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(54) FLOW CONTROL IN A DEFINED LOCATION

(57) A facility includes a location node having a transceiver of wireless signals. It communicates with a central hub and mobile devices in the facility. The nodes are located in a specific location in the facility, and provide data about the movement of the entities in the facility relative to the location. This includes at least one of entry into the location, departure from the location, amount of time spent in the vicinity of the location; and the data being transmitted to the operator in at least one of real time or being for storage and analysis at a later time for use by the operator. There can be a series of location nodes in the facility. The nodes provide data about the movement of the entities in the facility, such data including the travel path of the entities in the facility. Multiple cameras periodically photograph the facility, the cameras being distributed about the facility; and transmitting the photographs to a control station, which receives the data from the location nodes and the photographs to constitute line flow control information.

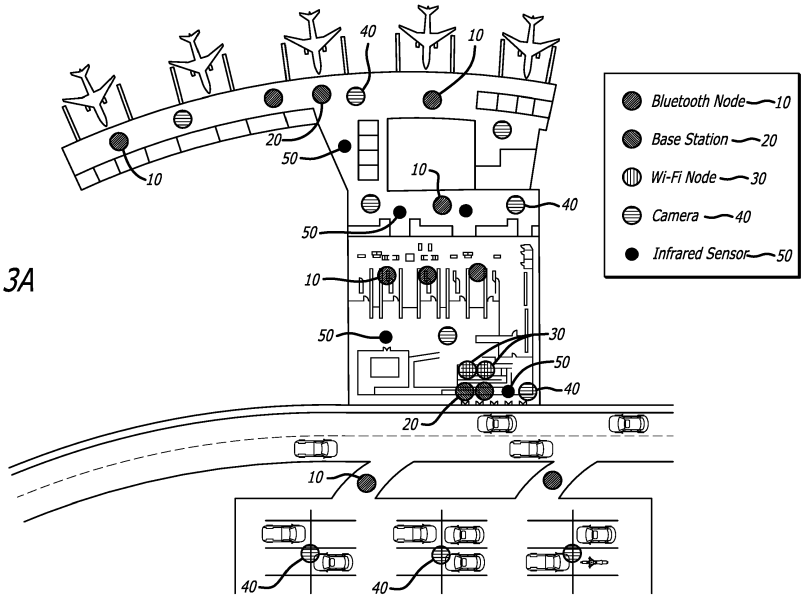

FIG. 3A

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Description

BACKGROUND

[0001] This application relates generally to monitoring wireless devices and to messaging by wireless communication between wireless devices in a specific geographical location and facilitating the movement of entities in and out and/or through the location.

[0002] In particular, the disclosure relates to improving queuing in the sense that entities in the location are better served by permitting for shorter queuing and times in the queue.

SUMMARY OF THE DISCLOSURE

[0003] The present disclosure relates to an apparatus, system, and method for a facility includes a location node having a transceiver of wireless signals. The node communicates with a central hub and mobile devices in the facility. The nodes are located in a specific location in the facility, and provide data about the movement of the entities in the facility relative to the location. Includes at least one of entry into the location, departure from the location, amount of time spent in the vicinity of the location; and the data being transmitted to the operator in at least one of real time or being for storage and analysis at a later time for use by the operator. There can be a series of location nodes in the facility. The nodes provide data about the movement of the entities in the facility, such data including the travel path of the entities in the facility. In one form the facility is a physically defined structure formed by physical walls.

[0004] In one or more embodiments, the system involves using a geographical zone, where the zone is selectively a preconfigured geographical zone. The zone includes a plurality of nodes. The system also includes sending messages between one or more of the users and one or more control stations, where the message communications are targeted to at least one or multiple users. The nodes are arranged in a multi-dimensional sense, the multi-directional sense selectively being a three-dimensional sense in the x, y and z axes or coordinates. The system further includes obtaining and mining data related to the location of a mobile user according to the placement of nodes in a multi-dimensional sense.

[0005] In one or more embodiments, the system employs a Bluetooth™ equipped mobile personal device associated with a user, where the device communicates with Bluetooth™ enabled location nodes in a mesh network. The Bluetooth™ equipped mobile personal device contains at least one specific algorithm to determine the relatively precise location of the user within the mesh network. Also, when the Bluetooth™ equipped mobile personal device is within the range of certain location nodes, specified events are triggered.

[0006] In one or more embodiments, the system includes the downloading of a commercial message, selectively an advertisement to the Bluetooth™ equipped mobile personal device. The system further includes transmitting to selected nodes the user's location data. The selected nodes transmit the data to a control center via other nodes within selectively at least one of a mesh network, relay stations, or intermediate supplementary stations. The user's location data is processed and analyzed at selectively at least one of a control center or an intermediate supplementary station.

[0007] In one or more embodiments, the system includes using a geographical zone, where the zone is multi-dimensional, and messaging a movable entity that has a transponder or subscriber device. The device being selectively a cell phone, personal digital assistant (PDA), pager, computer, or device which is configured to be in wireless communication with other devices through a suitable network. In addition, the system includes loading from a computing device to a memory in a transponder or subscriber device a plurality of coordinates; mapping the coordinates on a pixilated image wherein the assigned pixilated image is configurable; and forming a contiguous array of pixels that enclose a shape in the pixilated image to form the geographic space.

[0008] In one or more embodiments, the regulating comprises at least one of monitoring, controlling, and visualizing the movement the individuals, the vehicles, or the other moveable entities. The plurality of coordinates are entered by a user of a computer device, and transmitted to the transponder or subscriber device. The control center enters plurality of coordinates by selecting points in a map, and calculates geographical coordinates of each selected point in the map. Also, the control center enters the plurality of coordinates by entering on a computer the longitude, latitude, and elevation. A multi-dimensional shape of a geographical area is the shape of a non-regular geometrical shape. In the present system, messages are communicated with entities according to the location of the entities as mapped in the multi-dimensional space.

[0009] In one or more embodiments, the system includes loading from a computing device to memory in a transponder or subscriber device a plurality of coordinates, wherein the plurality of coordinates identify a multi-dimensional area; dividing the multi-dimensional area into a grid; allowing at least one user to select at least one section from within the grid in order to define a multi-dimensional geographical region; and associating the at least one section with at least one pixel in a pixilated computer image of the multi-dimensional area such that the pixels selected by the at least one user are identified as being loaded in the multi-dimensional geographical region. In some embodiments, the multi-dimensional area is divided into a grid of three-dimensional squares or rectangles, and the three-dimensional squares or rectangles of the grid have at least one depth.

DRAWINGS

[0010] The foregoing aspects and advantages of the present disclosure will become more readily apparent and understood with reference to the following detailed description, when taken in conjunction with the accompanying drawings, wherein:

Figure 1 is a first diagram of nodes chained together communicating with a base station and then through the internet to a control center.

Figure 2 is a second diagram of nodes and Blue tooth communication modules chained together communicating with a base station and then through the internet to a control center.

Figures 3A and 3B are an airport plan with doors for entry and exit from the building terminal. Within the terminal, there is an internal plan of an airport facility showing queue metrics, being an overflow area which is also the entry to the monitored area, the serpentine where a queue develops to approach a TSA checking area, an area where processing is done and then the re-composure area after the TSA processing, the exit from the TSA, and the terminal areas beyond the TSA checking stations, including stores, eating areas and the departure gates. There are different nodes, a base station, cameras and sensors. Queue measurements, queue paths, hardware placement details, and queue metric details are disclosed and shown. In Figure 45B, the approach and departure areas relative to the terminal is shown with automobiles and the parking structure associated with terminals.

Figure 4 is an airport plan with doors for entry and exit from a building terminal. Within the terminal, there is an internal plan of an airport facility showing a baggage claim area with a baggage carousel, seating, restroom area and different nodes, a base station, cameras and sensors.

DESCRIPTION

[0011] The present disclosure provides a system and method that provides a location-based service to an operator of a facility. In one form, the facility is a physically defined structure formed by physical walls.

[0012] The facility includes a series of location nodes, the location nodes including transceivers of wireless signals, and being for transmitting the signals received to a central hub for processing the received signals. The nodes are located in spaced apart positions in the facility. The nodes are for wireless communication with movable entities in the facility thereby to establish the location and movement of entities in the facility, the entities having wireless communicating units for transmitting signals wirelessly to the nodes

[0013] The nodes provide data about the movement of the entities in the facility, and such data includes at least one of entry into the facility, departure from the facility, amount of time spent in the vicinity of nodes located in the spaced apart positions; the travel path of the entities in the facility.

[0014] There are multiple single shot and/or video cameras for periodically photographing the facility, the cameras being distributed about the facility. The photographs are transmitted from the multiple cameras to a control station. The control station receives the data from the location nodes and the photographs to constitute line flow control information.

[0015] The disclosure also includes people counters. These are infrared sensors placed above doors, chokepoints and walkways and/or in or out of designated areas. They are designed to count how many people cross a threshold with a high degree of accuracy. Other forms of people counters include break beam lasers and pressure-sensitive flooring/floor mats.

[0016] The information from the nodes, camera and sensors are aggregated and analyzed and constitute a tool to plan operations in the facility and personnel assignment in the facility.

[0017] Users of the system, for instance store or airport operators as well as public shoppers or travelers can sign in via an app or computer program remotely to determine line conditions, in a simple manner similar to which map data is made available by navigation apps. and programs to facilitate travelling conditions on roads.

[0018] The data is for transmittal to the operator of a facility in at least one of real time or for storage and analysis at a later time for use by the operator.

[0019] In one form, the facility includes multiple checking locations. A checking location can for instance be a check out at supermarket or store or mall, a series of stores, a security scanning checking place at an airport facility, a ticket counter, or a baggage claim area at an airport.

[0020] Persons leaving the facility need to pass through at least one of the checking locations prior to leaving the facility. The nodes are located in a physical location to be related to different respective checking locations of the multiple checking locations. Data from the location nodes includes at least one of the number of entities passing through different checking locations, the speed with which entities pass through the different checking locations, the number of entities in the vicinity of the different respective checking locations.

[0021] The facility can be a shopping business. The check-out locations include registers for receiving payment for items purchased in the shopping business. The data includes at least one of the entity check-out rate from the facility; the entity entry volume to the facility, the entity entry volume relative to different time periods; the rate of entity entry to the facility, the rate at which entities enter and leave the facility; the amount of time spent by

different entities in the facility.

[0022] The data also relates to distinguish the number of entities spending different amounts of time in the facility. The different check-out facilities are designated for have the low volume shoppers in dedicated checking facilities and the data includes information about the numbers of low volume shoppers, high volume shoppers and the rate of time shoppers spend in the facility and at the checking locations.

[0023] The system can include two, multidimensional such as three dimensional, geographical zones for characterizing the movement and behavior patterns of a mobile user moving through an array of the geographical zones.

[0024] Where the location is a retail store, the store is divided into multi-dimensional zones where the radius of each zone is configurable, selectively from about three to about thirty feet.

[0025] The nodes are detection devices that are radio transmitter/receivers, placed at the center of each zone. The devices are capable of detecting the zone entry and exit events of mobile phones equipped with selectively a Bluetooth, WI-FI and other short range radio technologies or NFC systems. Each device is an element or node of a network connected to the Internet through a Wi-Fi bridge or base station, and selectively there are several separate networks formed by the nodes.

[0026] As a mobile user moves through the store, zone entry and exit events are collected, time stamped, and passed along the networks to the Internet. The event trail is routed to a remote server and placed in a database for analysis where behavior details are extracted from the entry/exit data.

[0027] The resultant data sets apply an algorithm to manage checking lane allocations based on visitor rate of entry and visitor rate of checking. The checking rates are selectively used to determine lane allocations with a capacity to check-out visitors at the same rate as they are entering the store, thereby providing the opportunity for a substantially continuous flow of visitors from entry to exit.

[0028] The algorithm establishes a visitor checking rate for small basket and large basket visitors from empirical checking data. Visitor entry rate and visitor pathing information is used to determine the number of small basket and large basket visitors.

[0029] The algorithm establishes checking rates which are then used to determine the required number of lanes to checking, the number of small and large basket visitors at the same rate as the rate of entry. The algorithm output is selectively a daily timeline defining the number and type of lane allocations, selectively express and normal lanes. This can be selectively for each hour of the working day for selectively each day of the week, thereby providing a tool for preplanning store operations and personnel assignments.

[0030] In another form of the disclosure there is a location-based service to an operator of a facility, the facility being a physically defined structure formed by physical walls comprising providing in the facility with a location node. The location node includes a transceiver of wireless signals, and is for transmitting the signals received to a central hub for processing the received signals.

[0031] The node is located in a specific location in the facility, and the node is for wireless communication with movable entities in the facility thereby to establish the location and movement of entities in the facility. The entities have wireless communicating units for transmitting signals wirelessly to the node. The node provides data about the movement of the entities in the facility relative to the location such data including at least one of entry into the location, departure from the location, amount of time spent in the vicinity of the location. The data is transmitted to the operator in at least one of real time or being for storage and analysis at a later time for use by the operator.

[0032] The facility includes at least one checking location, and persons passing through the facility should pass through that at least one of the checking locations. Upon exit should an entity not pass through a checking location, the system determines that someone visited but did not necessarily buy, or the visit was not converted to a sale. Thus the nodes can be strategically placed in the facility to permit the mining of the needed data. A node is located in a physical location to be related to the at least one checking location and wherein data from the location nodes includes at least one of the number of entities passing through the checking location, the speed with which entities pass through the checking location, the number of entities in the vicinity of the checking location.

[0033] The facility can be an airport terminal and the checking facility is a security checking station. Selectively there are multiple stations.

[0034] In one form of the disclosure, there is a method for alleviating queuing in grocery stores. This can be around the concept that two or three dimensional geographical zones can be used to characterize the movement and behavior patterns of a mobile user as the user moves through an array of the geographical zones.

[0035] A retail store can be divided into two or three-dimensional zones where the radius of each zone is configurable, from three to thirty feet. Figure 31 illustrates a zoned retail layout. The detection devices, small radio transmitter/receivers, placed at the center of each zone, and are capable of detecting the zone entry and exit events of mobile phones equipped with either a Bluetooth or WI-FI radio or NFC system. Each device is an element or node of a network connected to the Internet through a Wi-Fi bridge or base station as shown in Figure 39. Typically, several separate networks are formed by the nodes.

[0036] As a mobile user moves through the store, zone entry and exit events are collected, time stamped, and passed along the networks to the Internet. Ultimately, the event trail is routed to remote servers and placed in a database for analysis where behavior details are extract-

ed from the entry/exit data.

Data Analysis

[0037] The capability to characterize shopper patterns and behavior with respect to daily and seasonal conditions has provided insights and unique management opportunities previously unavailable to optimize resource applications, labor allocation, and store operations.

Monitor System Hardware

[0038] The monitor system consists of three separate element types: one or more nodes, one or more base stations, and a remote system server

Nodes

[0039] The node is a small radio frequency (RF) receiver and transmitter (transceiver), approximately the size of a deck of cards. It can be either a Bluetooth device or a Wi-Fi device or NFC system. In either case, software in the System Server contains its ID and the exact geographical location of its position in the retail layout as well as the diameter of its assigned virtual zone area.

[0040] The Bluetooth node continuously transmits a general inquiry message (3200 times per second) and listens for a mobile device response. Mobile devices continuously listen for inquiries, and after receiving one, respond with a message containing its unique Bluetooth MAC address and its device type.

[0041] firmware in the node collects the MAC address, type, and the node received signal strength (RSS), and returns these information items, via the Internet, to the Scan Service software resident in the Managed System Server.

[0042] After the initial reception from a mobile device, its unique Bluetooth MAC address is registered and time stamped. Subsequent messages are sampled at intervals of one to thirty seconds, and an event trail time history is developed as the mobile device moves through the array of zones, entering, dwelling in, and exiting from one zone to another. Mobile device positions relative to the node position are determined from the RSS data.

[0043] Zone proximity results are most effective when the nodes are configured to transmit at very low outputs, say around one-millionth of a watt.

[0044] Wi-Fi nodes operate in a completely passive mode. No transmissions are involved. In all other respects, they are identical to the Bluetooth nodes, Wi-Fi nodes listen to mobile device Wi-Fi transmissions and collect the same data items, i.e., MAC address, device type and RSS, and return them to the Managed System Server via the Internet.

Node network, Scatternet

[0045] The Bluetooth nodes in the system are capable of maintaining seven simultaneous communications links with other Bluetooth devices. Two of those links are used to form a network or chain with two other nearby nodes. One such chain is shown in Figure 2 where four nodes are connected. Data acquired by each node is passed along the chain from one to another and finally through the base station bridge to the Internet.

Base Station

[0046] The base station consists of two transceivers, one a Bluetooth device, the other a Wi-Fi. The Bluetooth device acts as a node connecting to one or more chains, and passing data from the other nodes on the chain to the Wi-Fi device, which then passes the data to the Internet. A wired base station needs only a single radio.

Checkout Rate Derivation

[0047] The disclosed description delivers precise and secure indoor passive consumer analytics via Bluetooth. This helps drive revenue, optimize store formats, increase operational efficiency, and deliver improved customer satisfaction. No or minimal application is required and no consumer action needed. The data is encrypted and anonymized.

[0048] Using the disclosed technology, establishes new benchmarks for grocers that include customers who lane hop. This key driver of CSAT is a new benchmark that is rewriting the lane optimization business

[0049] The system is applicable to mass transit locations with Wi-Fi providers, for instance at airports. The Bluetooth technology provides a precise and secure passive analytics on the market. As cell phones such as smartphones use Bluetooth, the system operates broadly, and no or minimal application or consumer forced interaction is required.

[0050] Positioning is by a continuous second polling of the device thereby not losing track of the customer (unlike WI-FI network solutions). The polling of the device can be at a regular rate (not increased), and the positioning algorithm can be run more frequently as needed. The precision as small as a 3' radius zone, provides accurate proximity in market. These features include

[0051] The method and system allows a user to control and monitor individuals, vehicles and other movable entities by using geographical zones. These zones can be pre-configured geographical zones. Such zones have a plurality of nodes. In different situations, messages can be sent between one or more of these mobile users and one or more control stations. The users can be a single user or multiple users in a group with whom there are message communications. The messages can be targeted to the one or multiple users.

[0052] The multi-dimensional sense can be a three-dimensional sense in the x, y and z axes or coordinates. The system allows for three-dimensional mapping according to the placement of nodes in a three-dimensional

sense. Further messages can be communicated with movable entities according to their location in the three-dimensional space, and the messages may be commercial or emergency messages.

[0053] The nodes are preferably part of a mesh network or other suitable network configuration. The nodes preferably communicate with transponders or subscriber devices that can be a cell phone, Personal Digital Assistant (PDA) or similar device using the Bluetooth™ protocol.

[0054] In one particular aspect, there is the ability to effect fine resolution determination of a movable entity's location. This can include three-dimensional mapping of that location. Disclosed in the present application is an apparatus and method for the relative precise three-dimensional mapping of a specific location. The apparatus and method can utilize a Bluetooth™ equipped device that communicates wirelessly via Radio Frequency (RF) using Bluetooth™ protocol with location nodes in a mesh network. The Bluetooth™ equipped device uses at least one specific algorithm to determine its three-dimensional location within the mesh network. This resulting location data is used to generate a fine resolution map centering on that specific location.

[0055] In another specific aspect, there is the ability to obtain and mine data related to the location of a mobile user. This can include an apparatus and method for mining data relating to the relatively precise three-dimensional location of a user. The apparatus and method can employ a Bluetooth™ equipped mobile personal device associated with a user that communicates wirelessly via RF using Bluetooth™ protocol with location nodes in a mesh network. The Bluetooth™ equipped mobile personal device contains at least one specific algorithm to determine the relatively precise location of the user within the mesh network. When the Bluetooth™ equipped mobile personal device is within the range of certain location nodes, specific events are triggered. These include, but are not limited to, the downloading of appropriate advertisements to the Bluetooth™ equipped mobile personal device. In addition, the location nodes transmit the user's location data to a central station via other nodes within the mesh network, relay stations, and/or intermediate supplementary stations. The user's location data can then be processed and analyzed at the central station and/or intermediate supplementary stations.

[0056] In another specific aspect, there is the ability to provide a security support system utilizing three-dimensional user location data. This can include an apparatus and method for providing security support to mobile users using three-dimensional location data of the users. The apparatus and method can employ a Bluetooth™ equipped mobile personal device associated with a user that communicates wirelessly via RF using Bluetooth™ protocol with location nodes in a mesh network. The Bluetooth™ equipped personal device uses at least one downloaded algorithm to determine the relatively specific three-dimensional location of the user within the mesh network. When an emergency event occurs, a central station and/or intermediate supplementary stations transmit emergency notifications to the users that are located within a specific group of nodes in the mesh network. These emergency notifications are transmitted to the users' personal devices via other nodes within the mesh network and/or through relay stations.

[0057] In one aspect, there is a method to define a geographical zone, which can be in two or three dimensions, and which can be utilized to regulate a movable entity that has a transponder or subscriber device. The device can be a cell phone, PDA, pager, computer or similar device, which is configured to be in wireless communication with other devices through a suitable network.

[0058] The method comprises loading from a computing device to a memory in a transponder or subscriber device a plurality of coordinates. The coordinates are mapped on a pixilated image so as to assign one pixel to each coordinate of the plurality of coordinates. The distance between each assigned pixel is configurable. The plurality of assigned pixels are connected with lines forming a contiguous line, and the connected line encloses an area in the pixilated image. The pixels that lie on the lines in order to form a contiguous array of pixels that enclose a shape in the pixilated image are activated. In another aspect, the method to define a geographical zone allows for regulation of the movable entity by monitoring, controlling and visualizing the status of the entity. The status of the entity may be movement, non-movement, and position of the entity. The movable entity is controlled and monitored depending on the location of the movable entity relative to said geographical zone.

[0059] In another aspect, the plurality of coordinates are entered by a user of a computer device and transmitted to the transponder or subscriber device. The user is allowed to enter geographical coordinates in a three-dimensional sense by allowing a user to select points in a map in a computer by clicking on the map and calculating the geographical coordinates of each selected point in the map. In another aspect, the user is allowed to enter geographical coordinates by typing on the computer the longitude and latitude. The plurality of geographical coordinates can have defined either by various systems including, but not limited to, the Mercator system and/or a latitude and longitude system.

[0060] In yet another aspect, the position of the movable entity in relation to the geographical zone as described in the method to define a three-dimensional geographical zone is determined by the steps of locating the transponder or subscriber device within the pixilated image by activating a pixel corresponding to the geographical coordinates where the transponder or subscriber device is located. Two vertical lines are extended in opposite directions and originating from the pixel, two horizontal lines are extended in opposite directions and originating from the pixel. The number of times each line crosses the boundary of the geographical zone is determined, and an outside status is assigned to each line that

crosses the boundary an even number of times. An inside status is assigned to each line that crosses the boundary an odd number of times. The transponder or subscriber device is identified as being inside the boundary if the status of three out of four lines indicate an inside status.

[0061] In another aspect, a subscriber device has a ground- or elevation-positioning system receiver that calculates the transponder or subscriber device coordinates, and allows a user or control center to identify the location of the movable entity in the pixilated image as one pixel in the computer image.

[0062] In another aspect, the geographical area is a geometrical shape such as a square, rectangle, triangle, circle, oval, or trapezoid in two or three dimensions. The shape of the geographical area can also be the shape of a non-geometrical shape such as the shape of the border delimiting a building, address, street, state, city, county, or country.

[0063] In one aspect, there is a method to define a geographical zone in two or three dimensions utilized to regulate a movable entity having a transponder or subscriber device. The method comprises allowing a user to enter a plurality of waypoints, each waypoint in the plurality of waypoints being defined by a geographical coordinate and a radius; wherein the geographical coordinate in two or three dimensions is represented by a latitude and longitude and elevation, and the radius is represented by a distance magnitude; and loading the plurality of waypoints on a transponder or subscriber device.

[0064] In another aspect, the transponder or subscriber device can determine whether the transponder or subscriber device is inside or outside the geographical zone in two or three dimensions by obtaining global positioning coordinates, and calculating whether the global positioning coordinates are inside at least one waypoint of the plurality of waypoints. The shape of the geographical area is the shape of a non-geometrical shape. The elevation relationship and positions can be determined by nodes set at different elevation levels.

[0065] In another aspect, all waypoints in the plurality of waypoints have the same coordinate but different radii, such that all the waypoints in the plurality of waypoints are concentric.

[0066] In one aspect, there is a method to identify a geographical area in one, two, or three dimensions for regulating a movable entity. The method comprises allowing a user to identify a geometrical area, region or space in a computer map. The geometrical area, region or space uses two or more coordinate attributes, and the identified geometrical area, region or space is divided into a grid. A user is allowed to select at least one section from within the grid in order to define a geographical area, region or space. The at least one section is associated with at least one pixel in a pixilated computer image such that the pixels selected by the user in the identified geometrical area are identified as being in the geographical area, region or space. The pixilated computer image is loaded to a memory in a transponder or subscriber device.

[0067] In another aspect, the pixilated computer image has a directly proportional number of columns and rows as the identified geometrical area, region or space. Alternatively, the pixilated computer image has the same number of columns and rows as the identified geometrical area, region or space. In another aspect, the geometrical area, region or space is rectangular or circular. In yet another aspect, a second geographical area, region or space is defined by a plurality of geographical areas, regions or spaces.

[0068] In one or more embodiments, the identified geometrical area, region or space is divided into a grid of three-dimensional squares and/or rectangles. The three-dimensional squares and/or rectangles of the grid may have various depths. The user is allowed to select at least one section from within the three-dimensional grid in order to define a three-dimensional geographical area, region, or space. The at least one section is associated with at least one pixel in a pixilated computer image such that the pixels selected by the user in the identified geometrical area are identified as being in the three-dimensional geographical area, region or space. The pixilated computer image is loaded to a memory in a transponder or subscriber device.

[0069] In yet another aspect the movable entity has a transponder or subscriber device associated with the entity and located in the geographical area, region or space. A position of the transponder or subscriber device is obtained from a ground or elevation positioning unit operably connected to the transponder or subscriber device. The position of the transponder or subscriber device is correlated in the geographical area, region or space to a representative position of the transponder or subscriber device in the pixilated computer image. The representative position of the transponder or subscriber device is determined as to whether the pixilated computer image falls on a pixel that is flagged as being in the geographical area, region or space.

[0070] The present disclosure provides a solution for providing wireless communication devices with relatively precise location awareness, system monitoring and area-specific messaging capabilities in environments where an accurate GPS position may not be able to be acquired, such as within a multi-story building.

[0071] The system-monitoring component performs health checks and validity tests on location nodes within an enabled environment, while the area-messaging component provides area-specific messaging to enabled wireless communication devices.

[0072] As used in this disclosure, "location node" is a stationary programmable device with a wireless transceiver, which is "Bluetooth™" capable for example, and a micro-controller. The location node is preferably programmed with one or more of its own device or "friendly" name-selection parameters, geographical positions, max power settings, installation identifiers, floor numbers and payload types.

[0073] A wireless communication device operable to detect a plurality of location nodes is disclosed. A wireless communication device periodically interrogates its environment and determines which location node is most practically near. The wireless communication device then communicates to that location node, and requests that any additional data information relevant to the specific location associated with that location node be sent back to the wireless communication device.

[0074] The most practically near node is defined as the node that is located at the closest accessible location to the movable entity. For example, a wireless communication device located on the second floor of a multi-story building may be closest to a location node located on the ceiling of the first floor, and may be next closest to a location node located on the second floor. Although the location node on the first floor is actually closer in distance to the movable entity than the location node on the second floor, since the location node on the first floor is not easily accessible to the movable entity located on the second floor, the location node on the second floor will be considered the most practically near node to the movable entity.

[0075] In one or more embodiments, the present disclosure relates to a system and method for the monitoring of and messaging to wireless communication devices within a predefined space, wherein the wireless communication device can be any wireless communication device with receiving and transmitting capabilities such as a cell phone, PDA, lap top computer, desktop computer and pager. The system and method utilizes, in its simplest form, at least two elements: at least one wireless communication device and at least one location node. When the system is activated, the wireless communication device will determine all of the location nodes within range. The wireless communication device will then determine the location of the most practically near location node. The wireless communication device can then request information specific to its location from this most practically near location node.

[0076] It should be appreciated that for simplicity and clarity of illustration, elements shown in the Figures and discussed below have not necessarily been drawn to scale. For example, the dimensions of some of the elements are exaggerated relative to each other for clarity.

[0077] Management and monitoring devices of assets and individuals that use ground positioning systems allow users to track the position of individuals, vehicles, cargo and other movable entities. The method and system described below utilizes a transponder or subscriber device that communicates over cellular and satellite communication networks in combination with GPS satellites capable of providing position and status information of the movable entity on a global scale. Additionally, there is the ability for more precise monitoring of assets and individuals. The transponder or subscriber device allows interaction with and control of a wide range of peripheral devices, including, but not limited to, operating the movable entity according to pre-configured geographical zones and triggered events.

[0078] A transponder or subscriber device can be mounted, attached, manufactured or otherwise included upon or in various articles or entities. Such individuals, articles or entities may include vehicles, aircraft, cargo, persons, animals or any other item where tracking its movement and/or location is beneficial. Within the context of the disclosed tracking system, the transponder or subscriber device works to collect, process and communicate information about the movable article or entity to which the transponder or subscriber device is associated. Furthermore, when requested, the transponder or subscriber device can issue various commands and instructions to the local article, entity, and/or command center.

[0079] The transponder or subscriber device has the features, flexibility, and capability of an intelligent device. The transponder or subscriber device may contain a Central Processing Unit (CPU). The CPU has at least a 4-bit processor, which can interface with at least one modem (cellular, satellite, and others), at least one GPS receiver, at least one memory module, and/or other peripheral devices. Other components of the transponder or subscriber device may include, but are not limited to, at least one GPS antenna, at least one modem antenna, at least one serial port for communication and configuration, and at least one multiple connector pin which contains at least one input and at least one output. The at least one input and output are configurable to be associated with a configurable event or configurable operation.

[0080] The transponder or subscriber device can include many different combinations of the components listed above and/or similar components. For example, a transponder or subscriber device may have two modems, where one modem is a satellite modem and one modem is a cellular modem. Additionally, a transponder or subscriber device can contain a Bluetooth™ equipped receiver, Bluetooth™ equipped transmitter, Bluetooth™ equipped transceiver, and/or GPS receiver in combination with the other components. In one or more embodiments, any or all of the components are co-located on the same integrated circuit (IC) chip within the transponder or subscriber device. The components of the transponder or subscriber device depend upon which capabilities the movable entity requires.

[0081] Among its many capabilities, the CPU of the transponder or subscriber device can be configured to manage configurable events or configurable operations. Managing events means that among other capabilities, the transponder or subscriber device can report, observe, recognize, process, and analyze numerous configurable events or configurable operations. In addition, the transponder or subscriber device can give and respond to various commands, effectuate numerous events in its local installation, and contain a history recording component.

[0082] An event message can be triggered by physical and logical events including the event message itself and/or other such information. Other such information

includes, but is not limited to, latitude, longitude, elevation, speed, direction, time, state of all the inputs, state of all outputs, event reason or source, and/or any other relevant information concerning the entity.

[0083] The transponder or subscriber device is configurable to include as few or as many configurable logical events or physical events as the user desires. Events may be physical or logical. Logical events may be based on rules using a combination of the GPS position of the movable entity, and one other factor, such as time or speed. However, logical events can be based upon a combination of factors. Physical events are those events that are physically manifested by the individual, the vehicle, or the object being tracked.

[0084] Other configurable events or configurable operations include the location of the vehicle, individual or object in terms of latitude, longitude, and/or elevation; the time and corresponding location of the last configurable event reported; the direction of the vehicle, individual or object; the state of any assigned inputs or outputs or change thereof; a pre-selected distance; a pre-selected time interval; pre-selected intervals based upon date and time reference; a pre-selected schedule for reporting and recording any of the configurable events or configurable operations; a pre-selected speed; length of relative stationary time; and length of non-movement for an individual or object.

[0085] Additional configurable events or configurable operations include the entering or exiting of a pre-set waypoint or a pre-set zone in a multi-dimensional space such as two or three dimensions being the longitude, latitude and elevation coordinates, namely the x, y and z coordinates. A waypoint is a circular, cylindrical, or spherical area defined by a geographical center point and radius in the multi-dimensional space. The area or space defined by the waypoint is configurable by changing the radius and the position of the geographical center point. A zone is an irregular region defined by a series of line segments enclosing an area or space.

[0086] The configurable events or configurable operations or combinations thereof can be processed in order to transmit a specific message, respond to a specific query or command, enable or disable a specific mechanism, or recognize a specific event. For example, the CPU can be configured to process that, if at a pre-selected time the individual, vehicle or object has not moved a pre-selected distance, then the transponder or subscriber device is sent a command to alter the state or conditions of the individual, vehicle, object, transponder or subscriber device.

[0087] The configurable events or configurable operations may occur in many situations. These situations include, but are not limited to, where configurable events or configurable operations occur in response to a command; where configurable events or configurable operations occur in response to a query, or where configurable events or configurable operations occur upon recognition of pre-selected conditions.

[0088] Configurable boundaries or geographical zones may also be employed and can be configurable to any shape the user desires. For example, the boundary or zone can trace the border of a building, floor of a building or structure, part of a building, part or whole of a facility, a campus, a select portion of a building falling within a GPS address designation, a state line, or trace the route of a selected highway or path. The boundary or zone can trace the border of the premises of a school zone, a no-fly zone, a city, etc. The boundary or zone can also be a geometric shape or non-geometric shape in a multi-directional coordinate sense. A further benefit of the present disclosure is that the transponder or subscriber device can be updated and configured locally or wirelessly.

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

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

[0091] Events can be physical or logical. Physical and logical events trigger the sending of a message over the air when certain conditions are met. Most logical events are based on rules using a combination of the GPS position and one other factor, such as time or speed. The event message triggered by physical and logical events includes, but is not limited to, the event message itself, and such information including latitude, longitude, speed, direction, time, state of all the inputs, event reason or source, and any other relevant information. The logical events are usually software driven, calculation based, and typically draw from GPS positions and/or positions from location nodes. The transponder or subscriber device is configurable to include as few or as many logical events as the user desires. One embodiment includes at least six different configurable logical events.

[0092] The first logical event of one embodiment is a feature that reports the last known location of the transponder or subscriber device for a specified interval of

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

Geofencing

[0093] The next logical event of one embodiment is a "geofencing" feature, which is the creation of a configurable boundaries or geographical zones feature. This feature consists of generating events when the transponder or subscriber device travels through waypoints and zones. A configurable boundary or geographical zone may be constructed through a combination of waypoints and/or zones. Because of this combination, the configurable boundary or geographical zone can be constructed in a very specific shape, which allows for the outlining of specific borders or routes. A waypoint is a circular area, cylindrical area, or spherical area defined by a geographical center point and radius. The area defined by the waypoint is configurable by changing the radius and the position of the geographical center point. Thus, the boundary created by the waypoints and zones is configurable.

[0094] In one embodiment, the transponder or subscriber device is loaded with a plurality of waypoints, each waypoint is defined by a coordinate and a radius. A zone can be defined by a plurality of waypoints. Thus, for example, a building, campus, part of a building, and/or a city can be defined by two waypoints in multiple dimensions.

[0095] Using GPS data, the transponder or subscriber device, for example, can calculate whether it is located within two waypoints that define a city in two dimensions or three dimensions, namely longitude, latitude, and elevation. If the transponder or subscriber device determines that it is located inside one of the two waypoints, then the transponder or subscriber device assumes that it is within the limits of the city.

[0096] The third dimension, namely the elevation, is defined by nodes located at different levels of elevation with which the transponder or subscriber device communicates. Also, more precise longitude, latitude, and elevation coordinates can be defined by the nodes, in a manner normally beyond GPS precision and ability.

[0097] A zone is an irregular region defined by a series of line segments enclosing an area. In one embodiment, each zone contains 3 to 256 or more deflection points for creating the line segments defining this irregular area. In one embodiment, this irregular area can create a configurable boundary or a geographical zone. The properties of a zone include a name, description, and a flag determining if the zone is an off-limits zone or an enclosed zone.

[0098] In one embodiment, a geographical zone may be created by selecting a plurality of coordinates and downloading the coordinates to the transponder or subscriber device. The plurality of coordinates may be in the Mercator system. Next, the transponder or subscriber device assigns each coordinate to a pixel in a pixilated image that is loaded in the transponder or subscriber device. In order to perform the assignment, the transponder or subscriber device utilizes logic to define a "bounding" square or box around the plurality of coordinates. Then the bounding box is pixilated, and the pixels where all the coordinates fall are marked as activated. Once the pixels for each coordinate are assigned, lines are extended from one pixel to the next so as to form an enclosed area in the pixilated image. The pixels that lie in the path of the lines between the activated pixels are also activated. Thus, an enclosed and contiguous line of pixels is formed.

is exceeded, the position packet is discarded.

[0099] In exemplary embodiments, the mobile device of the present disclosure is a Bluetooth™ enabled device. In one or more embodiments, the mobile device is a cell phone, a laptop computer, a pager, a PDA, or any other wireless communication device with the ability to receive the detailed mobile device location information from at least one location node. The type of wireless communication employed by the system includes, but is not limited to, radio frequency (RF) communications and/or infrared communications.

[0100] The mapping of the geographical space is affected in a three-dimensional sense, selectively being defined by x, y and z axes or coordinates, which in some embodiments may correspond to latitude, longitude, and elevation. The nodes are enabled to communicate using GPS and/or Bluetooth™ protocol. The nodes are located at various locations within the geographical space, which comprises of at least one zone. The zones are typically defined as non-regular geometrical shapes. Such a non-regular shape is something different from a circle, square, rectangle, or a series of straight lines defining a bounded area. As such, the lines defining the non-regular geometrical shapes are irregularly shaped and/or curved to define the irregularity. In some embodiments, users have the ability to define and change the boundaries of the zones employed by the system.

[0101] In one or more embodiments, the nodes are enabled to communicate using Bluetooth™ protocol to effect communications between nodes and mobile devices, which are each associated with at least one user. In some embodiments, the mobile devices are also enabled to communicate with each other using Bluetooth™ protocol. The nodes are selectively part of a mesh network, or other suitable network configuration. The nodes selectively communicate with mobile devices associated with users. The mobile devices 4010 being selectively a cell phone, PDA, pager, or other computer device.

[0102] In different systems, the zone is affected in two

or three dimensions, and this can be used to regulate the location of a user. The user can be a movable entity that is associated with a transponder or subscriber device. The transponder or subscriber device being selectively a cell phone, PDA, pager, computer, or device configured to be in wireless communication with other mobile devices and with nodes in a wireless communication network.

[0103] Mapping is attained by loading a plurality of mapping coordinates from a computer device to a memory module of a transponder or subscriber device, or by the user directly loading a plurality of mapping coordinates to a memory module of the transponder or subscriber device. The mapping coordinates are used to generate a pixilated image. The pixilated image is configured to form a contiguous array of pixels that enclose a shape in the pixilated image, whereby the enclosed shape forms a geographical space.

[0104] A user can enter geographical coordinates on a computer device, or on a transponder or subscriber device **4010,** by entering numerical values for the coordinates of a specific location or locations. For example, the user can enter numerical values for the longitude, latitude, and elevation of a specific location. Conversely, a user can enter geographical coordinates on a computer device, or on a transponder or subscriber device **4010,** by selecting points on a map displayed on a display screen by using a cursor to click on those point locations on the map. The computer device, or transponder or subscriber device **4010,** will calculate the corresponding geographical coordinates for each point on the map that has been selected by the user.

[0105] The system for mapping a geographical space comprises communicating mapping data between communication nodes and at least one selected mobile communication device. An array of communication nodes is arranged about a two- or three- dimensional geographical space. One or more different mobile communication devices are in communication with different communication nodes when the devices are within range of one or more selected nodes. A mobile device is associated with the respective nodes such that the mobile device is locatable within the three-dimensional space.

[0106] In a store environment, special advertisements can be offered to a user, depending on the user's perceived shopping habits or motion throughout the store. For instance, a person who spent a lot of time in the camera department of the store can strategically be messaged about promotions from that specific department. The behavior of the user can be part of the profile. Behavior of a user can include, but is not limited to, the amount of time the user spent in the vicinity of different nodes within the environment, the purchasing patterns of the user, the product or service preferences of the user, the commercial enquiries of the user, the dining preferences of the user, and the entertainment preferences of the user. In one or more embodiments, a control system is used to generate a profile of a user. For example, if the user purchased various different products, this product purchasing data can be fed into a control system to create and/or update the user's profile.

[0107] In a hotel environment, for instance, a casino, a past profile of a user can be preloaded onto a mobile device associated with that user when the user checks into the hotel. The past profile may have been generated from the user's behavior during the user's prior stays at the hotel. This past profile can be updated according to the user's movement throughout the hotel and actions during the user's stay at the hotel.

[0108] In one or more embodiments, the mobile devices are Bluetooth™ equipped. The mobile devices communicate via RF using Bluetooth™ protocol to Bluetooth™ enabled location nodes in a mesh network. When a mobile device is located within the range of certain location nodes, specific events are triggered. These specific events include, but are not limited to, the downloading of a commercial message, such as an advertisement, to the user's mobile device for the user.

[0109] The selected nodes can communicate the location information of the mobile device associated with a user. The selected nodes will transmit the location information to a central station either directly or via other nodes within at least one mesh network. The mesh network may include the use of relay stations and/or intermediate supplementary stations.

[0110] The mobile personal devices associated with users are Bluetooth™ equipped, and communicate wirelessly via RF using Bluetooth™ protocol to location nodes. When an emergency and/or security event occurs, a central station and/or intermediate supplementary station transmits emergency and/or security notifications to mobile devices associated with users located within at least one specific geographic zone of nodes in a mesh network. The emergency and/or security notifications are transmitted to the users' personal devices selectively via at least one node within a mesh network, or via at least one node and through at least one relay station.

[0111] The disclosure also includes an airport facility comprising a door for entry into the facility from an outside position from the facility. There is a first zone between the door and a security checking location within the facility and the security checking location. There is a second zone beyond the security checking location and providing information of movement of persons from the first zone through the security checking location and into the second zone.

[0112] The system provides a location based service to an operator of a facility-comprising a location node in the facility, the location node including a transceiver of wireless signals for transmitting the signals received to a central hub for processing the received signals. The node is located in a specific location in the facility, and the node is capable of communicating wirelessly with movable human entities in the facility entities thereby to establish the location and movement of human entities in the facility. The entities have wireless communicating units such as smart phones for transmitting and receiving

signals wirelessly with the node. Each unit is unique for each human entity.

[0113] The node includes a detection device, and the device includes a radio transmitter/receiver, the device being capable of detecting the zone entry, dwell and exit events of the human entities, and wireless communicating units of human entities.

[0114] The wireless communicating units are equipped with a Bluetooth and WI-FI radio.

[0115] The node is capable of providing data about the movement of the human entities in the facility relative to the location such data including the entry into the location, the departure from the location, and the amount of time spent in the vicinity of the location.

[0116] The data transmission to the operator is in at least one of real time or being for storage and analysis at a later time for use by the operator. There is an algorithm, executable by a computer processor, for processing the data. The data includes entry into the location and departure from the location; and the data including information of the number of entities in the vicinity of the security checking location within the facility zone.

[0117] There is one camera or multiple cameras for periodically photographing the facility, the cameras being distributed about the facility. Photographs are transmitted from the multiple cameras to a control station. The control station receives the data from the location nodes and the photographs to constitute line flow control information. Selectively the facility can include a sensor for counting entities at or passing through or past selected locations.

[0118] The information is a tool to monitor and/or plan operations in the facility and personnel and employee assignment such as check in personnel, check out personnel, security checking personnel in the facility. Personnel employed in a facility may have tags or badges with a transponder for communication with the nodes. There is a screen with information of movement of persons from the first zone through the security checking location and into the second zone as mapped in the first zone and second zone. The screen is a tool to monitor and/or plan operations in the facility and personnel assignment in the facility.

[0119] The airport facility includes a series of location nodes in the facility. The location nodes include transceivers of wireless signals, and transmit the signals received to a central hub for processing the received signals. The nodes are located in spaced apart positions in the facility.

[0120] The airport facility includes at least one checking location. Persons passing through the facility need to pass through at least one of the checking location, and wherein a node is located in a physical location to be related to the at least one checking location. The algorithm relates the data, and the data from the location nodes includes at least one of the number of entities passing through the checking location, the speed with which entities pass through the checking location, and the number of entities in the vicinity of the checking location.

[0121] There are additional aspects of the disclosure for flow and/or line control.

SOLUTION

[0122] The disclosure includes a passive indoor flow and/or line management and/or shopper analytics system, apparatus and method for line management in shopping environments, airports, passenger terminals of different kinds, sports stadiums, theatres, shopping malls, entertainment areas and venues where lines of people accumulate. There is an accuracy within about 1 meter.

[0123] The disclosure monitors, observes, aggregates and analyzes line data, in-store location data via indoor positioning nodes. There are easily installed, the discreet nodes (about the size of a deck of cards) which are placed strategically throughout a brick and mortar location and set to dynamically sized zones. The flexible zones can cover a broad range, 1-10 meters (3 to 30 feet).

[0124] In some cases, there can be monitoring of and /or within parking structures and approaches to parking structures and airport or terminal facilities. In these cases, the monitoring is of smart communication devices which maybe in automobiles or with persons in automobiles.

[0125] This advanced method of measuring indoor customer location, and also persons standing in a line puts actionable data and insights at a user's control. Data is presented in graphical dashboards that include behavioral snapshots, gauges, graphs, heat maps and trending data. Reports include individuals such as traveler's, passenger' s, shopper's path, dwell time, traffic density and other metrics delivered by display, department, location, region, and national views.

[0126] The disclosure includes a system and method for determining a user's path. There is a server arranged to receive location data of a communication device associated with the user, the location data defining the detected position of the communication device at a number of different points in time. The location server is further arranged to receive data associated with the location data indicative of the order in which the location data was determined. The server is further arranged to compare the received location data and zone data defining a plurality of zones and to associate the received location data with one of the plurality of zones.

[0127] The user's path passing through a zone defined by the associated location data and the associated data is determined. Also there is the storage for a plurality of user profiles wherein each user profile is defined by zone data defining an order in which a given type of user passes through the plurality of zones. The determined path of the user passing through the of zones with the user profiles is compared, and the server is further arranged to associate the user with a given user profile and to process and the path of the user.

[0128] The server is further arranged to track the location of user at a point in time on the path based on real time or cached location data. The server is configured to receive location data comprising timestamp data indicative of when the location of the device was determined. The server is further configured to determine the user's dwell time at a particular location or within a zone based on the processed associated location data. The server is further configured to determine the number of points on the determined user path, and preferably to compare the determined number of points with a predetermined threshold stored in a storage means. The server is further configured to determine the user dwell time only if the number points on the determined user path is greater than the predetermined threshold.

[0129] Each one of the plurality of coordinates define a shape of at least one zone, the shape of the zone is selectively a square, rectangle, triangle, circle, oval, or trapezoid, non-geometric or has irregular boundaries.

[0130] Regulating an entity by performing an action that comprises at least one of monitoring, controlling and visualizing the position the entity or movement or non-movement of the entity. The movable entity is controlled and monitored depending on the location of the movable entity relative to at least one zone.

[0131] The system determines the location of a regulated transponder, and selectively determines whether the transponder is inside or outside the zone by obtaining positioning coordinates, and calculating whether or not the positioning coordinates are inside at least one waypoint of the plurality of waypoints defining at least one zone.

[0132] At least one zone is rectangular and is divided into a plurality of rectangles. Alternatively or additionally at least one zone is circular and is divided into a plurality of sections. Further alternatively or additionally at least one zone has a user-defined shape other than circular or spherical, and selectively is a closed polygonal shape.

[0133] The system and method of path determination can be applied for flow control and/or line control in environments such as airport terminals where there are different zones of activity and service being provided, and the need to monitor the location of users who can be passengers, and/or employees.

BLUETOOTH (™) INFRASTRUCTURE

HARDWARE:

BASE STATION

[0134] Measuring 5.5" wide x 4.0" deep x 1.5" high, Base Stations are the disclosure Bluetooth to IP bridges, and are used for forwarding field collected data to a cloud infrastructure. Installation requires at least one Base Station. The total number of Base Stations required is a factor of the number of nodes installed and number of patrons that visit the installation site.

BLUETOOTH NODE

[0135] Measuring 3.25" high x 2.5" wide x 1.0" deep, nodes are devices that passively collect unencrypted Bluetooth advertisements. Creating a virtual RF bubble from their installation center point, nodes are used to define zones in an installation. Each distinct zone will require at least one node, but two or more can be used to define very large or irregularly-shaped zones as well. the disclosure has the ability to configure the RF power, sensitivity and range of each node independently, enabling 1- meter accuracy in most environments.

POWER CONSIDERATIONS:

BASE STATION

[0136] The Base Station is powered from a standard 110v AC/DC outlet, using a two-prong power adaptor to provide regulated DC voltage of 3.3 VDC. The Base Station has a maximum operating current of < 700mA.

BLUETOOTH NODE

[0137] The node can be powered by one of two sources:

1. The node is powered from a standard 110v AC outlet, using a two-prong power adaptor to provide DC voltage between 5 and 15 VDC. The node has a maximum operating current of < 75mA.

2. Each node is connected to a power distribution network powered by an AC/DC converter. The node operates with an input of 12 volts DC, and has a maximum operating current of < 75mA.

[0138] In either case, the node has a four-port power header that can be leveraged to daisy chain power from one node to the next, eliminating the need to pull a home run to an available 110v AC outlet for each node. The total number of nodes that can be powered from a single power source is a factor of the wire gauge and length of wire run in conjunction with the source supply DC voltage.

DATA COLLECTION

MANAGED NETWORK:

[0139] A component of the solution is its hosted services, named the Managed Network. Data collected in the field is forwarded to the Managed Network, where it is anonymized, analyzed, aggregated and reported on. The Managed Network also provides tools for managing and storing customer, site, security and installation configurations.

CHAINING:

[0140] Although each node and Base Station requires power, they communicate with each other wirelessly via Bluetooth Scatternets. Serial chains are formed, node to node, ultimately terminating at a single Base Station. Chains enable two-way communications with a central control center infrastructure. Messages initiated by the Managed Network (Commands) are passed downstream to the Base Station and/or one or more nodes. Nodes and Base Stations generate device detections and responses to commands, which are passed upstream to the Base Station, who forwards it on to the Managed Network via an encrypted Internet connection.

[0141] Chains are self-healing. In the event a node loses power or is somehow tampered with, the remaining nodes operating in the chain will report the event to the Managed Network and re-route the chain, circumventing the down node. When the anomalous node is brought back into an operating state, the chain will re-route itself to include the node and report the event to the Managed Network.

[0142] The use of Bluetooth Scatternets reduces the deployment requirements and increases reliability and decreases the operating cost of an infrastructure.

DATA ENCRYPTION & PRIVACY:

[0143] The Bluetooth nodes passively detect unencrypted Bluetooth Classic and Bluetooth Smart (Low Energy) advertisements. The detections are accumulated and compressed into a protocol before being encrypted and forwarded upstream to the Base Station at the head of the chain via the Bluetooth Scatternet. The Base Station receives the encrypted Bluetooth packet and forwards it to the Managed Network via an AES encrypted TCP/IP connection.

[0144] No personally identifiable information is stored in the Managed Network for any device passively detected by the disclosure infrastructure. Specifically, as it pertains to Bluetooth, the Managed Network does not write to disk the MAC address of any device passively detected, but instead hashes the MAC address into an irreversible and anonymous identity using a hashing algorithm before the data is aggregated and written to disk.

NETWORK CONSIDERATIONS

INTERNET CONNECTIVITY:

[0145] The Base Station uses Internet connectivity and support both wired and wireless connectivity (802.11 b/g), wired being preferred.

NETWORK BANDWIDTH:

[0146] The amount of bandwidth consumed by an installation is more a factor of the number of patrons than it is the number of nodes. The use of accumulation, compression and a proprietary protocol ultimately results in minimal Internet bandwidth requirements. The chart of Figure 44 illustrates the actual network bandwidth consumption of an installation in kilobits/second (Kbps) in a venue accommodating more than 12 million patrons annually. The example venue installation often consumes less than 2 Kbps over 95% of the time, occasionally reaching 5 Kbps and rarely, peaking at 23.3 Kbps.

RF CONSIDERATIONS

2.4 GHz RADIO BAND:

[0147] Nodes and Base Stations operate in the 2.4 GHz radio band. Devices communicating in this band run the risk of causing and encountering interference in environments where other wireless technologies are in use (wireless LAN and other applications based on the IEEE 802.11 specification for example).

[0148] Bluetooth Classic leverages a technique of Adaptive Frequency Hopping (AFH) to diminish the impact of interference. To start, Bluetooth Classic randomly hops 1600 times across up to 79 channels each second, and only those channels not already saturated by other devices are used. Avoiding channels already in use while randomly hopping across all others virtually overcomes any impact Bluetooth Classic has on any other devices operating in the 2.4 GHz radio band.

CLASS II BLUETOOTH RADIO:

[0149] Nodes and Base Stations utilize a Class II Bluetooth Classic radio for chaining, typically communicating at a nominal RF range of up to 30' (greater distances can be achieved in open spaces). It is common for each enabled zone to be within 30' of another, but when not, "bridge" nodes., namely nodes with passive detection disabled, will likely be required to ensure the integrity of the Bluetooth Chain.

[0150] Cameras configured as part of an installation meet a security configuration standard:

1. Cameras shall not be directly accessible via the Internet at any time.

2. Cameras supporting credential-based access shall use password(s) that comply with the Password Policy.

3. Cameras shall be installed overhead when at all possible, eliminating the ability to capture personally identifiable characteristics of patrons/visitors.

4. Cameras shall only be used for providing still imagery at regular intervals. Video streams shall not be captured and/or recorded from a camera at any time without prior written consent from the installa-

tion site/customer.

5. Cameras shall be polled for still imagery via an API (typically REST) through an SSH proxy leveraging no less than a 2048-bit key.

6. Camera imagery shall be stored in a secure media store. Said media store shall not be directly accessible via the Internet and shall reside on servers that can only be accessed within the disclosure's secure network. Media store server access shall be limited to SSH connections leveraging no less than a 2048-bit key. TCP/IP database connections with media store access shall use password(s) that complies with the Password Policy.

7. Volatile camera imagery shall be captured at a rate no greater than once every 10 seconds. Volatile camera imagery shall not persist for more than 5 minutes.

[0151] Non-volatile camera imagery shall be captured at a rate no greater than once every 60 seconds. Non-volatile camera imagery shall not persist for more than 90 days.

[0152] The disclosure and as shown in Figures 3A and 3B includes Queue Measurements, Queue Paths, Hardware Placement Details, Queue Metric Details (Predictive and Historical) and Coverage. There is illustrated in Figures 3A and 3B, an installation and measurement of queue wait times at an airport terminal. There are shown:

1 projected wait time (Standard): Entering the Queue to the end of processing.

2 historical metrics: TSA Pre wait time and Total time spent in TSA.

QUEUE METRICS

[0153] Projected Wait Time Standard Time from entering the Queue to Exiting Processing. This does not include re-composure after passage through security areas of TSA from reaching B (*) to reaching D. If there is an overflow condition detected (serpentine area full) then the measurement will be: From reaching A to reaching D.

[0154] Historical Wait Time Standard Time from entering the Queue to Exiting the Scanner. This does not include re-composure. From reaching B (*) to reaching D.

[0155] Historical Wait Time Pre Time from entering the Queue to Exiting the TSA Pre Scanner (Scanner 7). This does not include re-composure from reaching B (*) to reaching D.

[0156] The hardware system includes 2 Base Stations (20), 16 Bluetooth Sensors (10) 2 Wi-Fi Sensors (30), and 8 IP Cameras (40), and several Infrared Sensors (50).

[0157] The features include:

a method of providing a location-based service to an operator of a facility, the facility being a physically defined structure formed within physical walls comprising: providing in the facility a series of location nodes, the location nodes including transceivers of wireless signals, and being for transmitting the signals received to a central hub for processing the received signals; the nodes being located in spaced apart positions in the facility, the nodes being for wireless communication with movable entities in the facility thereby to establish the location and movement of entities in the facility, the entities having wireless communicating units for transmitting signals wirelessly with the nodes , the nodes providing data about the movement of the entities in the facility, such data including at least one of entry into the facility, departure from the facility, amount of time spent in the vicinity of nodes located in the spaced apart positions; the travel path of the entities in the facility; a camera for periodically photographing the facility, the camera being located in the facility transmitting the photographs from the camera to a control station, the control station receiving the data from the location nodes and the photographs to constitute flow control information; the information being a tool to monitor operations in the facility and personnel assignment in the facility; and the information data being transmitted to the operator in at least one of real time or being for storage and analysis at a later time for use by the operator;

a method wherein the facility includes multiple checking locations wherein persons leaving the facility need to pass through at least one of the checking locations prior to leaving the facility, and wherein nodes are located in a physical location to be related to different respective checking locations of the multiple checking locations and wherein data from the location nodes includes at least one of the number of entities passing through different checking locations, the speed with which entities pass through the different checking locations, the number of entities in the vicinity of the different respective checking locations;

a method wherein the facility includes a sensor for counting entities at or passing through or past selected locations;

a method wherein the system includes three dimensional geographical zones for characterizing the movement and behavior patterns of a mobile user moving through an array of the geographical zones;

a method where the nodes include detection devices, the devices including radio transmitter/receivers, placed in spaced apart locations in each zone, the devices being capable of detecting the zone entry

and exit events of mobile phones equipped with selectively a Bluetooth or WI-FI radio or NFC system;

a method wherein each device is an element or node of a network connected to the Internet, selectively through a Wi-Fi bridge or base station or wired Ethernet, and selectively there are several separate networks formed by the nodes;

a method wherein as a mobile user moves through the store, zone entry and exit events are collected, time stamped, and passed along the networks to the Internet;

a method wherein the event trail is routed to a remote server and placed in a database for analysis where behavior details are extracted from the entry/exit data;

a method wherein resultant data sets apply an algorithm to manage checking lane allocations based on visitor rate of entry and visitor rate of checking, and wherein checking rates are selectively used to determine lane allocations with a capacity to check-out visitors at the same rate as they are entering the store, thereby providing the opportunity for a substantially continuous flow of visitors from entry to exit;

a method wherein the facility includes at least one checking location, and wherein persons passing through the facility need to pass through that at least one of the checking locations, and wherein a node is located in a physical location to be related to the at least one checking location and wherein data from the location nodes includes at least one of the number of entities passing through the checking location, the speed with which entities pass through the checking location, the number of entities in the vicinity of the checking location;

a method wherein the facility is an airport terminal and the checking facility is a security checking station, and selectively there are multiple stations;

a system for providing a location-based service to an operator of a facility comprising: a location node in the facility with, the location node including a transceiver of wireless signals, and being for transmitting the signals received to a central hub for processing the received signals; the node being located in a specific location in the facility, the node being for wireless communication with movable entities in the facility thereby to establish the location and movement of entities in the facility, the entities having wireless communicating units for transmitting signals wirelessly with the node; the node providing data about the movement of the entities in the facility relative to the location such data including at least one of entry into the location, departure from the location, amount of time spent in the vicinity of the location; multiple cameras for periodically photographing the facility, the cameras being distributed about the facility, transmitting the photographs from the multiple cameras to a control station., the control station receiving the data from the location nodes and the photographs to constitute flow control information; the information being a tool to monitor operations in the facility and personnel assignment in the facility, and the information data being transmitted to the operator in at least one of real time or being for storage and analysis at a later time for use by the operator;

a system including a series of location nodes in the facility, the location nodes including transceivers of wireless signals, and being for transmitting the signals received to a central hub for processing the received signals; the nodes being located in spaced apart positions in the facility, the nodes being for wireless communication with movable entities in the facility thereby to establish the location and movement of entities in the facility, the entities having wireless communicating units for transmitting signals wirelessly to the nodes , the nodes providing data about the movement of the entities in the facility, such data including at least one of entry into the facility, departure from the facility, amount of time spent in the vicinity of nodes located in the spaced apart positions; the travel path of the entities in the facility; and the data being transmitted to the operator in at least one of real time or being for storage and analysis at a later time for use by the operator;

a system wherein the facility includes multiple checking locations wherein persons leaving the facility need to pass through at least one of the checking locations prior to leaving the facility, and wherein nodes are located in a physical location to be related to different respective checking locations of the multiple checking locations and wherein data from the location nodes includes at least one of the number of entities passing through different checking locations, the speed with which entities pass through the different checking locations, the number of entities in the vicinity of the different respective checking locations;

a system wherein the facility includes a sensor for counting entities at or passing through or past selected locations;

a system wherein the location is a retail store, the store being divided into multi-dimensional zones where the radius of each zone is configurable, selectively from about three to about thirty feet;

a system wherein the facility includes at least one

checking location, and wherein persons passing through the facility need to pass through at least one of the checking locations, and wherein a node is located in a physical location to be related to the at least one checking location and wherein data from the location nodes includes at least one of the number of entities passing through the checking location, the speed with which entities pass through the checking location, the number of entities in the vicinity of the checking location;

a system wherein the facility is an airport terminal and the checking facility is a security checking station, and selectively there are multiple stations;

a system wherein the facility includes an indicator for posting waiting times, selectively including a communication by internet, telephone, message or a display;

a system wherein the facility is defined as at least one checking station for thoroughfare traffic, selectively being a street or sidewalk;

a system wherein the facility is defined as at least one checking station at an airport terminal;

a system including avoiding storage of personally identifiable information relating to a detected device, and wherein there no writing to disk of an identifiable MAC address of a detected device;

a method of providing a location-based service to an operator of a facility, the facility being a physically defined structure formed within physical walls comprising: providing in the facility a series of location nodes, the location nodes including transceivers of wireless signals, and being for transmitting the signals received to a central hub for processing the received signals; the nodes being located in spaced apart positions in the facility, the nodes being for wireless communication with movable entities in the facility thereby to establish the location and movement of entities in the facility, the entities having wireless communicating units for transmitting signals wirelessly with the nodes; the nodes providing data about the movement of the entities in the facility, such data including at least one of entry into the facility, departure from the facility, amount of time spent in the vicinity of nodes located in the spaced apart positions; the travel path of the entities in the facility; a server arranged to receive location data of a communication device associated with a user, the location data defining the detected position of the communication device at a number of different points in time, the location server further arranged to receive data associated with the location data indicative of the order in which the location data was determined; wherein the server is further arranged to compare the received location data and zone data defining a plurality of zones and to associate the received location data with one of the plurality of zones; determining the user's path passing through a zone defined by the associated location data and the associated data; storage for a plurality of user profiles wherein each user profile is defined by zone data defining an order in which a given type of user passes through the plurality of zones; comparing the determined path of the user passing through the of zones with the user profiles; wherein the server is further arranged to associate the user with a given user profile and to process and the path of the user; the control station receiving the data from the location nodes to constitute flow control information; the information being a tool to monitor operations in the facility and personnel assignment in the facility; and the information data being transmitted to the operator in at least one of real time or being for storage and analysis at a later time for use by the operator;

a method wherein the facility includes multiple checking locations wherein persons leaving the facility need to pass through at least one of the checking locations prior to leaving the facility, and wherein nodes are located in a physical location to be related to different respective checking locations of the multiple checking locations and wherein data from the location nodes includes at least one of the number of entities passing through different checking locations, the speed with which entities pass through the different checking locations, the number of entities in the vicinity of the different respective checking locations;

a method wherein the facility includes a sensor for counting entities at or passing through or past selected locations;

a method wherein the system includes three dimensional geographical zones for characterizing the movement and behavior patterns of a mobile user moving through an array of the geographical zones;

a method wherein the nodes include detection devices, the devices including radio transmitter/receivers, placed in spaced apart locations in each zone, the devices being capable of detecting the zone entry and exit events of mobile phones equipped with selectively a Bluetooth or WI-FI radio or NFC system;

a method wherein each device is an element or node of a network connected to the Internet, selectively through a Wi-Fi bridge or base station or wired Ethernet, and selectively there are several separate networks formed by the nodes;

a method wherein as a mobile user moves through the store, zone entry and exit events are collected, time stamped, and passed along the networks to the Internet;

a method wherein the event trail is routed to a remote server and placed in a database for analysis where behavior details are extracted from the entry/exit data;

a method wherein resultant data sets apply an algorithm to manage checking lane allocations based on visitor rate of entry and visitor rate of checking, and wherein checking rates are selectively used to determine lane allocations with a capacity to check-out visitors at the same rate as they are entering the store, thereby providing the opportunity for a substantially continuous flow of visitors from entry to exit;

a method wherein the facility includes at least one checking location, and wherein persons passing through the facility need to pass through that at least one of the checking locations, and wherein a node is located in a physical location to be related to the at least one checking location and wherein data from the location nodes includes at least one of the number of entities passing through the checking location, the speed with which entities pass through the checking location, the number of entities in the vicinity of the checking location;

a method wherein the facility is an airport terminal and the checking facility is a security checking station, and selectively there are multiple stations;

a system for providing a location-based service to an operator of a facility comprising: a location node in the facility with, the location node including a transceiver of wireless signals, and being for transmitting the signals received to a central hub for processing the received signals; the node being located in a specific location in the facility, the node being for wireless communication with movable entities in the facility thereby to establish the location and movement of entities in the facility, the entities having wireless communicating units for transmitting signals wirelessly with the node; the node providing data about the movement of the entities in the facility relative to the location such data including at least one of entry into the location, departure from the location, amount of time spent in the vicinity of the location; the control station receiving the data from the location nodes and the photographs to constitute flow control information; a server arranged to receive location data of a communication device associated with a user, the location data defining the detected position of the communication device at a number of different points in time, the location server further arranged to receive data associated with the location data indicative of the order in which the location data was determined; wherein the server is further arranged to compare the received location data and zone data defining a plurality of zones and to associate the received location data with one of the plurality of zones; determining the user's path passing through a zone defined by the associated location data and the associated data; storage for a plurality of user profiles wherein each user profile is defined by zone data defining an order in which a given type of user passes through the plurality of zones; comparing the determined path of the user passing through the of zones with the user profiles; wherein the server is further arranged to associate the user with a given user profile and to process and the path of the user; the information being a tool to monitor operations in the facility and personnel assignment in the facility, and the information data being transmitted to the operator in at least one of real time or being for storage and analysis at a later time for use by the operator;

a system including a series of location nodes in the facility, the location nodes including transceivers of wireless signals, and being for transmitting the signals received to a central hub for processing the received signals; the nodes being located in spaced apart positions in the facility, the nodes being for wireless communication with movable entities in the facility thereby to establish the location and movement of entities in the facility, the entities having wireless communicating units for transmitting signals wirelessly to the nodes ;the nodes providing data about the movement of the entities in the facility, such data including at least one of entry into the facility, departure from the facility, amount of time spent in the vicinity of nodes located in the spaced apart positions; the travel path of the entities in the facility; and the data being transmitted to the operator in at least one of real time or being for storage and analysis at a later time for use by the operator;

a system wherein the facility includes multiple checking locations wherein persons leaving the facility need to pass through at least one of the checking locations prior to leaving the facility, and wherein nodes are located in a physical location to be related to different respective checking locations of the multiple checking locations and wherein data from the location nodes includes at least one of the number of entities passing through different checking locations, the speed with which entities pass through the different checking locations, the number of entities in the vicinity of the different respective checking locations;

a system wherein the facility includes a sensor for counting entities at or passing through or past se-

lected locations;

a system wherein the location is a retail store, the store being divided into multi-dimensional zones where the radius of each zone is configurable, selectively from about three to about thirty feet;

a system wherein the facility includes at least one checking location, and wherein persons passing through the facility need to pass through at least one of the checking locations, and wherein a node is located in a physical location to be related to the at least one checking location and wherein data from the location nodes includes at least one of the number of entities passing through the checking location, the speed with which entities pass through the checking location, the number of entities in the vicinity of the checking location;

a system wherein the facility is an airport terminal and the checking facility is a security checking station, and selectively there are multiple stations;

a system wherein the facility includes an indicator for posting waiting times, selectively including a communication by internet, telephone, message or a display;

a system wherein the facility is defined as at least one checking station for thoroughfare traffic, selectively being a street or sidewalk.

a system wherein the facility is defined as at least one checking station at an airport terminal;

a system including avoiding storage of personally identifiable information relating to a detected device, and wherein there no writing to disk of an identifiable MAC address of a detected device;

a method of operating an airport facility, said airport facility comprising a door for entry into the facility from an outside position from the facility, a first zone between the door and a security checking location within the facility, the security checking location, and a second zone beyond the security checking location and providing information of movement of persons from the first zone through the security checking location and into the second zone, a location node within the facility, the location node including a transceiver of wireless signals, and transmitting the signals received to a central hub for processing the received signals; the location node being located in a specific security checking location within the facility, the node wireless communicating with movable human entities within the facility thereby to establish the location and movement of human entities within the facility, the human entities having wireless communicating units transmitting and receiving signals wirelessly with the node, each unit being unique for each human entity and communicating with the node when the person enters at least one zone; the location node including a detection device, the device including a radio transmitter/receiver, the device being capable of detecting the first zone entry, dwell and exit events of the human entities respectively through a communication with the wireless communicating unit of respective human entities, the wireless communicating units equipped with selectively a Bluetooth and WI-FI radio; including the steps of: the location node providing data through the respective wireless communication devices about the movement of the human entities in at least one zone within the facility relative to the location, such data including entry into the security checking location within the facility, and departure from the security checking location within the facility, and amount of time spent in the vicinity of the security checking location within the facility; the data being transmitted to the operator in at least one of real time or being for storage and analysis at a later time for use by the operator, parameters being established based on the rate of entities entering a line within the facility and the rate of entities departing from the line within the facility, and communicating with the node when the person enters a zone; the location node being located in a physical location related to the at least one security checking location, and wherein data from the location node related to the security checking location within the facility provides information being an indicator of the number of entities in the vicinity of the security checking location within the facility zone, and providing information of movement of persons from the first zone through the security checking location and into the second zone, a server arranged to receive location data of a communication device associated with a user, the location data defining the detected position of the communication device at a number of different points in time, the location server further arranged to receive data associated with the location data indicative of the order in which the location data was determined; wherein the server is further arranged to compare the received location data and zone data defining a plurality of zones and to associate the received location data with one of the plurality of zones; determining the user's path passing through a zone defined by the associated location data and the associated data; storage for a plurality of user profiles wherein each user profile is defined by zone data defining an order in which a given type of user passes through the plurality of zones; comparing the determined path of the user passing through the of zones with the user profiles; wherein the server is further arranged to associate the user with a given user profile and to process and the path of the user; the control station re-

ceiving the data from the location nodes to constitute flow control information, and the information being a tool to monitor operations in the facility and personnel assignment in the facility;

a method in which the server is further configured to determine the user's dwell time at a particular location or within a zone based on the processed associated location data;

a method in which the server is further configured to determine the number of points on the determined user path, and preferably to compare the determined number of points with a predetermined threshold stored in a storage means;

a method in which the server is further configured to determine the user dwell time only if the number points on the determined user path is greater than the predetermined threshold;

a method wherein each one of the plurality of coordinates define a shape of at least one zone, the shape of the zone is selectively a square, rectangle, triangle, circle, oval, or trapezoid, non-geometric or has irregular boundaries;

a method further comprising regulating an entity by performing an action that comprises at least one of monitoring, controlling and visualizing the position the entity or movement or non-movement of the entity;

a method wherein said movable entity is controlled and monitored depending on the location of the movable entity relative to at least one zone;

a method including determining the location of a regulated transponder, and selectively determining whether the transponder is inside or outside the zone by obtaining positioning coordinates, and calculating whether or not the positioning coordinates are inside at least one waypoint of the plurality of waypoints defining at least one zone;

[0158] Furthermore, the disclosure includes any combination or sub combination of the elements from the different species and/or embodiments disclosed herein. One skilled in the art will recognize that these features, and thus the scope of this disclosure, should be interpreted in light of the following claims and any equivalents thereto.

Claims

1. A method of operating a facility, said facility comprising a door for entry into the facility from an outside position from the facility, a first zone between the door and a security checking location within the facility, the checking location, and a second zone beyond the checking location and providing information of movement of persons from the first zone through the checking location and into the second zone,
a location node (30) within the facility, the location node including a transceiver of wireless signals, and transmitting the signals received to a central hub for processing the received signals;
the location node being located in a specific checking location within the facility, the node wireless communicating with movable human entities within the facility thereby to establish the location and movement of human entities within the facility, the human entities having wireless communicating units transmitting and receiving signals wirelessly with the node, each unit being unique for each human entity and communicating with the node when the person enters at least one zone;
the location node including a detection device, the device including a radio transmitter/receiver, the device being capable of detecting the first zone entry, dwell and exit events of the human entities respectively through a communication with the wireless communicating unit of respective human entities, the wireless communicating units equipped with selectively a Bluetooth (10) and WI-FI radio (30);
including the steps of:

the location node providing data through the respective wireless communication devices about the movement of the human entities in at least one zone within the facility relative to the location, such data including entry into the checking location within the facility, and departure from the checking location within the facility, and amount of time spent in the vicinity of the checking location within the facility;
the data being transmitted to the operator in at least one of real time or being for storage and analysis at a later time for use by the operator, parameters being established based on the rate of entities entering a line within the facility and the rate of entities departing from the line within the facility, and

communicating with the node when the person enters a zone;

the location node being located in a physical location related to the at least one security checking location, and wherein data from the location node related to the security checking location within the facility provides information being an indicator of the number of entities in the vicinity of the checking location within the facility zone, and providing information of movement of per-

sons from the first zone through the checking location and into the second zone,
multiple cameras (40) for periodically photographing the facility, the cameras being distributed about the facility,
transmitting the photographs from the multiple cameras to a control base station (20), the control station receiving the data from the location nodes and the photographs to constitute flow control information, and
the information being a tool to monitor operations in the facility and personnel assignment in the facility.

2. The method of operating a facility being an airport facility of claim 1 including a direct communication between the node, the node being in a fixed non movable location in the facility and the communicating unit of the human entity.

3. The method of operating an airport facility of either claim 1 or 2 wherein the facility includes a sensor for counting entities at or passing through or past selected locations.

4. The method of operating an airport facility of anyone of claims 1 to 3 including data for at least one of monitoring, controlling and visualizing the movement of the person.

5. The method of operating an airport facility of anyone of claims 1 to 4 wherein said person is monitored depending on the location of the movable entity relative to the zone, and wherein the person is a passenger, and the communication is effected when the passenger enters or exists a threshold, selectively a door, and selectively including people counters, selectively being infrared sensors (50) or break beam lasers or pressure-sensitive flooring/floor mats.

6. The method of any one of claims 1 to 5 including providing in the facility a series of location nodes, the location nodes including transceivers of wireless signals, and being for transmitting the signals received to a central hub for processing the received signals;
the nodes being located in spaced apart positions in the facility, the nodes being for wireless communication with movable entities in the facility thereby to establish the location and movement of entities in the facility, the entities having wireless communicating units for transmitting signals wirelessly with the nodes
the nodes providing data about the movement of the entities in the facility, such data including at least one of entry into the facility, departure from the facility, amount of time spent in the vicinity of nodes located in the spaced apart positions; the travel path of the entities in the facility.

7. The method of any one of claims 1 to 6 wherein the facility includes multiple checking locations wherein persons leaving the facility need to pass through at least one of the checking locations prior to leaving the facility, and wherein nodes are located in a physical location to be related to different respective checking locations of the multiple checking locations and wherein data from the location nodes includes at least one of the number of entities passing through different checking locations, the speed with which entities pass through the different checking locations, the number of entities in the vicinity of the different respective checking locations.

8. The method of any one of claims 1 to 7 wherein the facility includes a sensor for counting entities at or passing through or past selected locations.

9. The method of any one of claims 1 to 8 including
determining the user's path passing through a zone defined by the associated location data and the associated data;
storage for a plurality of user profiles wherein each user profile is defined by zone data defining an order in which a given type of user passes through the plurality of zones;
comparing the determined path of the user passing through the of zones with the user profiles; wherein the server is further arranged to associate the user with a given user profile and to process and the path of the user;
the control station receiving the data from the location nodes to constitute flow control information;
the information being a tool to monitor operations in the facility and personnel assignment in the facility; and
the information data being transmitted to the operator in at least one of real time or being for storage and analysis at a later time for use by the operator.

10. An airport facility comprising a door for entry into the facility from an outside position from the facility, a first zone between the door and a security checking location within the facility, the security checking location, and a second zone beyond the security checking location and providing information of movement of persons from the first zone through the security checking location and into the second zone,
a system providing a location based service to an operator of a facility-comprising:

a location node in the facility, the location node including a transceiver of wireless signals for transmitting the signals received to a central hub for processing the received signals;

the node (30) being located in a specific location in the facility, the node being capable of communicating wirelessly with movable human entities in the facility entities thereby to establish the location and movement of human entities in the facility, the entities having wireless communicating units transmitting and receiving signals wirelessly with the node, each unit being unique for each human entity;
the node (30) including a detection device, the device including a radio transmitter/receiver, the device being capable of detecting the zone entry, dwell and exit events of the human entities, and wireless communicating units of human entities,
the wireless communicating units being equipped with a Bluetooth (10) and WI-FI radio (30);
the node being capable of providing data about the movement of the human entities in the facility relative to the location such data including the entry into the location, the departure from the location, and the amount of time spent in the vicinity of the location;
and the data transmission to the operator being in at least one of real time or being for storage and analysis at a later time for use by the operator, and an algorithm, executable by a computer processor, for processing the data, the data including entry into the location and departure from the location; the data including information of the number of entities in the vicinity of the security checking location within the facility zone,
a camera (40) for periodically photographing the facility, the camera being located about the facility,
transmitting the photographs from the camera to a control station, the control station receiving the data from the location nodes and the photographs to constitute flow control information,
selectively the facility including a sensor for counting entities at or passing through or past selected locations,
the information being a tool to monitor operations in the facility and personnel assignment in the facility, and
a screen with information of movement of persons from the first zone through the security checking location and into the second zone as mapped in the first zone and second zone, and the screen being a tool to plan operations in the facility and personnel assignment in the facility.

11. The airport facility of claim 10 including a series of location nodes in the facility, the location nodes including transceivers of wireless signals, and being for transmitting the signals received to a central hub for processing the received signals; the nodes being located in spaced apart positions in the facility.

12. The airport facility of either claim 10 or 11 wherein the facility includes at least one checking location, and wherein persons passing through the facility need to pass through at least one of the checking location, and wherein a node is located in a physical location to be related to the at least one checking location, and the algorithm relating the data, wherein data from the location nodes includes at least one of the number of entities passing through the checking location, the speed with which entities pass through the checking location, and the number of entities in the vicinity of the checking location.

13. The airport facility of any one of claims 10 to 12 including
determining the user's path passing through a zone defined by the associated location data and the associated data;
storage for a plurality of user profiles wherein each user profile is defined by zone data defining an order in which a given type of user passes through the plurality of zones;
comparing the determined path of the user passing through the of zones with the user profiles; wherein the server is further arranged to associate the user with a given user profile and to process and the path of the user;
the information being a tool to monitor operations in the facility and personnel assignment in the facility, and
the information data being transmitted to the operator in at least one of real time or being for storage and analysis at a later time for use by the operator.

14. The airport facility of any one of claims 10 to 13 including storage for a plurality of user profiles wherein each user profile is defined by zone data defining an order in which a given type of user passes through the plurality of zones;
comparing the determined path of the user passing through the of zones with the user profiles; wherein the server is further arranged to associate the user with a given user profile and to process and the path of the user;
the control station receiving the data from the location nodes to constitute flow control information, and the information being a tool to monitor operations in the facility and personnel assignment in the facility.

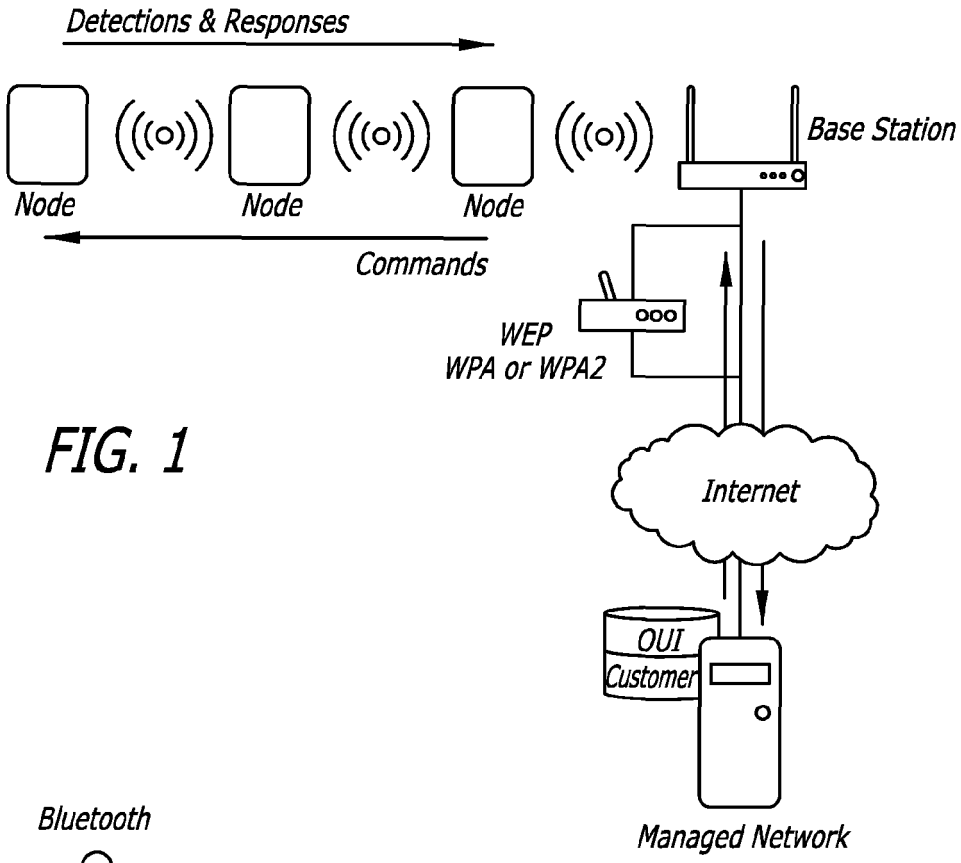
Detections & Responses
Node
Node
Node
Base Station
Commands
WEP
WPA or WPA2
Internet
OUI
Customer
Managed Network

FIG. 1

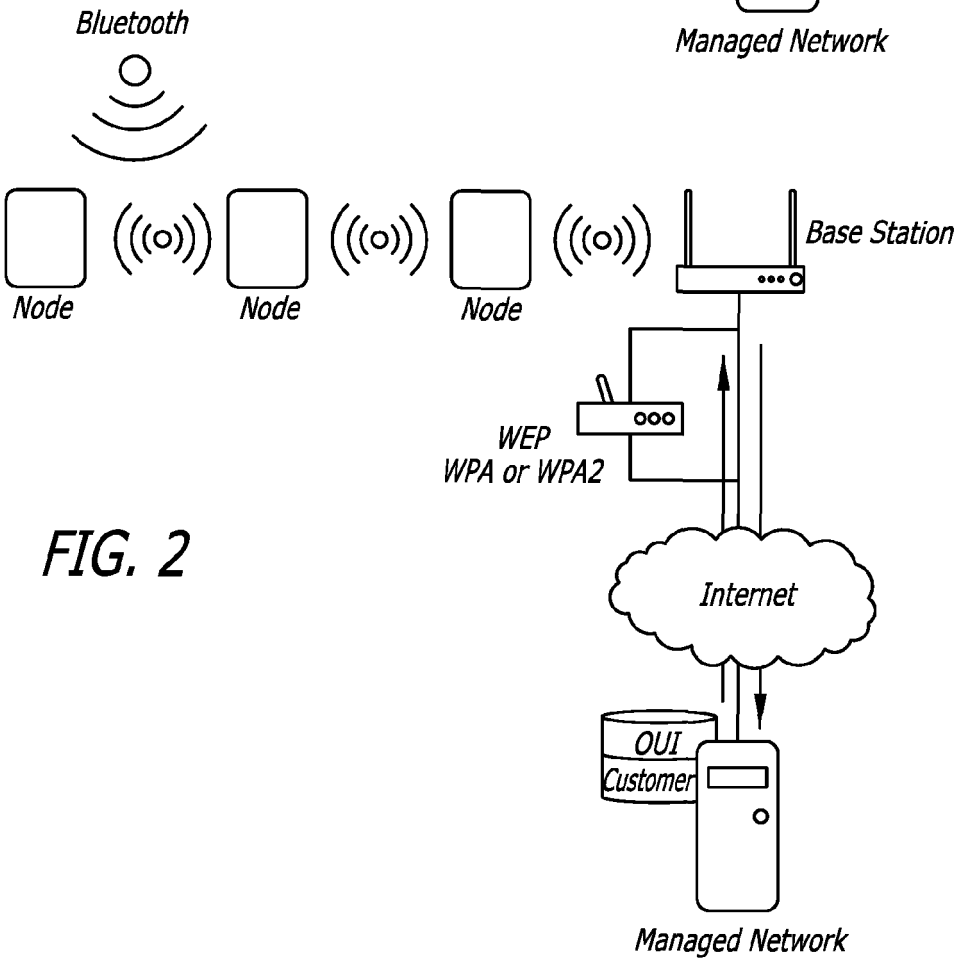
Bluetooth
Node
Node
Node
Base Station
WEP
WPA or WPA2
Internet
OUI
Customer
Managed Network

FIG. 2

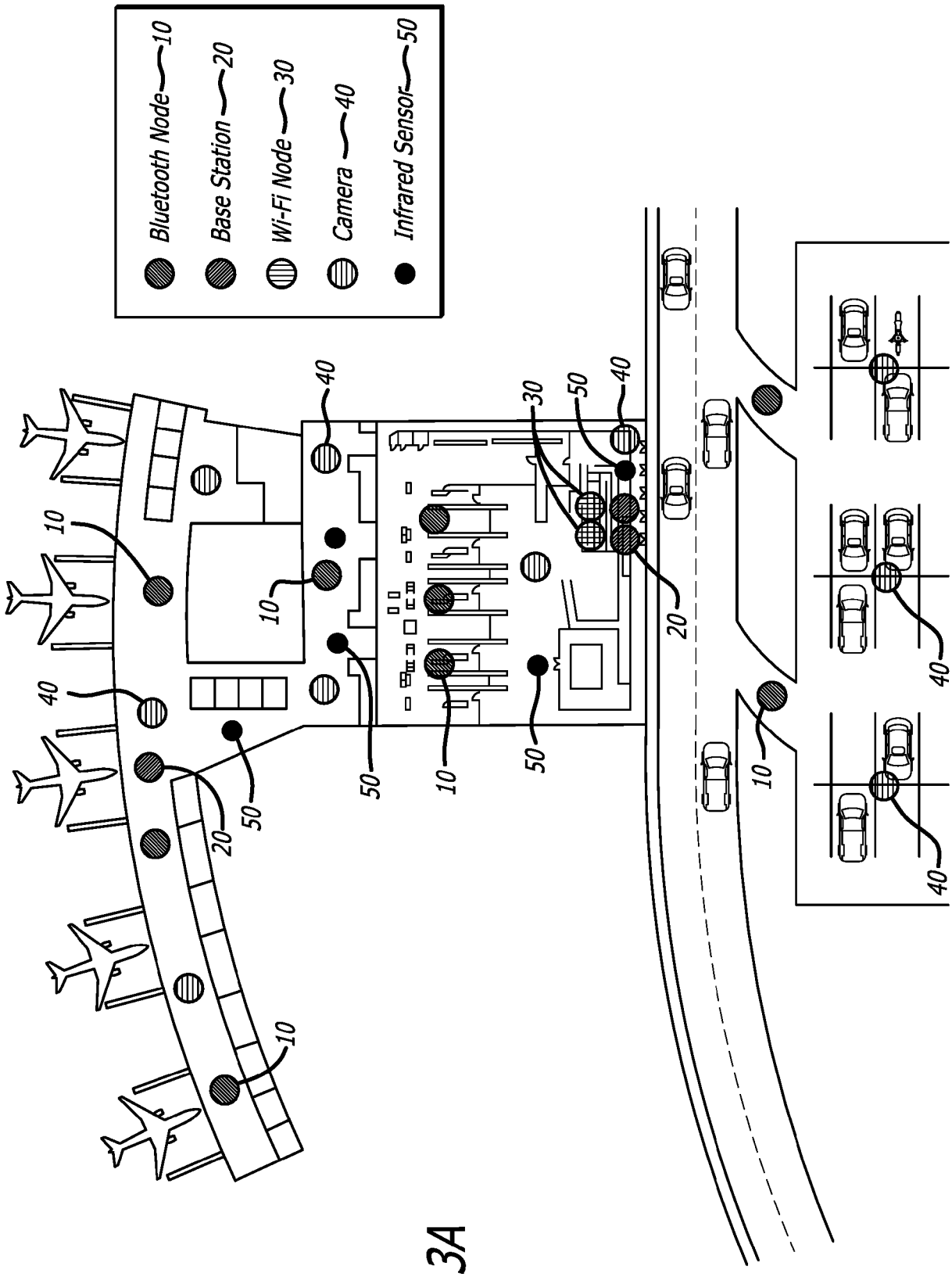
Bluetooth Node 10
Base Station 20
Wi-Fi Node 30
Camera 40
Infrared Sensor 50

FIG. 3A

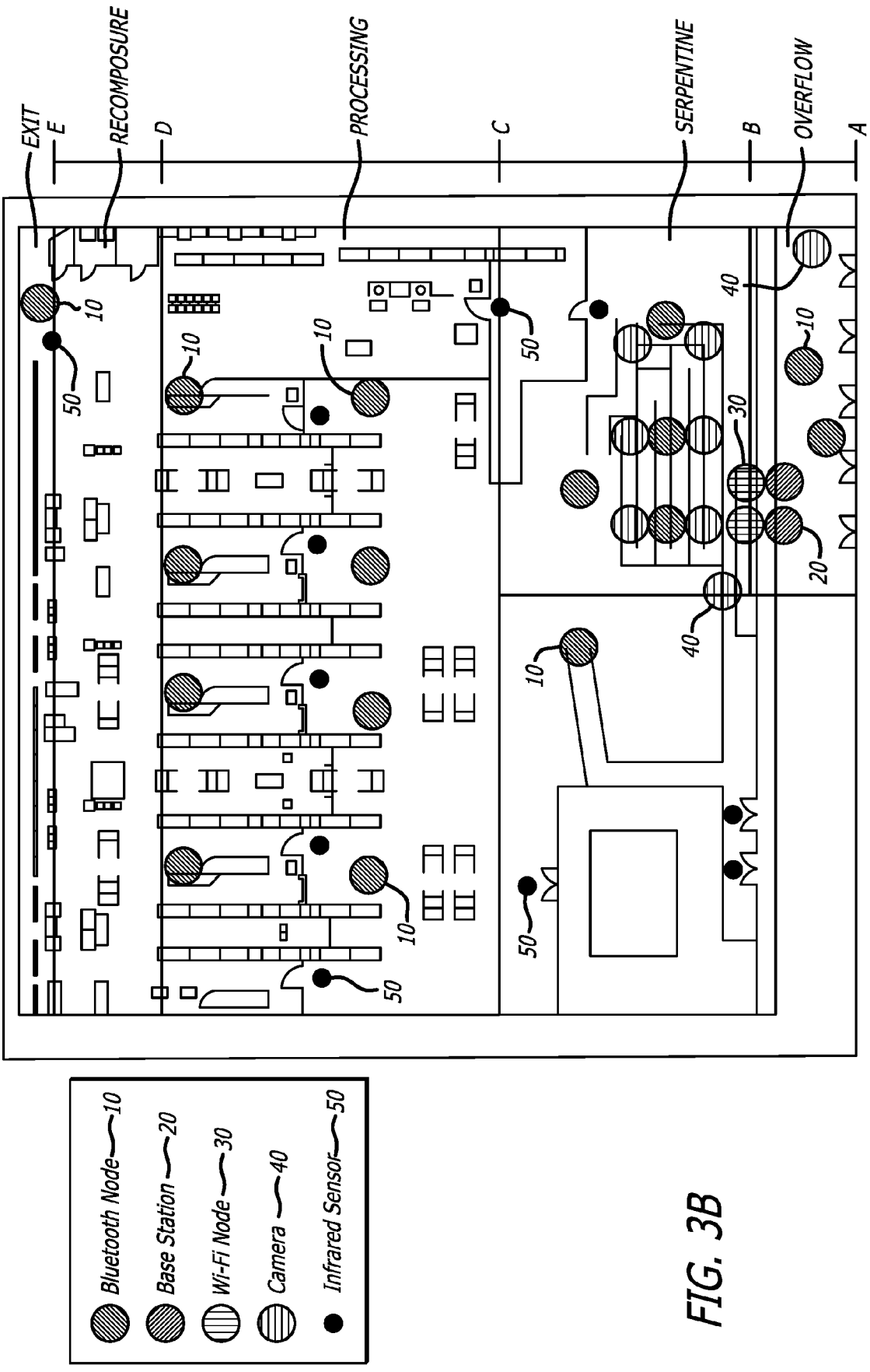
EXIT
E
RECOMPOSURE
D
PROCESSING
C
SERPENTINE
B
OVERFLOW
A
10
20
30
40
50
Bluetooth Node
Base Station
Wi-Fi Node
Camera
Infrared Sensor

FIG. 3B

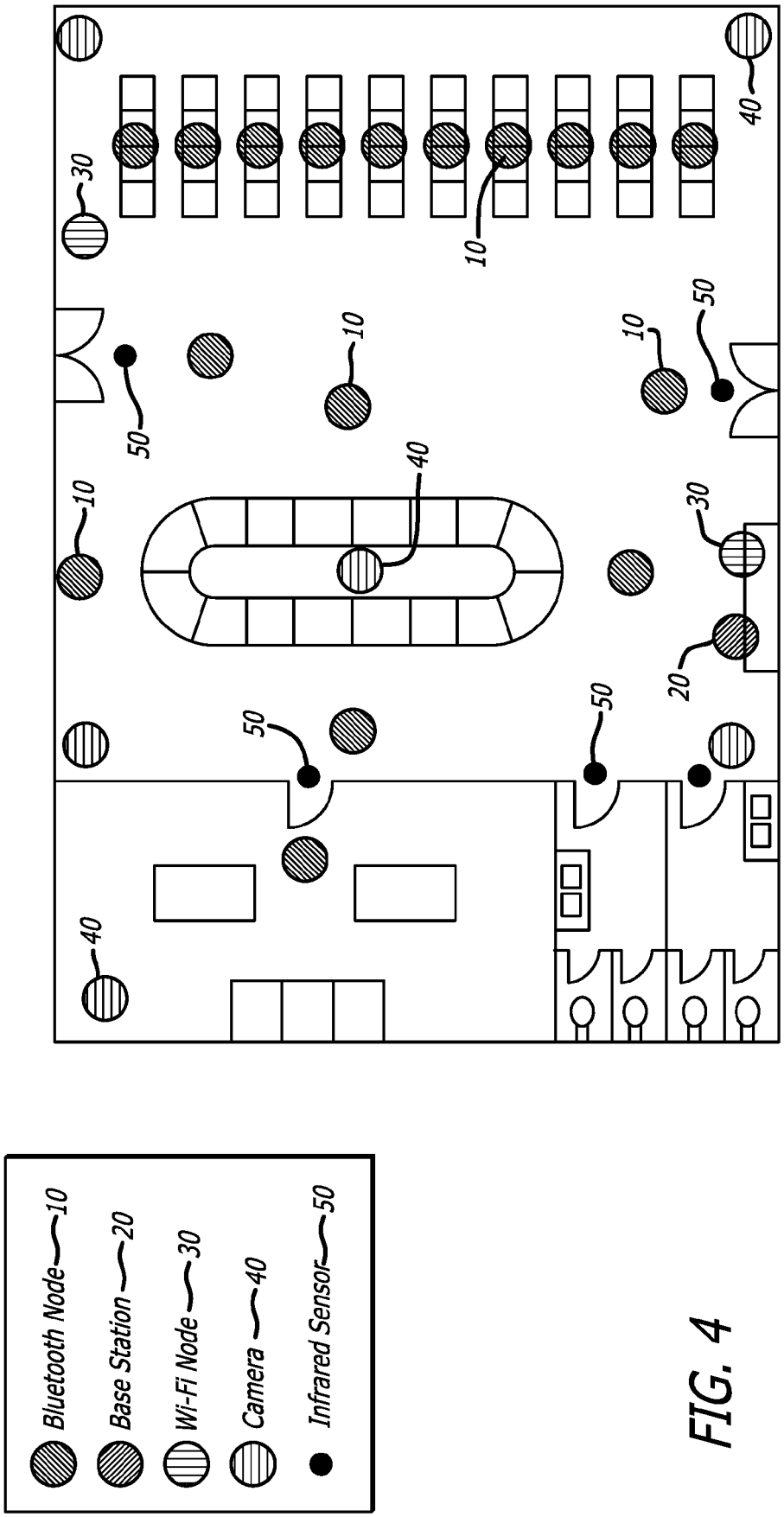
Bluetooth Node 10
Base Station 20
Wi-Fi Node 30
Camera 40
Infrared Sensor 50

FIG. 4

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 17 19 2150

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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X : particularly relevant if taken alone
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