optionally, the plurality of beacon devices are electric beacon devices which transmits a beacon signal selected from a group consisting of radio frequency signal, infrared signal, and sonar signal.

More optionally, each of the plurality of beacon devices independently broadcasts an electric signal transmission.

More optionally, each the electric signal transmission is distinct and comprises a unique identifier of a corresponding beacon device of the plurality of beacon devices.

More optionally, the electric signal transmission is continuous.

According to some embodiments of the present invention there is provided a mobile client terminal. The mobile client terminal comprises a processor, a repository which stores a mapping dataset defining a plurality of physical locations of a plurality of beacon device identifiers, a beacon signal analysis module which extracts a first of the plurality of beacon device identifiers from at least one beacon signal transmitted by a beacon device, a location mapping module which uses the processor to select one of the plurality of physical locations according to a match between the first beacon identifier and the mapping dataset, and an application management module which automatically operates at least one application hosted by the mobile client terminal according to the selected physical location.

Optionally, the application management module prioritizes the at least one application according to the selected physical location.

Optionally, the application management module activates the at least one application according to the selected physical location.

Optionally, the application management module facilitates the at least one application to access storage according to the selected physical location.

According to some embodiments of the present invention there is provided a positioning system that comprises a plurality of beacon devices each comprises: a processor, a memory which stores a beacon device identifier to a different of a plurality of beacon devices, and a transmitter which transmits a beacon signal which encoding the beacon device identifier and a plurality of location mapping modules which are installed in a plurality of client devices, each the location mapping module, accesses a mapping dataset which maps between a plurality of physical locations and a plurality of beacon devices, and uses a processor of a respective hosting the client device to select one of the plurality of physical locations according to an analysis of beacon device identifier extracted from the beacon signal and the mapping dataset.

Unless otherwise defined, all technical and/or scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which the invention pertains. Although methods and materials similar or equivalent to those

described herein can be used in the practice or testing of embodiments of the invention, exemplary methods and/or materials are described below. In case of conflict, the patent specification, including definitions, will control. In addition, the materials, methods, and examples are illustrative only and are not intended to be necessarily limiting.

Implementation of the method and/or system of embodiments of the invention can involve performing or completing selected tasks manually, automatically, or a combination thereof. Moreover, according to actual instrumentation and equipment of embodiments of the method and/or system of the invention, several selected tasks could be implemented by hardware, by software or by firmware or by a combination thereof using an operating system.

For example, hardware for performing selected tasks according to embodiments of the invention could be implemented as a chip or a circuit. As software, selected tasks according to embodiments of the invention could be implemented as a plurality of software instructions being executed by a computer using any suitable operating system. In an exemplary embodiment of the invention, one or more tasks according to exemplary embodiments of method and/or system as described herein are performed by a data processor, such as a computing platform for executing a plurality of instructions. Optionally, the data processor includes a volatile memory for storing instructions and/or data and/or a non-volatile storage, for example, a magnetic hard-disk and/or removable media, for storing instructions and/or data. Optionally, a network connection is provided as well. A display and/or a user input device such as a keyboard or mouse are optionally provided as well.

BRIEF DESCRIPTION OF THE DRAWINGS

Some embodiments of the invention are herein described, by way of example only, with reference to the accompanying drawings. With specific reference now to the drawings in detail, it is stressed that the particulars shown are by way of example and for purposes of illustrative discussion of embodiments of the invention. In this regard, the description taken with the drawings makes apparent to those skilled in the art how embodiments of the invention may be practiced.

In the drawings:

FIG. 1 is a flowchart of a computerized method for positioning a mobile client terminal, according to some embodiments of the present invention;

FIG. 2A is a flowchart of a computerized method for modifying input device operation on mobile client terminals, according to some embodiments of the present invention;

FIG. 2B is a schematic illustration of a system for enforcing an input components operation policy on a plurality of mobile devices, according to some embodiments of the present invention;

FIG. 3A is a relational view of software and hardware components of a system for location-based modification of mobile computing device applications, according to some embodiments of the present invention;

FIG. 3B is a schematic illustration of an exemplary arrangement of components of a beacon device that is used to transmit a beacon signal, according to some embodiments of the present invention;

FIG. 3C is a schematic illustration if an electric circuit combining between a compact fluorescent lamp (CFL) and the arrangement of components depicted in FIG. 3B, according to some embodiments of the present invention;

FIG. 4 is a flowchart of a computerized method of providing a platform for tracking mobile client terminals' locations, according to some embodiments of the present invention;

FIG. 5 is a schematic representation of relations between software and hardware modules of a mobile client terminal and a platform for tracking mobile client terminals' locations, according to some embodiments of the present invention;

FIG. 6 is a schematic representation of a challenge-response protocol implementation for inquiring and setting a location based context for input devices of a mobile client terminal, according to some embodiments of the present invention; and

FIG. 7 is a representation of a broadcast protocol implementation for setting a location based context for input devices of a mobile client terminal, according to some embodiments of the present invention.

DESCRIPTION OF EMBODIMENTS OF THE INVENTION

The present invention, in some embodiments thereof, relates to mobile computing device applications and, more particularly, but not exclusively, to positioning system and methods and to runtime location-based functionality modification of computing device applications on mobile client terminals.

Some embodiments of the present invention provide methods and systems of identifying locations of mobile client terminals, optionally within boundaries of confined spaces using a plurality of independent beacon devices which are dispersed in a target service area. Embodiments of the present invention further provide methods and systems of updating operation of input modules and/or units, such as a camera, a microphone, and/or a positioning module, for example a global positioning system (GPS) module, installed on or operated by mobile client terminals, according to the location of the mobile client terminals. Embodiments of the present invention further provide methods and systems of controlling operation of applications executed on mobile client terminals according to location data.

Determining the location of the mobile client terminal involves acquiring relatively small amounts of data from signals transmitted by independent beacon devices, also referred to herein as beacons. As used herein, a beacon may be any element which transmits a unique identifier, either sequentially, continuously, randomly and/or in response to an inquiry. Optionally, the mobile client terminal extracts an identifier from a beacon signal and determines a location based on a match between the identifier and a dataset mapping the locations of various beacons. The dataset maps between distinct beacon signals and locations of the beacons which omit the signals. In some embodiments signal strengths are measured, and the dataset is used to calculate distances between the mobile client terminal and one or more beacons according to measured signal strengths. This matching between the beacon signal strength and the dataset may improve the positioning accuracy. The dataset with the beacon positioning data may be provided from a central unit, such as a server. The beacons may be electric elements which transmits, for example broadcast, a beacon data over a signal encoded according to known protocols, such as Bluetooth™ ZigBee™, Wi-FI™, cellular, and Near Field Communication (NFC).

Embodiments of the systems and methods may be used, for example and without limitation, to centralize control of security settings in confined spaces. An input device usage policy may be used to dictate operation modes for input devices of visiting mobile client terminals. Such a usage policy may dictate, for example, blocking operation of input devices such as microphones and cameras in high-security areas.

Before explaining at least one embodiment of the invention in detail, it is to be understood that the invention is not necessarily limited in its application to the details of construction and the arrangement of the components and/or methods set forth in the following description and/or illustrated in the drawings and/or the Examples. The invention is capable of other embodiments or of being practiced or carried out in various ways.

Reference is now made to FIG. 1, which is a flowchart of a computerized method for locating a mobile client terminal 100, according to some embodiments of the present invention.

Reference is also made to FIG. 3A, which is a relational view of software and hardware components of a mobile device 300 hosting a positioning application, according to some embodiments of the present invention. The mobile device 300 includes an interface serving as an interface (input and/or output) module 301, for example an integrated Wi-Fi™ and/or Bluetooth™ module and a positioning application 299 having a beacon signal analysis module 302, a location mapping module 303, a monitoring and modification module 304, and a processor 305. For brevity, it should be noted that computing functions described herein may be performed using the processor 305. The positioning application 299 may be an app selected and installed via an app store or application market, a module provided with the mobile device 300, a part of an operating system, and/or an application that is remotely installed in the mobile device 300. The positioning application 299 may function in auto-run mode without any user intervention.

The system 300 may be implemented using software and/or hardware components.

As shown at numeral 101 of FIG. 1, the interface module 301 acquires, for example receives or accesses, a mapping dataset of beacons and their respective physical locations.

The beacons are electronic beacon devices capable of transmitting devices signals encoded according to a known protocol, such as Bluetooth™, ZigBee™, NFC and Wi-FI™ and/or according to a designated protocol. The transmission may be continuous, periodic, and/or upon demand, for example in response to an inquiry from a mobile device.

For example, and without limitation, the electronic beacon devices may be radio frequency (RF) beacons, microwave beacons, infrared beacons, and/or sonar beacons. The beacons may transmit data in various forms such as but not limited to light, sound or combinations thereof, typically unnoticeable by human vision or hearing capabilities.

For example, reference is now made to FIG. 3B, which is a schematic illustration of an exemplary arrangement of components of a beacon device 310 which is used to transmit a beacon signal, according to some embodiments of the present invention. The exemplary beacon device includes a power management unit 314 which supplies energy for beacon components. For example, a power supply line 318 is connected to a transceiver 317 and allows the power management unit 314 to adjust power output of the transceiver 317. Central processing unit (CPU) 315, which may be implemented using a microprocessor, sends beacon data, for example a beacon identifier (ID), one more security setup(s), a protocol implementation and/or the like, from a memory 316. The CPU 315 may receive data via the transceiver, for example firmware update(s), reset command, new beacon ID and configuration parameters. The transceiver 317 is connected to an antenna 319. The transmission may be according to various protocols, for example Wi-Fi™, Bluetooth™, WiMAX™, ZigBee™, NFC, Cellular and/or the like.

As described above, the beacon device may be an independent device that is set to be inexpensive and simple for installation. According to some embodiments of the present invention, the beacon device is integrated within a lamp that fits into a light bulb socket, for example into a compact fluorescent lamp (CFL). For example, reference is also made to FIG. 3C, which is a schematic illustration if an electric circuit combining between the CFL 320 and the arrangement of components 310, according to some embodiments of the present invention. The CFL 320 includes an electronic ballast unit with a bridge and filter unit 411, direct current (DC) to alternating current (AC) convertor 412 and lamp 413. The beacon is connected to bridge and filter unit 411 as it

power supply. Optionally, the beacon and the electronic ballast for CFL are integrated together at the CFL's case.

According to some embodiments of the present invention, the beacon device includes a solar panel or any other renewable energy generator for powering a battery. In such embodiments, the beacon device includes a renewable energy generator (i.e. linear or curved solar photovoltaic (PV) panel, a miniature wind turbine system) a charge controller and battery. Such beacon device may transmits a beacon signal without the having a fixed power source.

According to some embodiments of the present invention, the beacon device includes an inductive charger for powering a battery. In such embodiments, the beacon device may be charged when in proximity to an induction source. Such beacon device may transmit a beacon signal when being powered.

The physical locations of the beacons in each dataset entry may be defined and provided according to a virtual grid of coordinates, optionally mapping one or more confined spaces, namely indoor, roofed, and/or covered surroundings, such as halls, rooms, warehouses, containers portions and/or the like. The beacons may be used for indicating room segments, for example aisles in a store (i.e. supermarkets aisles), a room area, a proximity to a certain shelf or object, and/or the like.

As shown at numeral 102 of FIG. 1, the interface module 301 further acquires one or more distinct signals transmitted from one or more of the beacons either in a push or a pull scheme for example as depicted in FIGs. 6 and 7. In some embodiments, the distinct signals are electronic signals of various forms broadcasted from the beacons and received by the interface module 301 continuously or periodically. In other embodiments, the interface transmits a periodic challenge message and receives one or more responses in the form of electronic signals from one or more beacons.

Each of the received electronic signals is distinct, corresponding with an identifier indicative of a unique beacon device. As shown at numeral 103 of FIG. 1, the beacon signal analysis module 302 extracts a unique beacon identifier from each of the distinct signals associating each distinct signal with a respective beacon device. Then, as shown at numeral 104 of FIG. 1, each of the distinct signals is matched with one of the physical locations of the beacons according to the mapping dataset and the unique

beacon identifier, such that each distinct signal is associated with a specific location according to the signal's source beacon.

As shown at numeral 105 of FIG. 1, the beacon signal analysis module 302 may further measure signal strengths of each distinct signal. Finally, as shown at numeral 106 of FIG. 1, the location mapping module 303 uses the identified physical locations of the beacons associated with each of the received distinct signals and the optional signal strengths of each of the received distinct signals to identify a momentary location of the mobile client terminal. For example, each record in the mapping database includes a positioning data, a unique beacon identifier, and a signal strength threshold. Optionally, only when the measured signal strength is above the signal strength threshold, the positioning data is used for calculating the current location of the mobile device.

Location identification may be set according calculations of the momentary distance between the mobile client terminal and each of the locations of the beacon devices from which signals were received. The measured signal strengths may be used to achieve better accuracy of distance calculations. Geometric calculation techniques such as but not limited to triangulation may be used to calculate distances and identify the position of the mobile client terminal respective to the predefined reference points.

It should be noted that as the locational data is deduced from a beacon signal, the accuracy of the locational data may be with a resolution of less than 3 meters, for example less than 1 meter. Moreover, as the locational data is deduced from a beacon signal there is no need in a cellular and/or GPS connections and/or a SIM card installation.

Reference is now made to FIG. 2A, which is a flowchart of a computerized method for modifying input component operation on mobile client terminals 200 according to their location, optionally based on a selected policy, according to some embodiments of the present invention.

Input components on a mobile client terminal may be integrated into the terminal, or alternatively auxiliary devices momentarily connected to the mobile client terminal via a standard or a dedicated port. Input components may be used to acquire visual, audible, positional, tactile and mechanical input related to the mobile client terminal.

Exemplary input components may include devices such as but not limited to cameras, microphones, positioning units, touch sensors and movement sensors.

First, as shown at numeral 201 of FIG. 2A, the interface module 301 acquires, for example receives or accesses, a policy specifying at least one operation mode for an input component of a mobile client terminal according to a location data of the mobile client terminal.

Exemplary operation modes for input components may include:

- Turning a specific input component and/on or off altogether, for example turning off a camera integrated into or connected to a mobile client terminal upon entering a high security zone in a factory.
- Enabling and/or disabling certain features of a specific input component, for example enabling microphone operation and sound recordings upon exiting classified meeting rooms.
- Applying a filter which processes recording of input components, for example processes video and/or audio recordings. In such an embodiment, filters may be used for scrambling recorded data. The scrambled recordings may be later decoded, for example by an external decoding module. In such a manner, the recorded data may be retrieved only a system operator.
- Turning on and off groups of input components according to categories, for example disabling all visual and audio input components on a mobile client terminal located within a confined space for a pre-defined period.
- Disabling or operating groups of applications according to categories, for example disabling all applications classified as restricted applications within a confined space for a pre-defined period.

Also, as shown at numeral 202 of FIG. 2A, the interface module 301 further acquires a location data of the mobile client terminal, optionally as identified by the location mapping module 303 and described above.

Then, as shown at numeral 203 of FIG. 2A, the monitoring and modification module 304 modifies the operation of input component(s) on the mobile client terminal according to the received operation mode and the location data.

In some embodiments, the monitoring and modification module 304 may further monitor applications running on the mobile client terminal which use data acquired by the input components, as shown at numeral 204 of FIG. 2A. The interface module 301 may acquire an application policy for the monitored applications, as shown at numeral 205 of FIG. 2A.

An application policy may dictate an operation mode for any application, for example mail application, communication application, a game application and/or an application which uses data acquired from one or more input components. Application mode options may be demonstrated herein using an exemplary face and/or voice recognition application which uses facial images and sounds acquired from cameras and microphones to identify the identity of a participant in a meeting.

- The application may be turned on or off altogether, for example turned off in a highly classified zone of a nuclear power plant.
- The application may be updated to include new modules and/or participant data upon entering a press meeting zone of a governmental office.
- Certain features of the application may be enabled or disabled according to input component categories, for example enabling voice recognition and disabling facial recognition.
- Location based application triggering and prioritizing – the usage of one or more specific mobile applications at an area of interest such as an organization, a public event and/or the like may be prioritized according to the location of the mobile device.
- Access to corporate and network service, private networks and/or privileged resources may be determined according to the location of the mobile device.

Selecting one or more secure policies according to an area of interest. The monitoring and modification module 304 may then modify the operation mode of one or more applications running on the mobile client terminal which use data acquired by the input components, as shown at numeral 206 of FIG. 2A.

For example, reference is now made to FIG. 2B, which is a schematic illustration of a system for enforcing an input components operation policy on a plurality of mobile devices, according to some embodiments of the present invention. In FIG. 2B mobile device 211, which is located in an uncontrolled area is free of any device control. If

monitoring and modification module 304 is installed in the mobile device 211 then the application is in a standby mode. When the mobile device 211 passes through a gateway base station 212 it is intercepted by the gateway and the details of mobile device 211 is passed via a network 219 to main server 210. Base station may refer to a cellular base station, Wi-Max™ station and/or the like. Optionally, the main server 210 sends a default policy to be enforced at the entrance of the controlled area and messages such as welcome and/or warning message to mobile device 211. Optionally, the main server 220 is connected to a user interface (UI) 220 that allows an operator to set policies and to receive information pertaining to connected client terminals.

In use, a mobile device 215 may report to a main server 210 details of identified beacons, such as 213 at transmitting area 214. The main server 210 may now update a control policy and/or services at the mobile device 215 according to the beacon identifier, for example indicative of a classified room at the size of 3mx3mx2.5m. The policy may also be extracted from a policy dataset correlated with a mapping dataset which maps the location of beacon and documents which policy should be acted in proximity to which beacons. Different areas may be associated with different policies. For example, input components of mobile device 217 which identifies its location according to a beacon signal from beacon 218 in transmitting area 216 may be operated according to a different policy than mobile device 215 which identifies its location according to a beacon signal from beacon 213.

Optionally, any attempt to uninstall the positioning application 299 is reported to the main server 210. Optionally, a protection mechanism is installed for preventing uninstalling the positioning application 299.

Reference is made to FIG. 4, which is a flowchart of a computerized method of providing a platform for tracking mobile client terminals' locations, according to some embodiments of the present invention. As shown at numeral 401 of FIG. 4, the method comprises positioning a plurality of beacons in a plurality of physical locations, optionally within a confined space. Placement of the beacons may be documented in a dataset reflecting locations in a virtual grid mapping a space.

Then, as shown at numerals 402 and 403 of FIG. 4, a dataset mapping between beacon devices and their physical locations is created and transmitted to mobile client terminals. Transmission to mobile client terminals may take place, for example and

without limitation, by broadcasting the dataset mapping to mobile client terminals which enter a confined space.

Reference is made to FIG. 5, which is a schematic representation of relations between software and hardware modules of a generalized embodiment of a mobile client terminal 500 and an exemplary generalized platform 600 for mobile client terminals' location tracking and application modification, according to some embodiments of the present invention.

Mobile client terminal 500 comprises two input components 501A and 501B, a policy and application version agent 502 for modification of applications and input components, and two applications 503A and 503B. Application 503A uses input data received from input component 501A, and application 503B uses input data received from input components 501A and 501B.

Generalized platform 600 comprises three beacon devices 601x, 601y and 601z which located within a confined space, a policy provider 602 dictating device operation policies for input components of mobile client terminals within the confined space, and an application version provider 603 for updating applications running on mobile client terminals according to their location information.

Policy and application version agent 502 serves as the interaction unit between the mobile client terminal and the platform. It interacts with beacon devices 601x, 601y and 601z to receive location data of the client terminal, queries and receives device operation policies from the policy provider 602 dictating operation policies for each of input components 501A and 501B, and updates applications versions for applications 503A and 503B according to its interaction with application version provider 603.

Reference is made to FIG. 6 is a schematic representations of a challenge-response protocol implementation for inquiring and setting a location based context for input components of a mobile client terminal, according to some embodiments of the present invention. It should be noted that the communication between the beacon and the mobile device is held without pairing. In such a manner, less energy and bandwidth is required. Reference is also made to FIG. 7, which is a representation of a broadcast protocol implementation for setting a location based context for input components of a mobile client terminal, according to some embodiments of the present invention.

The challenge response and/or broadcast protocols illustrated in FIG. 6 and FIG.7 respectively may be used for communication with beacon devices, input component policy providers and application version providers, as demonstrated above.

It is expected that during the life of a patent maturing from this application many relevant mobile client terminals and input components will be developed and the scope of the term mobile client terminal and/or input component is intended to include all such new technologies a priori.

As used herein the term “about” refers to ± 10 %.

The terms "comprises", "comprising", "includes", "including", “having” and their conjugates mean "including but not limited to". This term encompasses the terms "consisting of" and "consisting essentially of".

The phrase "consisting essentially of" means that the composition or method may include additional ingredients and/or steps, but only if the additional ingredients and/or steps do not materially alter the basic and novel characteristics of the claimed composition or method.

As used herein, the singular form "a", "an" and "the" include plural references unless the context clearly dictates otherwise. For example, the term "a compound" or "at least one compound" may include a plurality of compounds, including mixtures thereof.

The word “exemplary” is used herein to mean “serving as an example, instance or illustration”. Any embodiment described as “exemplary” is not necessarily to be construed as preferred or advantageous over other embodiments and/or to exclude the incorporation of features from other embodiments.

The word “optionally” is used herein to mean “is provided in some embodiments and not provided in other embodiments”. Any particular embodiment of the invention may include a plurality of “optional” features unless such features conflict.

Throughout this application, various embodiments of this invention may be presented in a range format. It should be understood that the description in range format is merely for convenience and brevity and should not be construed as an inflexible limitation on the scope of the invention. Accordingly, the description of a range should be considered to have specifically disclosed all the possible subranges as well as individual numerical values within that range. For example, description of a range such as from 1 to 6 should be considered to have specifically disclosed subranges such as

from 1 to 3, from 1 to 4, from 1 to 5, from 2 to 4, from 2 to 6, from 3 to 6 etc., as well as individual numbers within that range, for example, 1, 2, 3, 4, 5, and 6. This applies regardless of the breadth of the range.

Whenever a numerical range is indicated herein, it is meant to include any cited numeral (fractional or integral) within the indicated range. The phrases "ranging/ranges between" a first indicate number and a second indicate number and "ranging/ranges from" a first indicate number "to" a second indicate number are used herein interchangeably and are meant to include the first and second indicated numbers and all the fractional and integral numerals therebetween.

It is appreciated that certain features of the invention, which are, for clarity, described in the context of separate embodiments, may also be provided in combination in a single embodiment. Conversely, various features of the invention, which are, for brevity, described in the context of a single embodiment, may also be provided separately or in any suitable subcombination or as suitable in any other described embodiment of the invention. Certain features described in the context of various embodiments are not to be considered essential features of those embodiments, unless the embodiment is inoperative without those elements.

Although the invention has been described in conjunction with specific embodiments thereof, it is evident that many alternatives, modifications and variations will be apparent to those skilled in the art. Accordingly, it is intended to embrace all such alternatives, modifications and variations that fall within the spirit and broad scope of the appended claims.

All publications, patents and patent applications mentioned in this specification are herein incorporated in their entirety by reference into the specification, to the same extent as if each individual publication, patent or patent application was specifically and individually indicated to be incorporated herein by reference. In addition, citation or identification of any reference in this application shall not be construed as an admission that such reference is available as prior art to the present invention. To the extent that section headings are used, they should not be construed as necessarily limiting.

WHAT IS CLAIMED IS:

1. A computerized method of identifying a location of mobile client terminals, comprising:

providing to a mobile client terminal a mapping dataset which defines a plurality of physical locations of a plurality of beacon devices;

receiving at said mobile client terminal at least one distinct signal transmitted from at least one of said plurality of beacon devices;

extracting from each of said at least one distinct signal an identifier of a beacon device of said plurality of beacon devices;

matching between said identifier and one of said plurality of physical locations using said mapping dataset; and

identifying a location of said mobile client according to said matching.

2. The computerized method of claim 1, further comprising measuring signal strength of each said at least one distinct signal, and wherein identifying a location of said mobile client further comprises calculating a physical distance from each of said plurality of physical locations according to said signal strength.

3. The computerized method of claim 2, wherein said physical distance is less than 3 meters.

4. The computerized method of claim 3, wherein said physical distance is less than 1 meter.

5. The computerized method of claim 1, further comprising outputting said location of said mobile client.

6. The computerized method of claim 1, wherein said plurality of physical locations are within the boundaries of a confined space.

7. The method of claim 6, wherein said mapping dataset is defined according to a grid of coordinates within said confined space and wherein said physical locations are provided according to said grid of coordinates.

8. A computerized method for modification of input component operation on mobile client terminals, the method comprising:

providing a policy specifying a plurality of operations for at least one input component of a mobile client terminal each said operation mode is associated with at least one of a plurality of geographical areas;

receiving a current location data of said mobile client terminal; and

selecting one of said plurality of operations to said at least one input component according a match between one of said plurality of geographical areas and said current location data.

9. The computerized method of claim 8, wherein said plurality of operations comprises a member of a group consisting of: filtering an output of said at least one input component, deactivating said at least one input component, encrypting an output of said at least one input component, rerouting said output of said at least one input component.

10. The computerized method of claim 8, wherein said at least one input component comprises a camera.

11. The computerized method of claim 8, wherein said at least one input component is an auxiliary device connected to said mobile client terminal via a port located on said mobile client terminal.

12. The computerized method of claim 8, wherein said at least one input component includes a sensor selected from a group consisting of an audible input sensor, a visual input sensor, a tactile input sensor and a mechanical input sensor.

13. The computerized method of claim 8, wherein said at least one input component comprises a microphone.

14. The computerized method of claim 8, wherein said at least one input component comprises a positioning unit.

15. The computerized method of claim 8, further comprising:

monitoring at least one application executed on said mobile client terminal according to input data received from said at least one input component;

operating said at least one application according to said current location data.

16. The computerized method of claim 8, wherein said location data refers to an area within boundaries of a confined space, and wherein said policy is restricted to said boundaries.

17. A computerized method of providing a platform for tracking mobile client terminals' locations, the method comprising:

positioning a plurality of beacon devices in a plurality of physical locations;

providing a mapping dataset which maps each of said plurality of beacon devices to a respective physical location selected from said plurality of physical locations; and

transmitting said mapping dataset to a mobile client terminal.

18. The method of claim 17, wherein said plurality of physical locations are defined according to a virtual grid of coordinates and wherein said physical locations are provided according to said grid of coordinates.

19. The method of claim 17, wherein said plurality of beacon devices are electric beacon devices which transmits a beacon signal selected from a group consisting of radio frequency signal, infrared signal, and sonar signal.

20. The method of claim 19, wherein each of said plurality of beacon devices independently broadcasts an electric signal transmission.

21. The method of claim 20, wherein each said electric signal transmission is distinct and comprises a unique identifier of a corresponding beacon device of said plurality of beacon devices.

22. The method of claim 20, wherein said electric signal transmission is continuous.

23. A mobile client terminal, comprising:

a processor;

a repository which stores a mapping dataset defining a plurality of physical locations of a plurality of beacon device identifiers;

a beacon signal analysis module which extracts a first of said plurality of beacon device identifiers from at least one beacon signal transmitted by a beacon device;

a location mapping module which uses said processor to select one of said plurality of physical locations according to a match between said first beacon identifier and said mapping dataset; and

an application management module which automatically operates at least one application hosted by said mobile client terminal according to said selected physical location.

24. The mobile client terminal of claim 23, wherein said application management module prioritizes said at least one application according to said selected physical location.

25. The mobile client terminal of claim 23, wherein said application management module activates said at least one application according to said selected physical location.

26. The mobile client terminal of claim 23, wherein said application management module facilitates said at least one application to access storage according to said selected physical location.

27. A positioning system, comprising:

a plurality of beacon devices each comprises:

a processor,

a memory which stores a beacon device identifier to a different of a plurality of beacon devices, and

a transmitter which transmits a beacon signal which encoding said beacon device identifier; and

a plurality of location mapping modules which are installed in a plurality of client devices, each said location mapping module:

accesses a mapping dataset which maps between a plurality of physical locations and a plurality of beacon devices, and

uses a processor of a respective hosting said client device to select one of said plurality of physical locations according to an analysis of beacon device identifier extracted from said beacon signal and said mapping dataset.

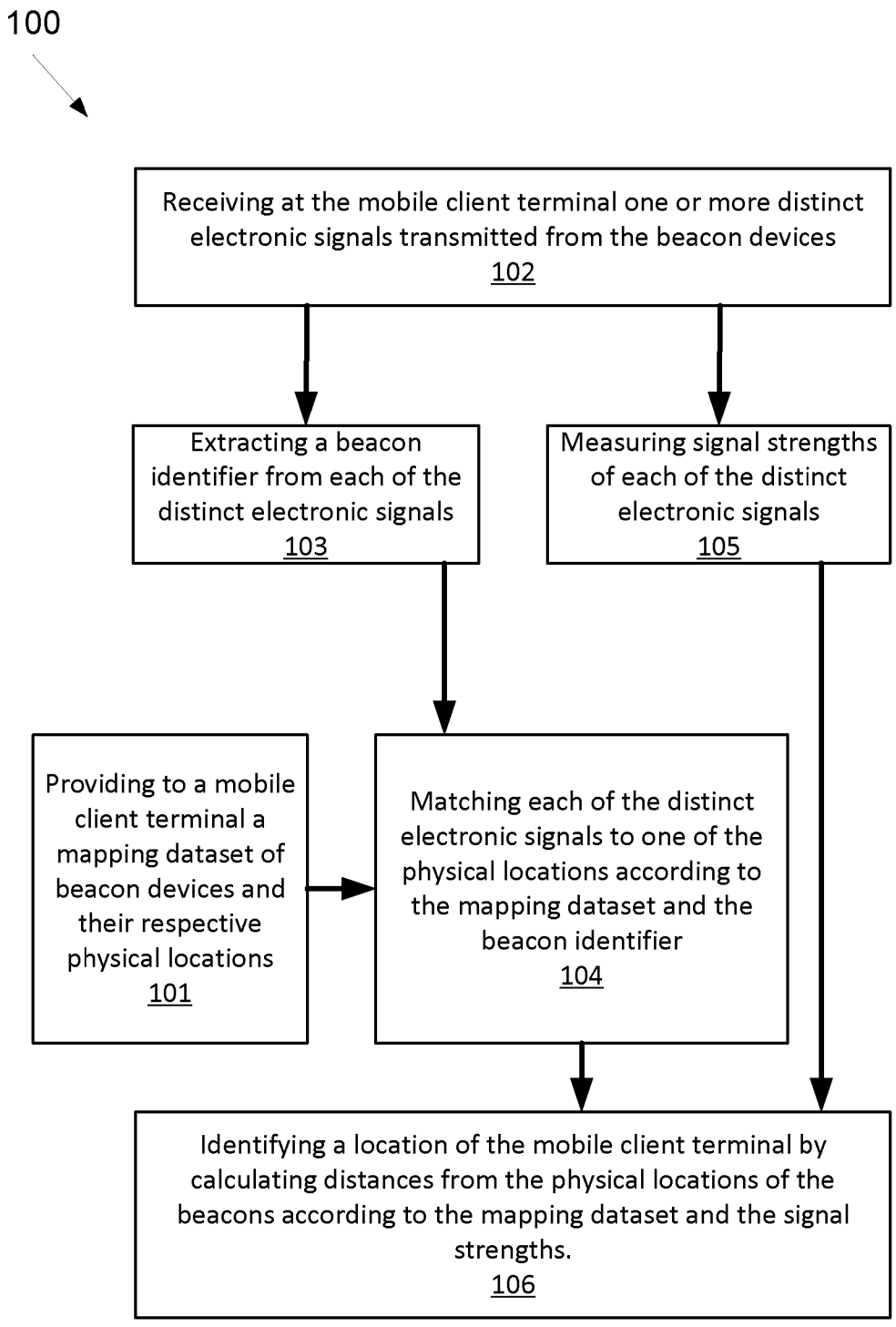
100
Receiving at the mobile client terminal one or more distinct electronic signals transmitted from the beacon devices
102
Extracting a beacon identifier from each of the distinct electronic signals
103
Measuring signal strengths of each of the distinct electronic signals
105
Providing to a mobile client terminal a mapping dataset of beacon devices and their respective physical locations
101
Matching each of the distinct electronic signals to one of the physical locations according to the mapping dataset and the beacon identifier
104
Identifying a location of the mobile client terminal by calculating distances from the physical locations of the beacons according to the mapping dataset and the signal strengths.
106

FIG. 1

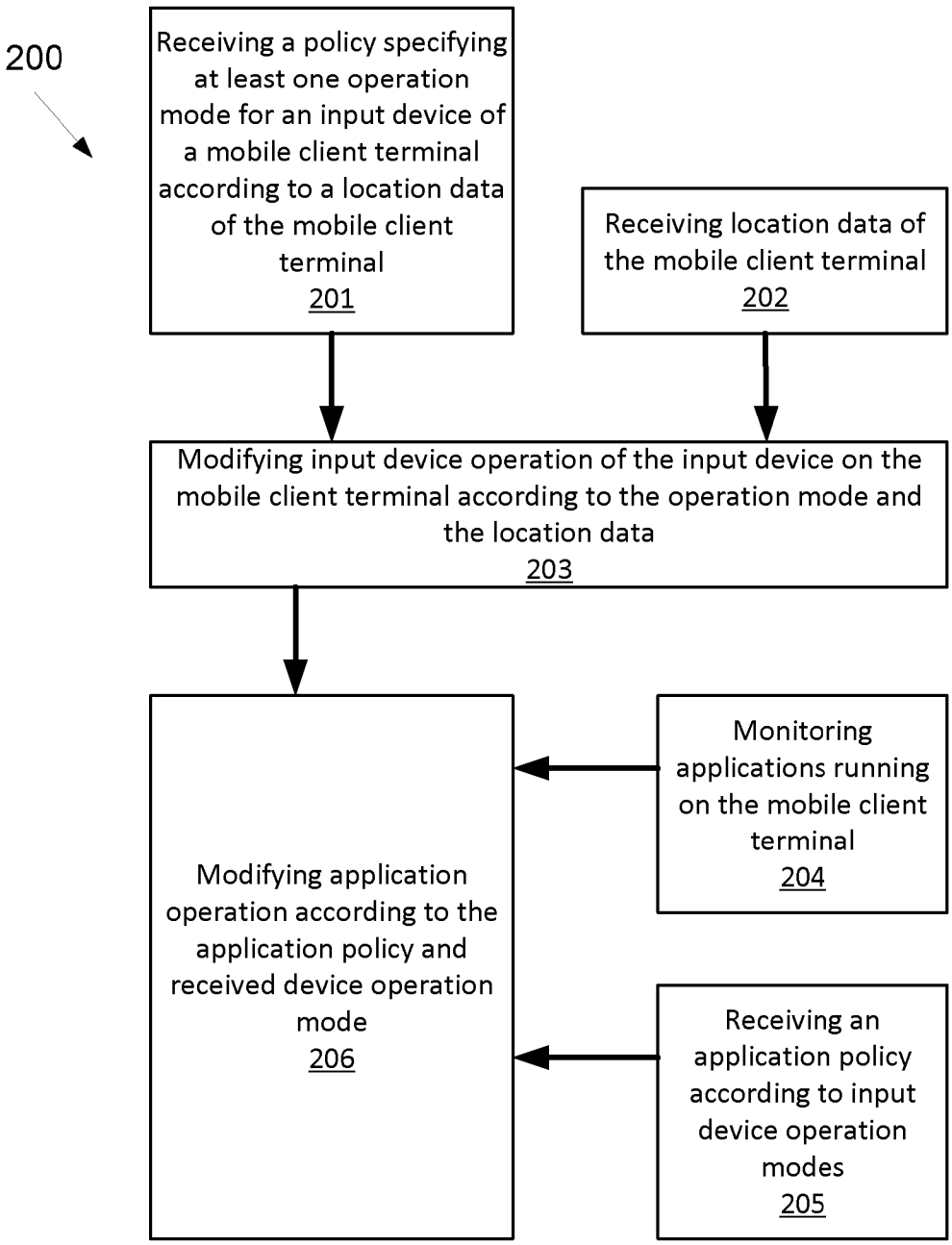
200
Receiving a policy specifying at least one operation mode for an input device of a mobile client terminal according to a location data of the mobile client terminal
201
Receiving location data of the mobile client terminal
202
Modifying input device operation of the input device on the mobile client terminal according to the operation mode and the location data
203
Modifying application operation according to the application policy and received device operation mode
206
Monitoring applications running on the mobile client terminal
204
Receiving an application policy according to input device operation modes
205

FIG. 2A

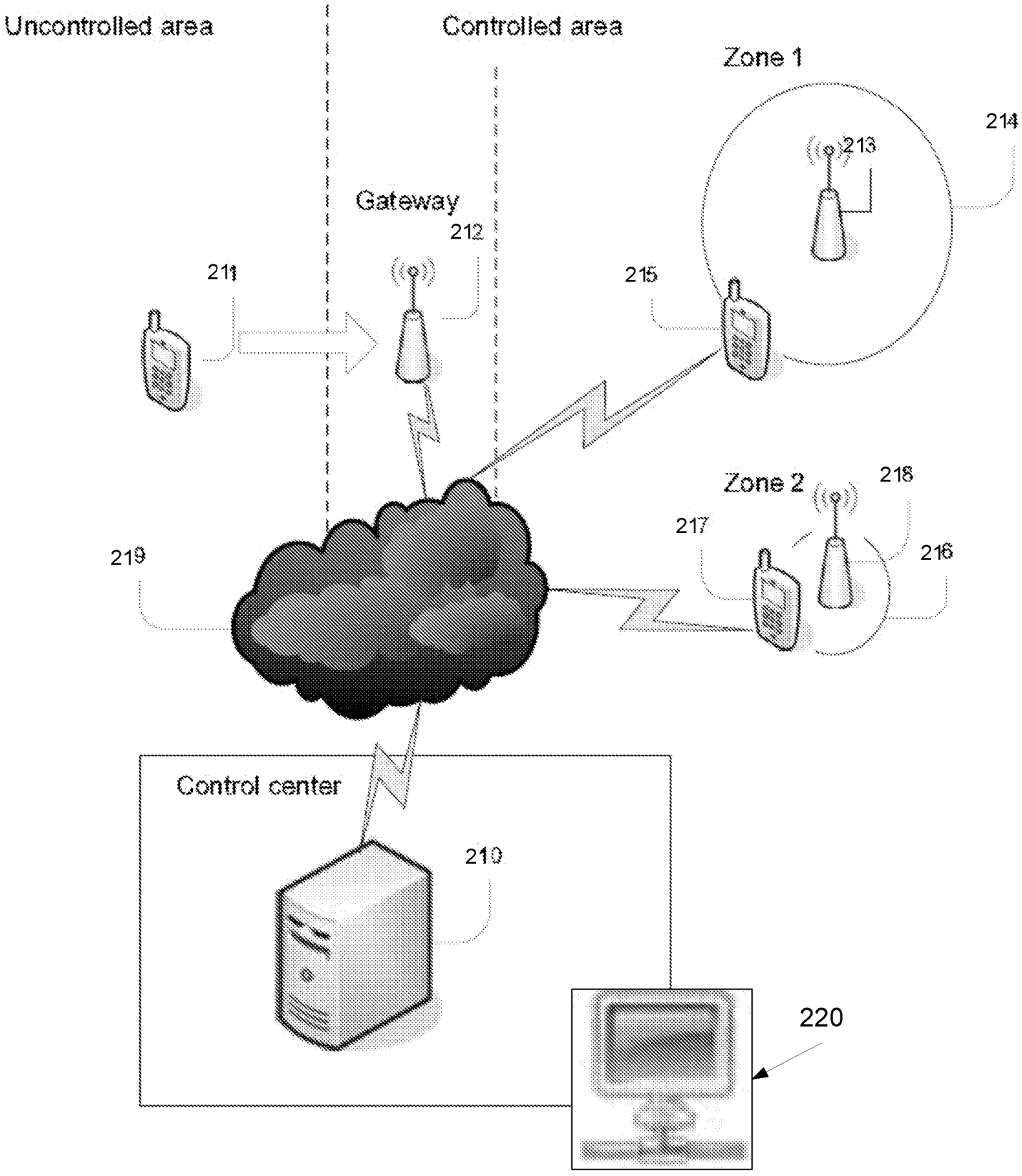
Uncontrolled area
Controlled area
Zone 1
214
213
Gateway
212
211
215
Zone 2
218
217
216
219
Control center
210
220

FIG. 2B

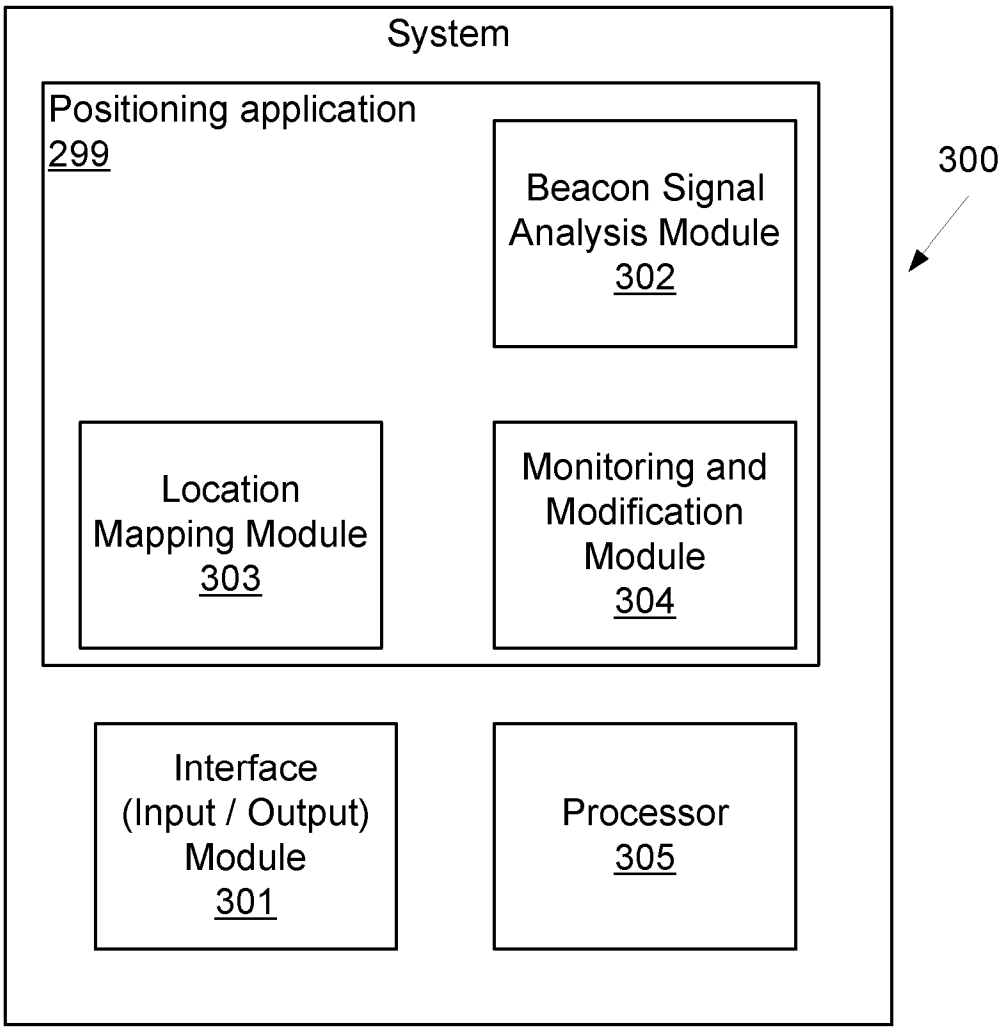
System
Positioning application
299
Beacon Signal
Analysis Module
302
300
Location
Mapping Module
303
Monitoring and
Modification
Module
304
Interface
(Input / Output)
Module
301
Processor
305

FIG. 3A

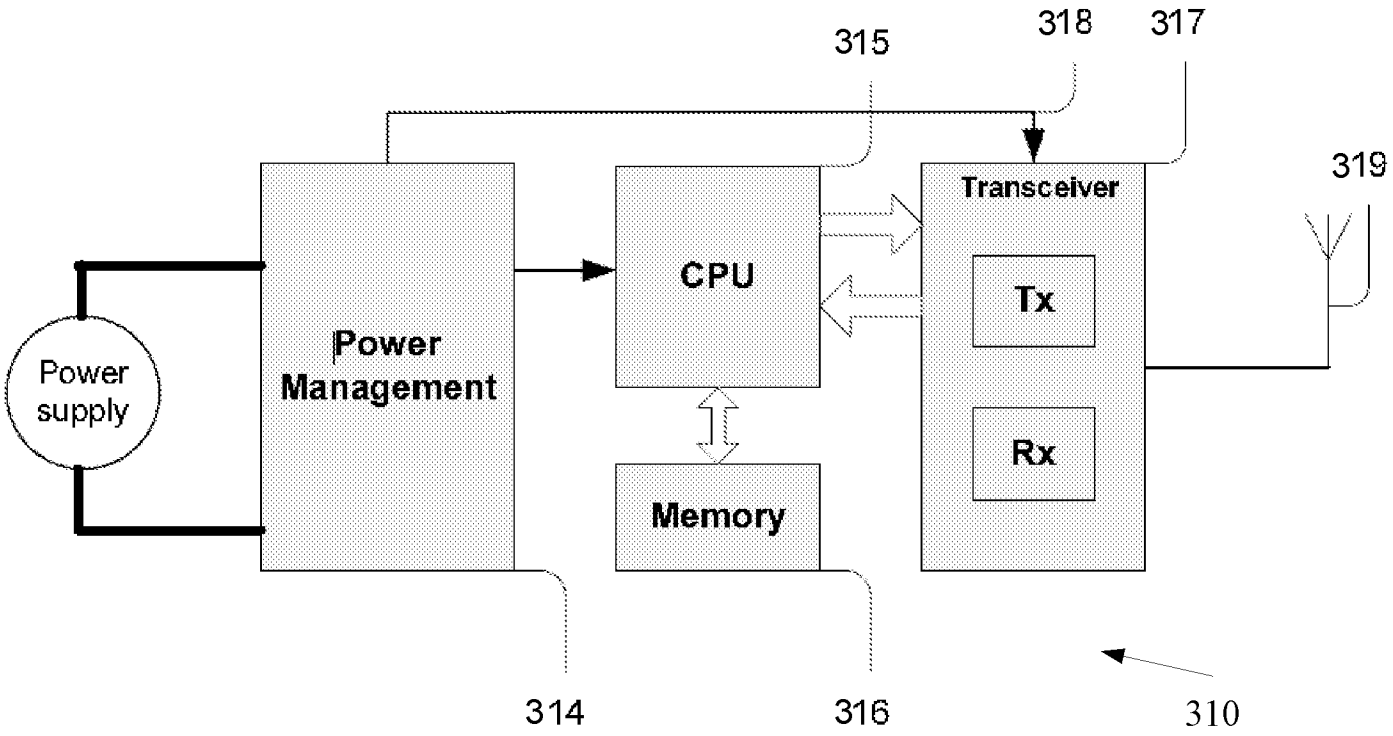
315
318
317
319
Transceiver
CPU
Tx
Rx
Power supply
Power Management
Memory
314
316
310

FIG. 3B

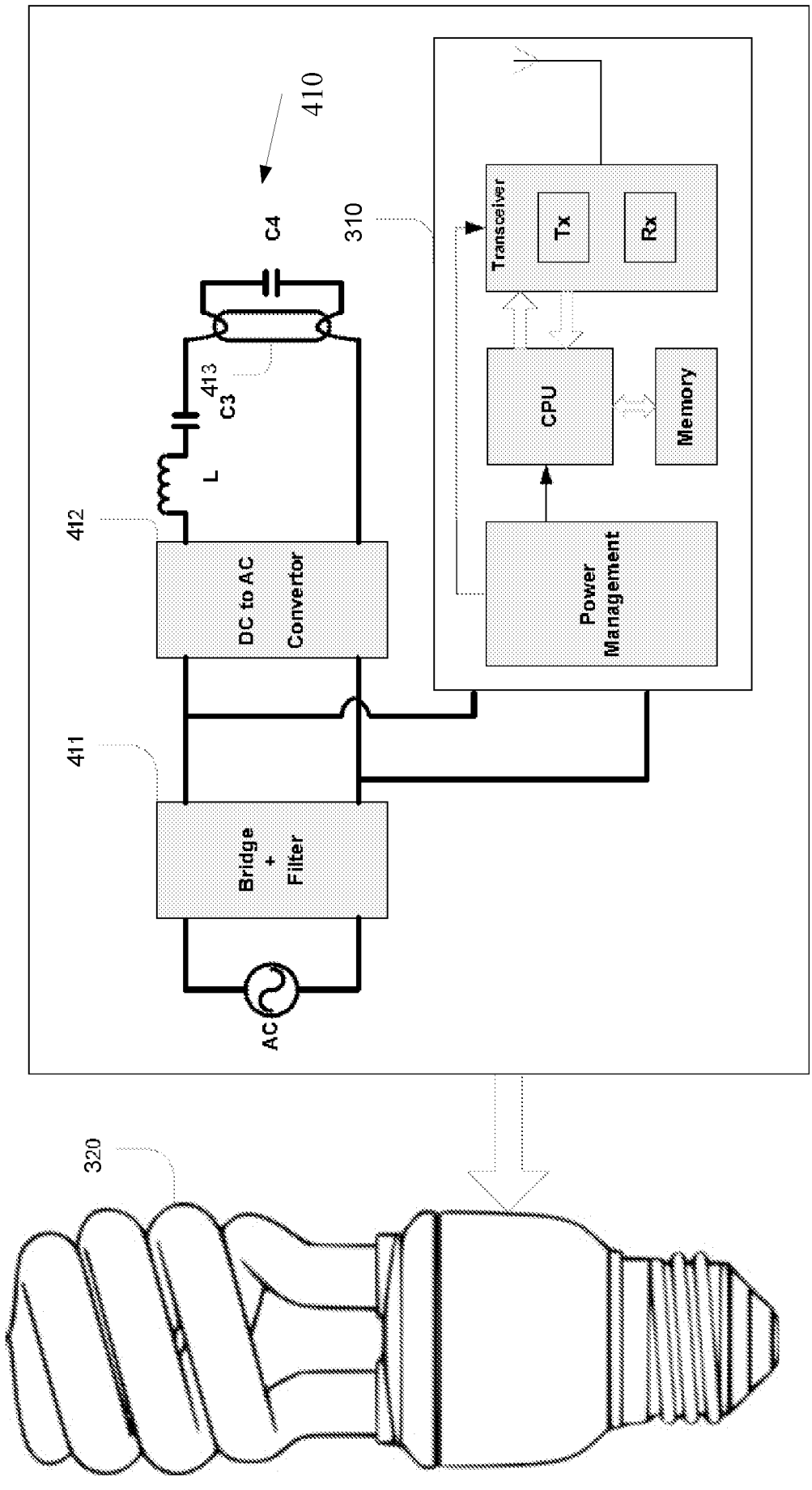
410
C4
310
Transceiver
Tx
Rx
413
C3
L
CPU
Memory
412
DC to AC
Convertor
Power
Management
411
Bridge
+
Filter
AC
320

FIG. 3C

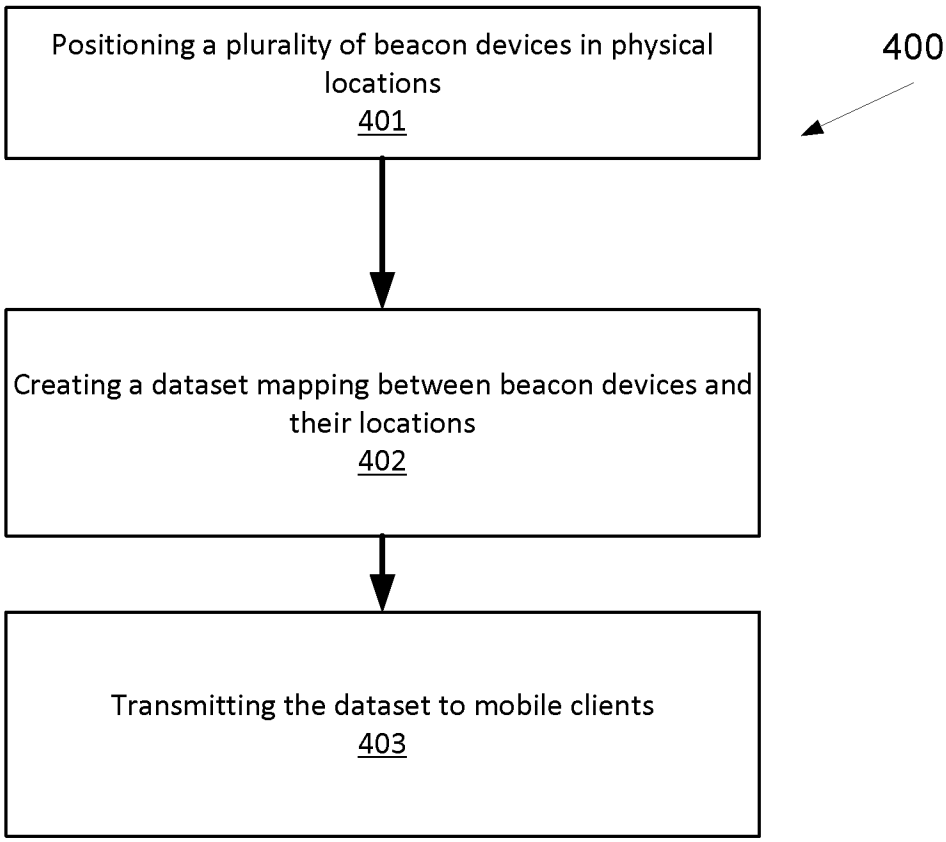
Positioning a plurality of beacon devices in physical locations
401
400
Creating a dataset mapping between beacon devices and their locations
402
Transmitting the dataset to mobile clients
403

FIG. 4

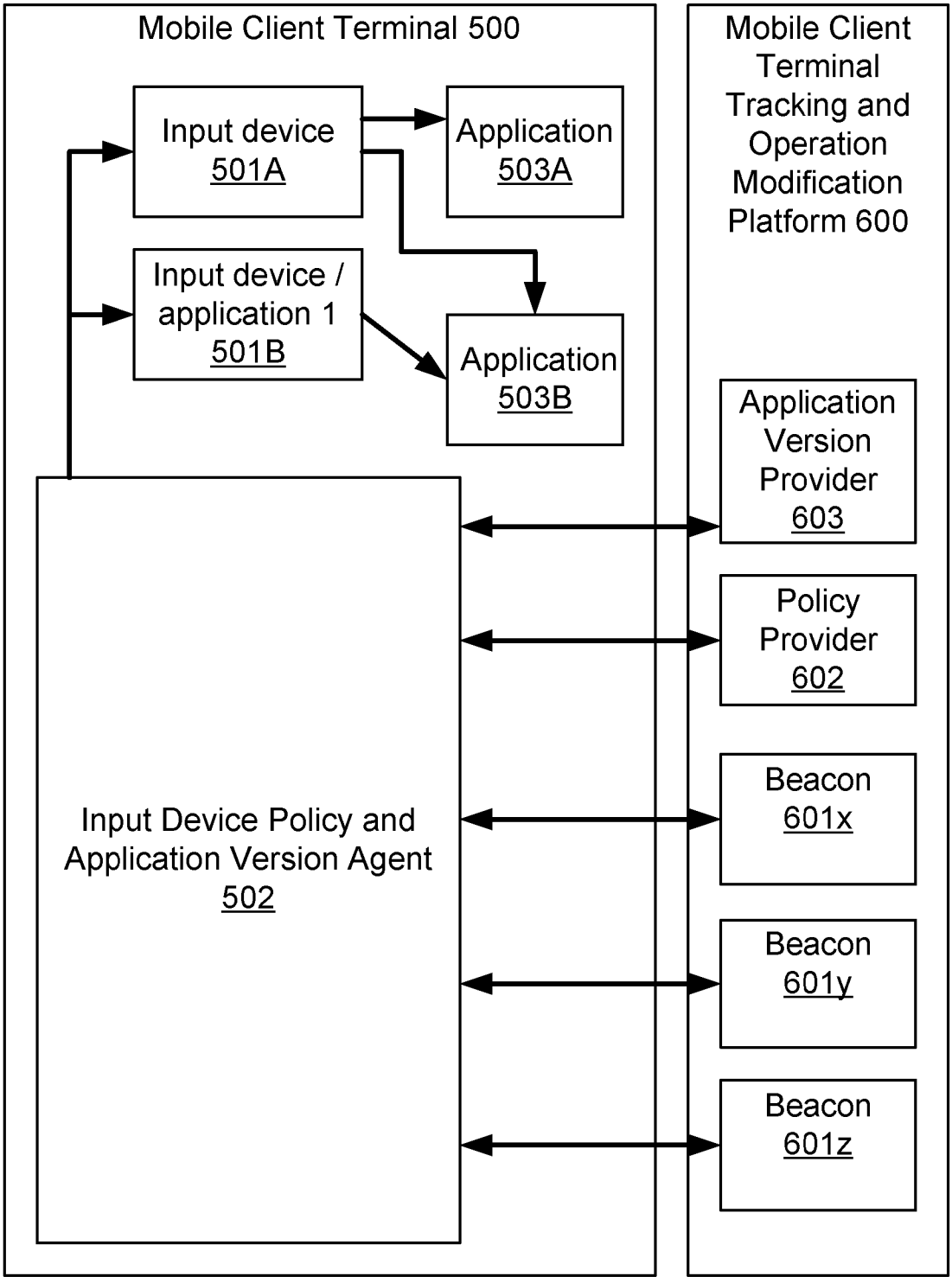
Mobile Client Terminal 500
Input device 501A
Application 503A
Input device / application 1 501B
Application 503B
Input Device Policy and Application Version Agent 502
Mobile Client Terminal Tracking and Operation Modification Platform 600
Application Version Provider 603
Policy Provider 602
Beacon 601x
Beacon 601y
Beacon 601z

FIG. 5

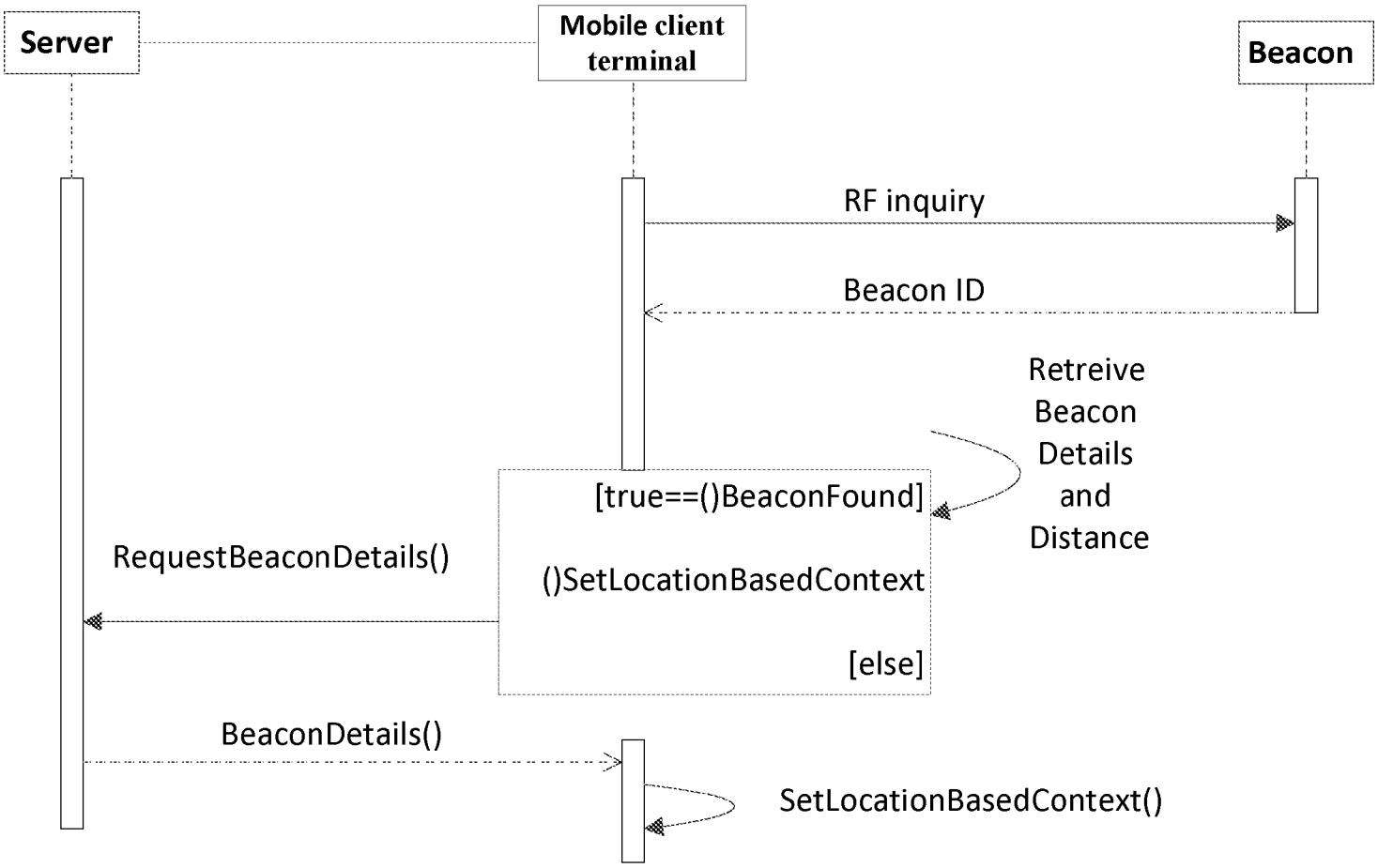
Server
Mobile client terminal
Beacon
RF inquiry
Beacon ID
Retreive Beacon Details and Distance
[true==()BeaconFound]
()SetLocationBasedContext
[else]
RequestBeaconDetails()
BeaconDetails()
SetLocationBasedContext()

FIG. 6

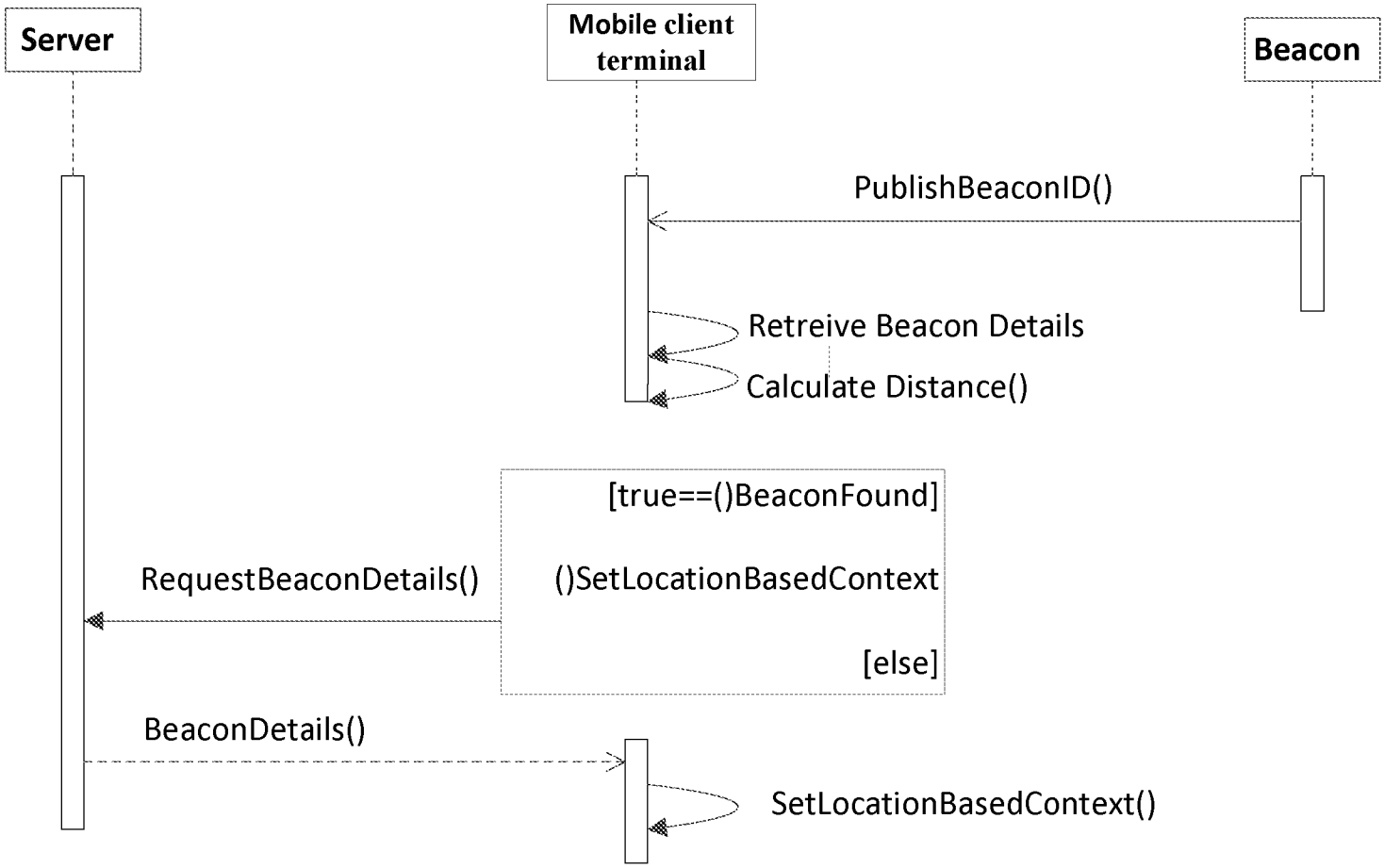
Server
Mobile client terminal
Beacon
PublishBeaconID()
Retreive Beacon Details
Calculate Distance()
[true==()BeaconFound]
()SetLocationBasedContext
[else]
RequestBeaconDetails()
BeaconDetails()
SetLocationBasedContext()

FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IL2012/050182

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - G01S 3/02 (2012.01)
USPC - 342/386
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(8) - G01S 3/00, 3/02, 3/04, 3/06 (2012.01)
USPC - 342/385, 386, 450, 463-465

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)
Questel Orbit, Google Patent, Google, ProQuest

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X -- Y	US 2009/0322890 A1 (BOCKING et al) 31 December 2009 (31.12.2009) entire document	8-16 --------- 23-26
Y	US 6,055,434 A (SERAJ) 25 April 2000 (25.04.2000) entire document	1-7, 17-27
Y	US 2008/0309557 A1 (MAILAENDER) 18 December 2008 (18.12.2008) entire document	1-7, 17-27
Y	US 6,839,560 B1 (BAHL et al) 04 January 2005 (04.01.2005) entire document	2-4
Y	US 2008/0045172 A1 (NARAYANASWAMI et al) 21 February 2008 (21.02.2008) entire document	24
Y	US 7,263,368 B2 (KNAUERHASE et al) 28 August 2007 (28.08.2007) entire document	26
A	US 5,732,354 A (MACDONALD) 24 March 1998 (24.03.1998) entire document	1-27
A	US 2006/0262014 A1 (SHEMESH et al) 23 November 2006 (23.11.2006) entire document	1-27

☐ Further documents are listed in the continuation of Box C. ☐

* 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
20 September 2012	01 OCT 2012
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

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