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(54) **USER PROFILING USING LOCATION DATA FROM ANALYSED USER'S PATH**

GEBRAUCHERPROFILERSTELLUNG UNTER VERWENDUNG VON LOKALISIERUNGSDATEN EINES ERMITTELTEN BENUTZERPFADS

COMPOSITION D'UN PROFIL D'UTILISATEUR UTILISANT DES DONNÉES DE LOCALISATION BASÉ SUR LA PROGRESSION DE L'UTILISATEUR ANALYSÉE

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Description

FIELD OF THE INVENTION

[0001] This invention relates to a method and system for determining a user's path. Further, this invention also relates to a method and system for determining the location of a user. More specifically, this invention relates to a method and system for tracking a user within an indoor or outdoor area, such as a hospital, a college campus, a sports arena or an airport This invention also relates to a method and system for determining a user's path for operational and planning purposes, and in particular to a method and system for determining the residence time of a user in a zone.

[0002] The invention also has application in providing real time information to passengers, as well as to the scheduling of services so that airport authorities can react to any build up of passengers in critical areas such as security screening, immigration checks, baggage and so on.

BACKGROUND OF THE INVENTION

[0003] In the past, airports have had difficulty getting historical and real-time information regarding the behaviour of passengers within and around an airport.

[0004] One solution to this problem is to use Bluetooth (Bluetooth is a registered trade mark of Bluetooth SIG, Inc, Washington, United States of America) or Radio Frequency Identification (RFID) tags. However these solutions have the following limitations:

- RFID tags are not typically carried by passengers and therefore cannot be used without specifically issuing them to passengers.
- Bluetooth is a short range protocol limited to small areas of the airport.
- Bluetooth is not commonly active in passenger smart telephone devices, thereby limiting the accuracy of any measurements.
- Bluetooth relies on Bluetooth Access Points in fixed locations. It is relatively complex and time consuming to relocate them if necessary.

[0005] Another solution is to use a WiFi triangulation method to track passenger smart telephones. WiFi uses a wireless connection between a user device and an access point to transfer data between the user device and access point. WiFi is a registered trade mark of Wi-Fi Alliance, San Jose, United States of America. Usually, the access point has a wired connection to a local area network (LAN). However, a problem with this approach is that WiFi devices do not emit a continuous stream of data. This is because a device will only be detected when a user is actually using the airport WiFi infrastructure.

[0006] This means that for any given device, it may be detected only sporadically throughout the airport. For example, a device may be detected while a passenger is using their telephone in a cafe, or at a gate area, but not while walking from check in to security zones. This is of course problematic for live dwell time measurements because this sporadic data is not representative of what is actually happening in the airport. WO2009/091553 relates to a method for locating a shopper's presumed location in a store over time using a communication multinetwork. US2010/197318 describes a system for generating crowd tracking data by obtaining current locations for mobile devices of users and grouping users into crowds.

[0007] Embodiments of the invention seek to address the above problems by using WiFi signals emitted through passenger smart telephones, and other devices, to provide location data which can be used to locate, track and measure the activities of passengers throughout the airport campus. The location data is processed to remove poor quality data and the remaining data is used to determine a passenger's path and associated dwell time information. This data can then be used to provide real time measurements for any section of the airport.

[0008] Embodiments of the invention, which may be referred to as and Indoor Anonymous Dwell Time Tracking system, are a multi component service that:

1. Allows airport staff to define arbitrary zones in the airport.
2. Locates devices using triangulation of WiFi signal strength
3. Associates these devices to a zone in an airport
4. Charts the path of devices in these spaces.
5. Maintains a live set of continuous device detections for devices detected in the airport
6. Uses this zone and device path data to determine the dwell time in any zones across the airport.

[0009] Embodiments of the invention improve on existing RFID systems because the passengers/consumers being tracked do not need to be given a RFID token to carry, and do not necessarily need to be informed that their movements are being tracked, which can subconsciously change behaviour.

[0010] Embodiments of the invention improve on Bluetooth systems because WiFi covers the entire airport campus, not just small specific areas. Therefore it is possible to provide sophisticated measurements such as "show current wait time for passengers in immigration who started in international arrivals". It also improves on Bluetooth systems because the zones being measured are arbitrary and are not tied directly to the location of access points. In this regard, in a Bluetooth system, if an airport wants to modify the zone being measured, it is necessary to physically move the Bluetooth sensors. In the present invention, the airport staff just need to configure the new zone using a Google Map application.

[0011] Embodiments of the invention improve on basic

WiFi triangulation because it can maintain a live device path, storing all the previous zones a device passed through, and use this data to determine if the data is suitable or not for live dwell time measurements.

SUMMARY OF THE INVENTION

[0012] The invention is defined in the appended claims to which reference should now be made.

[0013] According to a first aspect of the present invention, there is provided a system for profiling a user comprising: 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 server further arranged to receive sequence data associated with the location data indicative of the order in which the location data was determined, the server further arranged to compare the received location data with zone data defining a plurality of zones and to associate the received location data with one of the plurality of zones; and path determining means for determining the user's path through a first sequence of zones. The server is further arranged to profile the user as one or more predetermined user types based on the determined path.

[0014] According to another aspect of the present invention, there is provided a method for profiling a user comprising: receiving 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; receiving sequence data associated with the location data indicative of the order in which the location data was determined; comparing the received location data with zone data defining a plurality of zones; associating the received location data with one of the plurality of zones; determining the user's path through a first sequence of zones; and profiling the user as one or more predetermined user types based on the determined path.

[0015] A system is also described for determining the path taken by a user through one or more zones. The system may comprise: a location server arranged to receive location data indicative of the location of a communication device associated with the user, the location data defining the position of the communication device at a plurality of different points in time, the location server further arranged to receive sequence data associated with the location data indicative of the order in which the location data was determined; and a path determining means for determining the path of the user through the zone, the user's path being defined by at least a portion of the received location data; and a comparator for comparing the determined path of the user with on or more predetermined user paths. The location server processes the received location data depending upon the result of the comparison. Preferably, the location server corrects the determined user path with the process location data.

[0016] A system is also described for processing user location data comprising: a location server arranged to receive location data of a communication device associated with the user, the location data defining the position of the communication device at a plurality of different points in time, the location server further arranged to receive sequence data associated with the location data indicative of the order in which the location data was determined; path determining means for determining the user's path defined by the received location data and the associated sequence data; and a comparator for comparing the determined path of the user with one or more predetermined user paths. Each predetermined path is preferably defined by further location data and associated sequence data indicative of the order of the further location data. The location server is configured to process the received location data depending upon the result of the comparison. Usually, the location data is determined based on signal strength data which is usually received by an access point from a mobile device.

[0017] A method is also described for processing user location data is provided. The method comprises receiving, with a receiver, 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, and receiving, with the receiver, sequence data associated with the location data indicative of the order in which the location data was determined; determining, using a processor, the user's path passing through points defined by the received location data and the associated sequence data; and comparing, using the processor, the determined path of the user with one or more predetermined user paths; and processing, using the processor, the received location data depending upon the result of the comparison. Preferably, the determined user path is corrected or updated with the processed location data.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] Embodiments of the invention will now be described, by way of example only, and with reference to the accompanying drawings, in which:

Figure 1 is a schematic representation of the main functional components embodying the invention;

Figure 2 is a screen shot of a zone editor embodying the invention which may be used to select, create, edit or delete different zones in the airport to track a user's device;

Figure 3 is a screen shot of an editor embodying the invention in which a high quality device path in the airport is visualised in a particular zone;

Figure 4 is a screen shot of an editor embodying the invention in which a lower quality device path in the airport is visualised in a particular zone;

Figure 5 is a histogram showing live dwell time data obtained by embodiments of the invention; and

Figure 6 is a flow diagram showing the main steps performed by an embodiment of the invention.

[0019] The following description is of a system for use in the aviation industry, but this is exemplary and other applications of the invention will also be discussed. For example, the system may be used in any indoor or outdoor area where a user carries a WiFi enabled device, such as a hospital, a college campus, a sports arena and so on.

[0020] Referring now to figure 1, this shows a schematic representation of a system 100 according to an embodiment of the invention. Operation of the various components will be explained in further detail below.

[0021] The system 100 may be directed towards the tracking of users in an airport 101 having a plurality of WiFi access points 101a - 101 d providing at least part of a WiFi infrastructure in the airport 101. Each access point 101a - 101 d may be positioned at a different location in the airport 101.

[0022] The WiFi infrastructure may use Real-time Locating System (RTLS) triangulation to locate a passenger's smart telephone or other mobile communication device as will be known to the skilled person.

[0023] In the embodiment shown in figure1, a location server 107 is communicatively coupled to the airport WiFi infrastructure 101 a - 101 d. The location server 107 may be coupled to the airport infrastructure via a wireless link or a wired link. The sever 107 may run in an airport data centre or as a cloud service over a number of servers, which are usually positioned in different locations.

[0024] The server 107 may communicate with the airport network by means of an Application Programming Interface, API, that is provided by a WiFi vendor or provider. The server 107 may use a particular provider's API to obtain the raw location data from the airport.

[0025] The location server 107 may comprise a historical data store 103 for storing the determined movement of devices in the airport. The historical data store may be provided as part of the location server as a hard disk or solid state memory or other local storage means. Alternatively the historical data store 103 may be a separate store located in a different position to the location server 107, such as a hard disk or solid state memory or other remote storage means. The historical data store may store both historical reference data and also data identifying devices belonging to airport staff or infrastructure. In either case, the historical data store 103 is communicatively coupled a zone data component 102 which may be part of the location server 107. This may be using a wired or wireless connection. A zone refers to a spatial area in the airport in which dwell time measurements are to be made. Examples of zones are: Security, Baggage, Immigration, Retail, or Check in.

[0026] The zone data component 102 may store a definition of the zones of interest in the airport, for example: airside, landside, security, baggage, retail and so on. The data component 102 may store the zone definitions on a hard disk or solid state memory or in other storage means. The airside part of the airport is usually the part of the airport that is accessible only after a passenger has gone through boarding card and x-ray security checks. The landside part of the airport is usually the part before a passenger has gone through boarding card and x-ray security checks. It is also useful to note that arriving passengers emerges from the baggage hall into the Landside area.

[0027] In the example shown in figure 2, and described in further detail below, there are three terminals, T1, T2, and T3. Each terminal comprises a plurality of zones. For example, terminal T1 may comprise the following zones: Airside - First Floor, Airside - Ground Floor, and Landside zones. Terminal T2 may comprise Duty Free, Food, Retail, Airside, Check in, Landside-First Floor, and Landside - Ground Floor zones. Further, Terminal T3 may comprise Baggage and Check in zones, although the above definitions of which zones are associated with which terminal are exemplary only.

[0028] The zones are defined as virtual spaces. A user may define each zone by dragging a polygon out on a map application, such as an internet browser map application running on an administration interface 106. One example of a suitable internet browser map application is a Google maps application. Defining a zone is similar to creating a polygon shape in Microsoft Powerpoint. Google is a registered trade mark of Google Inc., USA, and Microsoft and PowerPoint are registered trade mark of Microsoft Corporation, USA.

[0029] It is only necessary to define zones in a region of the airport where access points exist. However, one or more physical access points may be added to or removed from a particular zone without modifying the virtual zones. Furthermore, virtual zones may be redefined without having to modify any airport infrastructure. This addresses one of the problems with Bluetooth identified above in that embodiments of the invention may allow a change in the area being measured or monitored without physically moving access points.

[0030] In figure 1, the arrow labelled B pointing from the administration interface towards the zone data component schematically shows how the administration interface sends data defining a particular zone to the zone data component. The data defining each zone may be data defining a polygon and preferably associated data defining the position of each access point in the polygon.

[0031] The server may also comprise an in-memory cache 104. The cache 104 stores data indicative of the current active devices that are being tracked in the airport, including their current position and zone. The cache may also store an in-memory representation of a path a device has taken as it moves thorough the airport. A path may be defined by the curve line or shape which links or joins a sequence of data points indicative of the position of the device. The sequence of the positional data is usually ordered in a chronological order.

[0032] An example of this representation is shown in

figures 3 and 4 of the drawings, described in further detail below. Figure 3 is an example of a device path that is considered a high quality device path. There are plenty of device detections with good accuracy in the desired measurement zone. Figure 4 is an example of a device path that is considered low quality compared to the device path shown in figure 3. There are more infrequent detections than the higher quality device path shown in figure 4. The path shown in figure 4 is an example of the type of problematic data quality that the invention seeks to address.

[0033] The server 107 may also comprise an Application Programming Interface (API) 105. The API provides a way to access the data stored in the in-memory cache 104.

[0034] In the embodiment shown in figure 1, the API 105 is communicatively coupled to an administration interface 106 and the in-memory cache 104. The administration interface is described in further detail below. Further, the in-memory cache 104 is communicatively coupled to the zone data component 102 and to the API 105. Further, in the embodiment shown in figure 1, the zone data component 102 is communicatively coupled to both the historical data store 103 and the airport WiFi infrastructure 101.

[0035] The administration interface 106 uses the API 105 to access the memory cache data 104. The administration interface sends a request via the API 105 to access the memory cache data 104. The arrows E and F shown in figure 1 represent the memory cache data 104 being sent to the administration interface 106 in response to that request.

[0036] As previously described, the system 100 may comprise an administration interface 106 tool. This tool may be used to define the zones and to display the data returned from the API. The administration interface tool 106 is usually provided on a separate or different server to the location server 107 however, they can in principle be provided on a single server. In either case, the administration interface 106 is communicatively coupled to the zone data component 102 and the API 105 within the location server 107.

[0037] The various steps performed by an embodiment of the invention will now be described in further detail below, referring to the flow diagram shown in figure 6. In some embodiments, not all of the steps shown in figure 6 will be performed, and the steps do not necessarily have to be performed in the order shown in figure 6.

[0038] At step 201, an airport operator uses the Administration Interface 106 to define the zones in the airport. A zone may be defined as a polygon having a plurality of lines joined by a number of vertices. Usually, the polygon is a closed shape so that a user has to cross one of the lines or zone boundary when leaving a zone.

[0039] The zone data may be stored in the Zone Data component 102. In addition, the zone data may also be stored offline in the Historical Data Store 103, but it is sufficient for the zone to be stored in a single storage means. An example of a baggage zone is shown in figure 2 as a filled black polygon area.

[0040] At step 203, the Location Server 107 polls the Airport WiFi infrastructure via a third party server. Usually, the airport WiFi infrastructure is provided by a third party, and therefore the location server 107 polls a third party server which in turn requests data, such as location data associated with all devices which may have moved since the last poll request. Usually, the third party server polls the Airport WiFi infrastructure in a periodic or regular manner. The server may poll the WiFi infrastructure approximately every 15 seconds. However, although the polling may be periodic, the received location data of each device is usually irregular in nature. This is because the airport WiFi infrastructure does not have control as to whether it receives a signal from a device. For example, if a device is temporarily switched off, then no location data of that device will be received by the location server when the device is switched off.

[0041] The third party server performs triangulation of the devices as the devices use the WiFi network. The third party server does this by well known triangulation methods familiar to the skilled person. The third party server sends to the location server location data of each mobile device which has been detected by the third party server. This allows the location server 107 to receive data associated with all devices that have moved since the last poll request. The arrow labelled A, shown in figure 1 represents this data being sent from the third party location server to the location server 105.

[0042] The quality of the data received from the third party server may be determined based on an accuracy value provided by the third party provider. Data quality may be determined based on the signal strength or, the number of access points which can see each device, or both.

[0043] In addition, the location data may be time-stamped. This provides additional data indicative of when the location data of a particular device was determined. The system may determine the frequency of detections by comparing the time stamp of sequential location data messages received by the location sever 107.

[0044] The third party server then sends raw, or in other words, unprocessed location data to the location server 107. The unprocessed location data may include absolute positional data of each device i.e. longitude and latitude of each device in an airport or in other words, the x and y coordinates of the devices. Usually, the received location data of each device does not depend upon the location of the access point which each device is communicating with. Accordingly, the received location data of each device may be independent of the position of each access point.

[0045] At step 205, the location server 105 receives from the third party triangulation server data determining the location of all mobile devices which are active within the airport. This may be performed every 15 seconds, but can be performed more frequently or less frequently

than this. After the server has received the location data at step 205, the location server may determine the user's path defined by the received location data and the associated sequence data defining a plurality of points on the path, at step 207. At step 209, the location server compares the determined path of the user with one or more predetermined user paths. At step 211, the location server processes the received location data depending upon the result of the comparison. At step 213, the location server corrects or updates the determined user path based on the comparison.

[0046] In some embodiments, the raw data received by the location server 107 may be combined or associated with the Zone Data to give it context. This is done by determining whether or not each device is within the boundary defining a particular zone. If it is determined that a particular device is located in a particular zone, then the location data associated with that device is also associated with the zone in which the device is located.

[0047] For example, the location server 107 may compare the location data i.e. the coordinates of a device with the coordinates defining a zone. If a device is determined to be inside the boundary of a polygon defining the zone under consideration, then the location server 107 associates that zone with the data structure for each device.

[0048] The combined or associated data may be referred to as contextual data. The data is combined by the server 107 and then stored in an in-memory (and preferably database) data structure. There is a data structure for each device detected. This data structure contains the coordinates, for example the abscissa (e.g. x coordinate) and ordinate (e.g. y coordinate) of the device.

[0049] In other words, each device is associated with a zone at each detected location. Usually, a plurality of devices are associated with each zone. In the example shown in figure 3, there are 5522 device paths are found, ready for an operator to review.

[0050] For example, there may be many people waiting in security or baggage zones at peak time. If there are 100 people waiting, and the server receives data detecting around 10% of them, then there would be 10 devices active in security or baggage.

[0051] Although not essential to all embodiments, the contextual location data may be stored in the Historical Data Store 103.

[0052] The contextual location data may also be updated in the In Memory Cache 104, storing a real time representation of the movements of all devices in the airport, as shown in figure 3.

[0053] The contextual data may be stored in both store 103 and memory cache 104 so that a) any airport staff may be automatically identified during nightly processing because they are in the airport longer than is typical for passengers, and b) so that the airport can use the data for historical comparison..

[0054] Each time the data is polled, the live dwell time may be determined for each device within each zones. This is described in further detail with reference to a particular Live Dwell Time Algorithm below.

[0055] For each communication device, the dwell time may be determined by determining the time when a user was first detected within a zone, and the time when the user was last detected within a zone (before the user moved do a different zone). The dwell time may be computed as the difference in time between the last detection time within a zone and the first detection time within a zone. In the histogram shown in figure 5, the number of devices within security is determined as function of wait or dwell time: 5 devices have a dwell time of less than one minute; 6 devices have a dwell time of 1 minute; a further 6 devices have a dwell time of 2 minutes; a further 6 devices have a dwell time of 3 minutes; 2 devices have a dwell time of 4 minutes; 2 further devices have a dwell time of 5 minutes; while finally, 2 devices have been determined to have a dwell time of 6 minutes in security. Steps 203, 205, 207, 209, 211, and 213 may be repeated as updated location data is received by the location server 107.

[0056] The dwell time is the amount of time that passengers spend in a particular area (i.e. a Zone) of the airport. This term is interchangeable with Wait Time. Dwell Time is used in areas of an airport that a passenger wants to be in for example retail, food hall. Wait Time is used in areas of an airport that a passenger doesn't want to be in, for example check in, security, baggage collection.

The data may be made accessible to 3rd parties via the API. In other words, 3rd parties may access the data stored in the historical data store 103 (and the in memory cache 104). This live data is in stored in memory 104, while the historic data is stored in historical data store 103. The data (both real time or historical or both) may be viewed using the Administration Interface 106, as shown in figure 4, although this step is in fact optional.

[0057] The processing, using an algorithm, of the raw WiFi positional data of each mobile device within the airport will now be described in further detail. The algorithm uses the received positional data to determine live dwell time of each mobile device within the airport. This algorithm may be performed every time the location server 107 refreshes the location of devices in the Airport.

[0058] When measuring the live dwell time for a given zone such as security, it is necessary to factor in the following data quality problems:

1. Staff and static WiFi devices (e.g. staff personal computers (PCs)) in the security should be filtered out.
2. The sporadic and periodically inaccurate nature of WiFi data means that devices that are passing near to, but not through, the Security zone may be incorrectly reported as being in Security.
3. The number, accuracy and frequency of detections will vary for devices.

[0059] Embodiments of the invention address these data quality problems in a number of different ways.

Handling staff devices

[0060] The Location Server 107 maintains a dynamic list of staff and infrastructure at the airport (Historic Data 103 above). This list is automatically generated by monitoring for devices that are in the airport for a long time which may be typical of a staff member working there, or are frequently in the airport which may be typical of airport staff working 5 days a week.

[0061] Devices in the Security zone are then compared with this list and filtered out from the results.

Handling inaccurate or partial paths

[0062] Inaccurate WiFi data can be smoothed out or eliminated by using the typical path of a departing passenger through the airport. The following example refers to a departing passenger because it is described in conjunction with a security area, and only departing passengers pass through security. Nevertheless, the processing steps equally apply to other passenger types such as arriving passengers.

[0063] The device path can be used to profile the passenger as a Departing, Arriving or Transfer passenger. In addition the device path can be profiled as Airport Staff, or a welcoming agent also known as a Meeter/Greeter.

[0064] The typical path of a departing passenger is given by the following sequence of zones:

LANDSIDE CHECK IN SECURITY AIRSIDE RETAIL GATE AREA

[0065] That is, a passenger arrives at the airport in the LANDSIDE zone, then CHECKS IN, then passes through SECURITY to the AIRSIDE zone. The passenger will typically dwell in the RETAIL area until ready for boarding and then go to the GATE AREA.

[0066] For the purposes of measuring dwell time in security, any paths that contain LANDSIDE or CHECKIN in the past, and do not contain AIRSIDE/RETAIL/GATEAREA can be considered good representative paths.

[0067] Examples of inaccurate paths caused by the sporadic nature of the WiFi data are:

1. SECURITY [SLEEP] GATE AREA

[0068] This would be an example of a path where a device is first detected in the SECURITY area, then enters SLEEP mode where it is no longer detected by the WiFi infrastructure, and after a long period of time detected in GATEAREA. This is a bad path because a) It is not known how long the device was in SECURITY before it was first detected and b) because it entered a SLEEP mode and was undetected, it is not known how long it remained there before going AIRSIDE.

1. AIRSIDE GATEAREA BAGGAGE SECURITY LANDSIDE

[0069] This is an example of an arriving passenger who has arrived at AIRSIDE in the GATEAREA, and walked to BAGGAGE to collect their bags. Before going LANDSIDE, the passenger is briefly (and incorrectly) detected in the SECURITY zone because of poor WiFi quality. This device path will therefore have to be eliminated from the dwell time measurements.

[0070] Because the full device path is maintained in memory, it is possible to filter or remove these bad quality paths by specifying filter criteria in the algorithm. The filter criteria vary according to the zone being measured, and therefore must be configurable for the zone in question. The following is an example of the filter criteria for two zones:

1. Security Zone

    a. Device must be in Security Zone, or device must have just transitioned out of Security into AIRSIDE
    b. Device must never have been AIRSIDE
    c. Device must have previously been LANDSIDE
    d. Device path must match profile for Departing Passenger

2. Baggage Zone

    a. Device must be in Baggage Zone, or device must have just transitioned out of Baggage into LANDSIDE
    b. Device must never have been LANDSIDE
    c. Device must have previously been AIRSIDE
    d. Device path must match profile for Arriving Passenger

Handling number, accuracy & frequency of detections

[0071] The live dwell time algorithm may factor in the number, accuracy & frequency of detections to determine the quality of any given device path for use. These three factors are important because:

1. In general, the more detections that of a particular device path, the better quality of that device path. Closely related to this is the accuracy and frequency of these detections.
2. The accuracy can vary from detection to detection, caused by environmental factors at the airport. The higher the accuracy, the more reliable the data.
3. The frequency of detections varies along the device path (typically due to whether the passenger is

using the device or not). Infrequent detections is a problem because if a device has not been detected for, say 2 minutes, it is not possible to tell if the device is still in Security or has moved out of Security. Figure 2 and 3 show examples of device paths with high and low frequency.

[0072] The algorithm factors in these three parameters when assigning a quality value to the path. Of particular importance are the frequency and accuracy of detections as the device transitions from CHECKIN to SECURITY and from SECURITY to AIRSIDE. If a determination can be made with a high degree of accuracy when a device moves into/out of SECURITY, then embodiments of the invention can determine with a high degree of accuracy how long the device spent in SECURITY.

[0073] The device path has to meet a quality threshold to be usable for zone dwell time measurement.

[0074] Accordingly, embodiments of the invention combine an arbitrary zone definition, device path profiling, device path filtering by history and device detection quality profiling such that that the variable and sporadic nature of WiFi signals can be processed. This allows live (as well as historic) dwell times of a user in any part of an airport to be determined.

Claims

1. A system for profiling a user comprising:

   a. a server (107) 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 server (107) further arranged to receive sequence data associated with the location data indicative of the order in which the location data was determined, the server (107) further arranged to compare the received location data with zone data defining a plurality of zones and to associate the received location data with one of the plurality of zones; and
   b. path determining means for determining the user's path through a first sequence of zones;

   wherein the server (107) is further arranged to profile the user as one or more predetermined user types based on the determined path.

2. A system according to claim 1 wherein the path determining means is configured to determine the path based on the zone data associated with the location data and the sequence data.

3. A system according to claim 1 further comprising a comparator for comparing the determined path of the user with one or more predetermined paths, each predetermined path defining a second sequence of zones, and for profiling the user based on the comparison.

4. A system according to any one of claims 1 to 3 wherein the zones are associated with an indoor or outdoor location, in particular one or more of a hospital, a campus, an arena and an airport, and preferably wherein each zone is associated with one or more of a landside, airside, check-in, security, retail, baggage, immigration, duty free, food, retail and gate area zones.

5. A system according to any preceding claim further comprising an administration interface (106) for defining each of the zones.

6. A system according to any preceding claim, wherein the server (107) is arranged to associate the user with one or more predetermined user types comprising a departing passenger, an arriving passenger, a transfer passenger, airport staff or a welcoming agent type based on the determined first sequence of zones.

7. A system according to any preceding claim wherein the zone data is associated with a plurality of different terminals of an airport and preferably wherein the zone data associated with each terminal comprises a plurality of different zones on different levels.

8. A system according to any preceding claim wherein each zone is defined based on a polygonal shape and preferably wherein the data defining each zone comprises associated data defining the position of an access point within the polygon.

9. A system according to any preceding claim further comprising storing data defining the plurality of zones in a zone data component (102).

10. A system according to any preceding claim in which the server (107) is configured to poll a further server to request location data associated with devices which have moved since a previous poll request, wherein the poll requests are preferably periodic and associated with location data received at irregular times.

11. A system according to any preceding claim in which the location data further comprises time stamp data and preferably wherein the user is associated with one or more predetermined user types based on the time stamp data.

12. A system according to claim 11 wherein the system is arranged to determine a period of time a user is

within one or more zones and preferably wherein the system is to associate the user with one or more predetermined user types if the period of time is greater than a predetermined value and preferably wherein the one or more predetermined user types comprise an airport staff user type.

13. A system according to claim 11 or 12 wherein the server (107) is further arranged to determine a dwell time associated with the one or more zones based on a difference in time stamp data between a first detection of a user within a zone and a last detection of a user within the zone.

14. A system according to claim 13 wherein the server (107) is arranged to associate the user with one or more predetermined user types based on the dwell time.

15. A method for profiling a user comprising:

a. receiving 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;
b. receiving sequence data associated with the location data indicative of the order in which the location data was determined; said method being **characterised by**:
c. comparing the received location data with zone data defining a plurality of zones;
d. associating the received location data with one of the plurality of zones;
e. determining the user's path through a first sequence of zones; and
f. profiling the user as one or more predetermined user types based on the determined path.

Patentansprüche

1. System zum Profilieren eines Benutzers, das Folgendes umfasst:

a. einen Server (107) zum Empfangen von Ortsdaten eines mit dem Benutzer assoziierten Kommunikationsgeräts, wobei die Ortsdaten die erkannte Position des Kommunikationsgeräts zu einer Reihe von unterschiedlichen Zeitpunkte definieren, wobei der Server (107) ferner zum Empfangen von mit den Ortsdaten assoziierten Sequenzdaten ausgelegt ist, die die Reihenfolge anzeigen, in der die Ortsdaten ermittelt wurden, wobei der Server (107) ferner zum Vergleichen der empfangenen Ortsdaten mit Zonendaten, die mehrere Zonen definieren, und zum Assoziieren der empfangenen Ortsdaten mit einer der mehreren Zonen ausgelegt ist; und
b. Wegermittlungsmittel zum Ermitteln des Wegs des Benutzers durch eine erste Sequenz von Zonen;

wobei der Server (107) ferner zum Profilieren des Benutzers als ein oder mehrere vorbestimmte Benutzertypen auf der Basis des ermittelten Wegs konfiguriert ist.

2. System nach Anspruch 1, wobei das Wegermittlungsmittel zum Ermitteln des Wegs auf der Basis der mit den Ortsdaten und den Sequenzdaten assoziierten Zonendaten konfiguriert ist.

3. System nach Anspruch 1, das ferner einen Komparator zum Vergleichen des ermittelten Wegs des Benutzers mit einem oder mehreren vorbestimmten Wegen, wobei jeder vorbestimmte Weg eine zweite Sequenz von Zonen definiert, und zum Profilieren des Benutzers auf der Basis des Vergleichs umfasst.

4. System nach einem der Ansprüche 1 bis 3, wobei die Zonen mit einem Ort im Innen- oder Außenbereich, insbesondere einem oder mehreren aus einem Krankenhaus, einem Hochschulgelände, einer Sportarena und einem Flughafen assoziiert sind, und wobei vorzugsweise jede Zone mit einer oder mehreren aus einer Landseiten-, Luftseiten-, Eincheck-, Sicherheitskontroll-, Einzelhandels-, Gepäck-, Einwanderungsprüfungs-, Duty-Free-, Essens-, Einzelhandels- und Gate-Bereichszone assoziiert ist.

5. System nach einem vorherigen Anspruch, das ferner eine Verwaltungsoberfläche (106) zum Definieren jeder der Zonen umfasst.

6. System nach einem vorherigen Anspruch, wobei der Server (107) zum Assoziieren des Benutzers mit einem oder mehreren vorbestimmten Benutzertypen, die einen abfliegenden Passagier, einen ankommenden Passagier, einen Transferpassagier, Flughafenpersonal oder Begrüßungspersonal umfassen, auf der Basis der ermittelten ersten Sequenz von Zonen ausgelegt ist.

7. System nach einem vorherigen Anspruch, wobei die Zonendaten mit mehreren unterschiedlichen Terminals eines Flughafens assoziiert sind und wobei vorzugsweise die mit jedem Terminal assoziierten Zonendaten mehrere unterschiedliche Zonen auf unterschiedlichen Ebenen umfassen.

8. System nach einem vorherigen Anspruch, wobei jede Zone auf der Basis einer polygonalen Form definiert wird und wobei vorzugsweise die jede Zone definierenden Daten assoziierte Daten umfassen, die

die Position eines Zugangspunkts innerhalb des Polygons definieren.

9. System nach einem vorherigen Anspruch, das ferner Daten speichert, die die mehreren Zonen in einer Zonendatenkomponente (102) definieren.

10. System nach einem vorherigen Anspruch, wobei der Server (107) zum Abfragen eines weiteren Servers zum Anfordern von Ortsdaten konfiguriert ist, die mit Geräten assoziiert sind, die sich seit einer vorherigen Abfrageanforderung bewegt haben, wobei die Abfrageanforderungen vorzugsweise periodisch und mit zu regelmäßigen Zeiten empfangenen Ortsdaten assoziiert sind.

11. System nach einem vorherigen Anspruch, wobei die Ortsdaten ferner Zeitstempeldaten beinhalten und wobei der Benutzer vorzugsweise mit einem oder mehreren vorbestimmten Benutzertypen auf der Basis der Zeitstempeldaten assoziiert ist.

12. System nach Anspruch 11, wobei das System zum Ermitteln einer Zeitperiode ausgelegt ist, für die sich ein Benutzer in einer oder mehreren Zonen befindet, wobei das System vorzugsweise zum Assoziieren des Benutzers mit einem oder mehreren vorbestimmten Benutzertypen dient, wenn die Zeitperiode größer ist als ein vorbestimmter Wert, und wobei vorzugsweise die ein oder mehreren vorbestimmten Benutzertypen einen Flughafenpersonal-Benutzertyp umfassen.

13. System nach Anspruch 11 oder 12, wobei der Server (107) ferner zum Bestimmen einer mit den ein oder mehreren Zonen assoziierten Verweilzeit auf der Basis einer Differenz in Zeitstempeldaten zwischen einer ersten Erkennung eines Benutzers in einer Zone und einer letzten Erkennung eines Benutzers in der Zone ausgelegt ist.

14. System nach Anspruch 13, wobei der Server (107) zum Assoziieren des Benutzers mit einem oder mehreren vorbestimmten Benutzertypen auf der Basis der Verweilzeit ausgelegt ist.

15. Verfahren zum Profilieren eines Benutzers, das Folgendes beinhaltet:

a. Empfangen von Ortsdaten eines mit dem Benutzer assoziierten Kommunikationsgeräts, wobei die Ortsdaten die erkannte Position des Kommunikationsgeräts zu einer Reihe von unterschiedlichen Zeitpunkten definieren;
b. Empfangen von mit den Ortsdaten assoziierten Sequenzdaten, die die Reihenfolge anzeigen, in der die Ortsdaten ermittelt wurden; wobei das genannte Verfahren ferner **gekennzeichnet ist durch**:
c. Vergleichen der empfangenen Ortsdaten mit Zonendaten, die mehrere Zonen definieren;
d. Assoziieren der empfangenen Ortsdaten mit einer der mehreren Zonen;
e. Ermitteln des Wegs des Benutzers **durch** eine erste Sequenz von Zonen; und
f. Profilieren des Benutzers als einen oder mehrere vorbestimmte Benutzertypen auf der Basis des vorbestimmten Wegs.

Revendications

1. Système de configuration d'un profil d'un utilisateur comprenant :

a. un serveur (107) agencé pour recevoir des données d'emplacement d'un dispositif de communication associé à l'utilisateur, les données d'emplacement définissant la position détectée du dispositif de communication à un nombre de points différents dans le temps, le serveur (107) étant agencé en outre pour recevoir des données de séquence associées aux données d'emplacement indicatives de l'ordre dans lequel les données d'emplacement ont été déterminées, le serveur (107) étant agencé en outre pour comparer les données d'emplacement reçues à des données de zones définissant une pluralité de zones et associer les données d'emplacement reçues à l'une de la pluralité de zones ; et
b. un moyen de détermination de chemin pour déterminer le chemin de l'utilisateur par une première séquence de zones ;

dans lequel le serveur (107) est agencé en outre pour composer un profil de l'utilisateur en tant qu'un ou plusieurs types d'utilisateur prédéterminés d'après le chemin déterminé.

2. Système selon la revendication 1, dans lequel le moyen de détermination de chemin est configuré pour déterminer le chemin en fonction des données de zones associées aux données d'emplacement et aux données de séquence.

3. Système selon la revendication 1, comprenant en outre un comparateur pour comparer le chemin déterminé de l'utilisateur à un ou plusieurs chemins prédéterminés, chaque chemin prédéterminé définissant une seconde séquence de zones, et pour composer le profil de l'utilisateur en fonction de la comparaison.

4. Système selon l'une quelconque des revendications 1 à 3, dans lequel les zones sont associées à un

emplacement intérieur ou extérieur, en particulier un ou plusieurs d'un hôpital, d'un campus, d'une arène et d'un aéroport, et de préférence dans lequel chaque zone est associée à une ou plusieurs de zones côté ville, côté piste, d'enregistrement, de sécurité, de magasins, de bagages, d'immigration, de vente hors taxes, de restauration, de magasins et de portes d'embarquement.

5. Système selon l'une quelconque des revendications précédentes comprenant en outre une interface d'administration (106) pour définir chacune des zones.

6. Système selon l'une quelconque des revendications précédentes, dans lequel le serveur (107) est agencé pour associer l'utilisateur à un ou plusieurs types d'utilisateurs prédéterminés dont un type de passager en partance, un type de passager arrivant, un type de passager en transit, un type d'employé d'aéroport ou un type de personnel d'accueil d'après la première séquence de zones déterminée.

7. Système selon l'une quelconque des revendications précédentes, dans lequel les données de zones sont associées à une pluralité de terminaux différents d'un aéroport et de préférence dans lequel les données de zones associées à chaque terminal comprennent une pluralité de zones différentes à différents niveaux.

8. Système selon l'une quelconque des revendications précédentes dans lequel chaque zone est définie selon une forme polygonale et de préférence dans lequel les données définissant chaque zone comprennent des données associées définissant la position d'un point d'accès dans le polygone.

9. Système selon l'une quelconque des revendications précédentes, comprenant en outre la mémorisation de données définissant la pluralité de zones dans un composant de données de zones (102).

10. Système selon l'une quelconque des revendications précédentes, dans lequel le serveur (107) est configuré pour interroger un autre serveur pour demander des données d'emplacement associées à des dispositifs ont bougé depuis une requête d'interrogation antérieure, dans lequel les requêtes d'interrogation sont de préférence périodiques et associés à des données d'emplacement reçues irrégulièrement.

11. Système selon l'une quelconque des revendications précédentes, dans lequel les données d'emplacement comprennent en outre des données d'estampille temporelle et de préférence dans lequel l'utilisateur est associé à un ou plusieurs types d'utilisateur prédéterminés en fonction des données d'estampille temporelle.

12. Système selon la revendication 11, le système étant agencé pour déterminer une période de temps durant laquelle un utilisateur se trouve dans une ou plusieurs zones et de préférence le système servant à associer les utilisateurs à un ou plusieurs types d'utilisateur prédéterminés si la période de temps est supérieure à une valeur prédéterminée et de préférence dans lequel les un ou plusieurs types d'utilisateur prédéterminés comprennent un type d'utilisateur d'employé d'aéroport.

13. Système selon la revendication 11 ou 12, dans lequel le serveur (107) est agencé en outre pour déterminer un temps de séjour associé aux une ou plusieurs zones en fonction d'une différence des données d'estampille temporelle entre une première détection d'un utilisateur dans une zone et une dernière détection d'un utilisateur dans la zone.

14. Système selon la revendication 13, dans lequel le serveur (107) est agencé pour associer l'utilisateur à un ou plusieurs types d'utilisateur prédéterminés en fonction du temps de séjour.

15. Procédé de configuration d'un profil d'un utilisateur comprenant :

a. la réception de données d'emplacement d'un dispositif de communication associé à l'utilisateur, les données d'emplacement définissant la position détectée du dispositif de communication à un nombre de points différents dans le temps ;
b. la réception de données de séquence associées aux données d'emplacement indicatives de l'ordre dans lequel les données d'emplacement ont été déterminées ; ledit procédé étant **caractérisé par** :
c. la comparaison des données d'emplacement reçues à des données de zones définissant une pluralité de zones ;
d. l'association des données d'emplacement reçues à l'une de la pluralité de zones ;
e. la détermination du chemin de l'utilisateur par une première séquence de zones ; et
f. la composition du profil de l'utilisateur en tant qu'un ou plusieurs types d'utilisateur prédéterminés d'après le chemin déterminé.

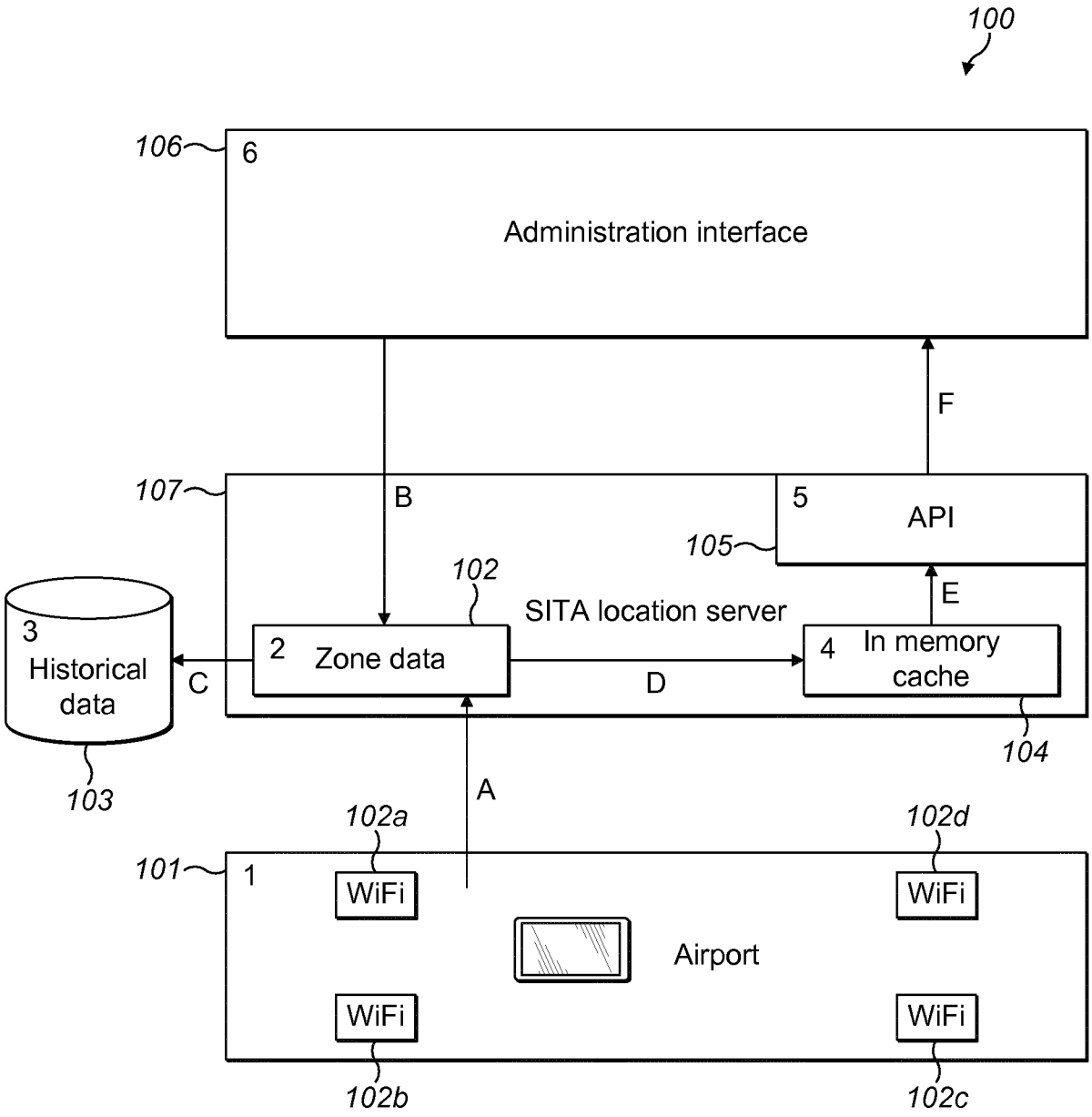
100
106
6
Administration interface
F
107
B
5
API
105
102
SITA location server
E
3
Historical data
2
Zone data
4
In memory cache
C
D
104
103
A
102a
102d
101
1
WiFi
WiFi
Airport
WiFi
WiFi
102b
102c

FIG. 1

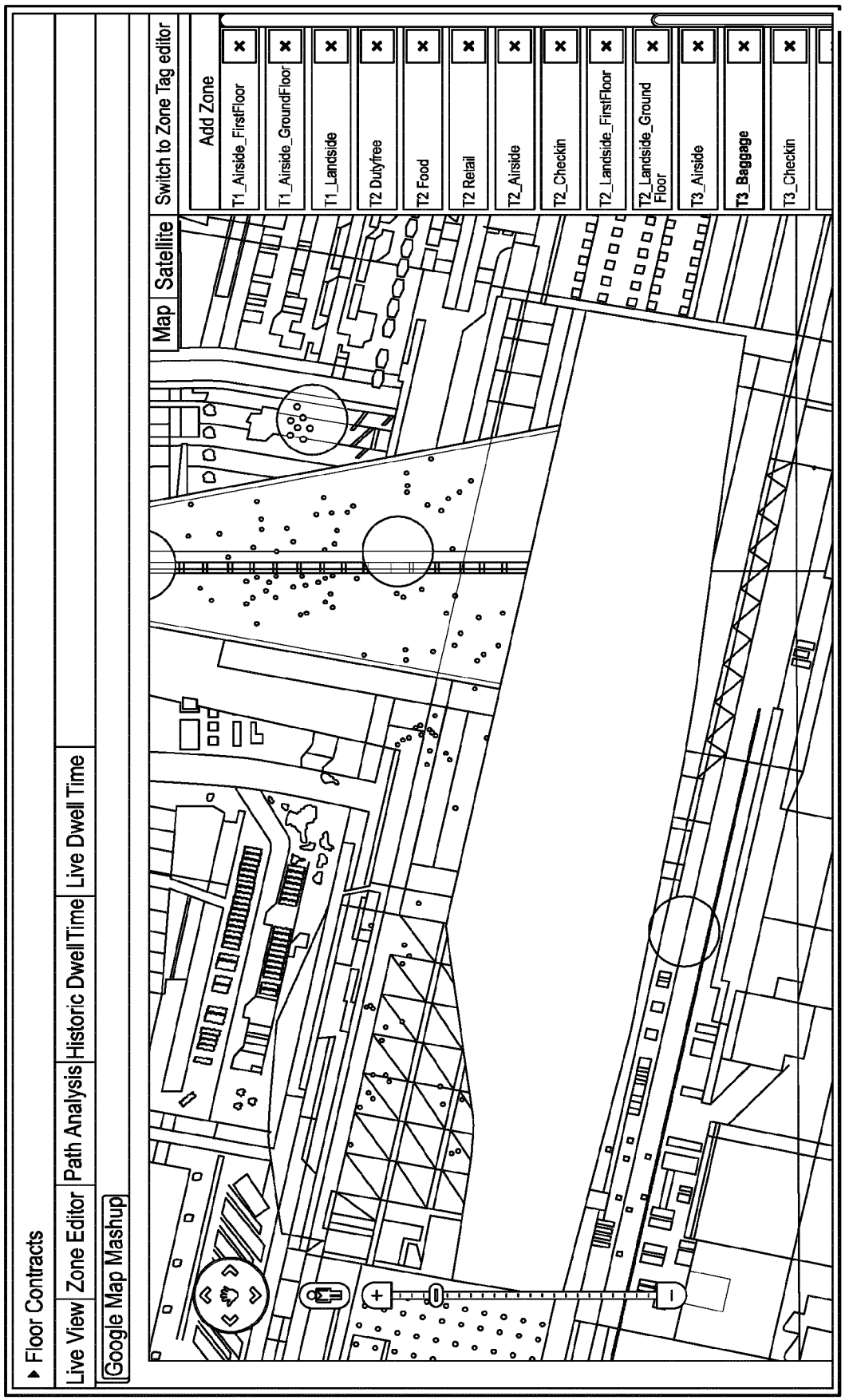
Floor Contracts
Live View
Zone Editor
Path Analysis
Historic Dwell Time
Live Dwell Time
Google Map Mashup
Switch to Zone Tag editor
Add Zone
Map
Satellite
T1_Airside_FirstFloor
T1_Airside_GroundFloor
T1_Landside
T2 Dutyfree
T2 Food
T2 Retail
T2_Airside
T2_Checkin
T2_Landside_FirstFloor
T2_Landside_Ground Floor
T3_Airside
T3_Baggage
T3_Checkin

FIG. 2

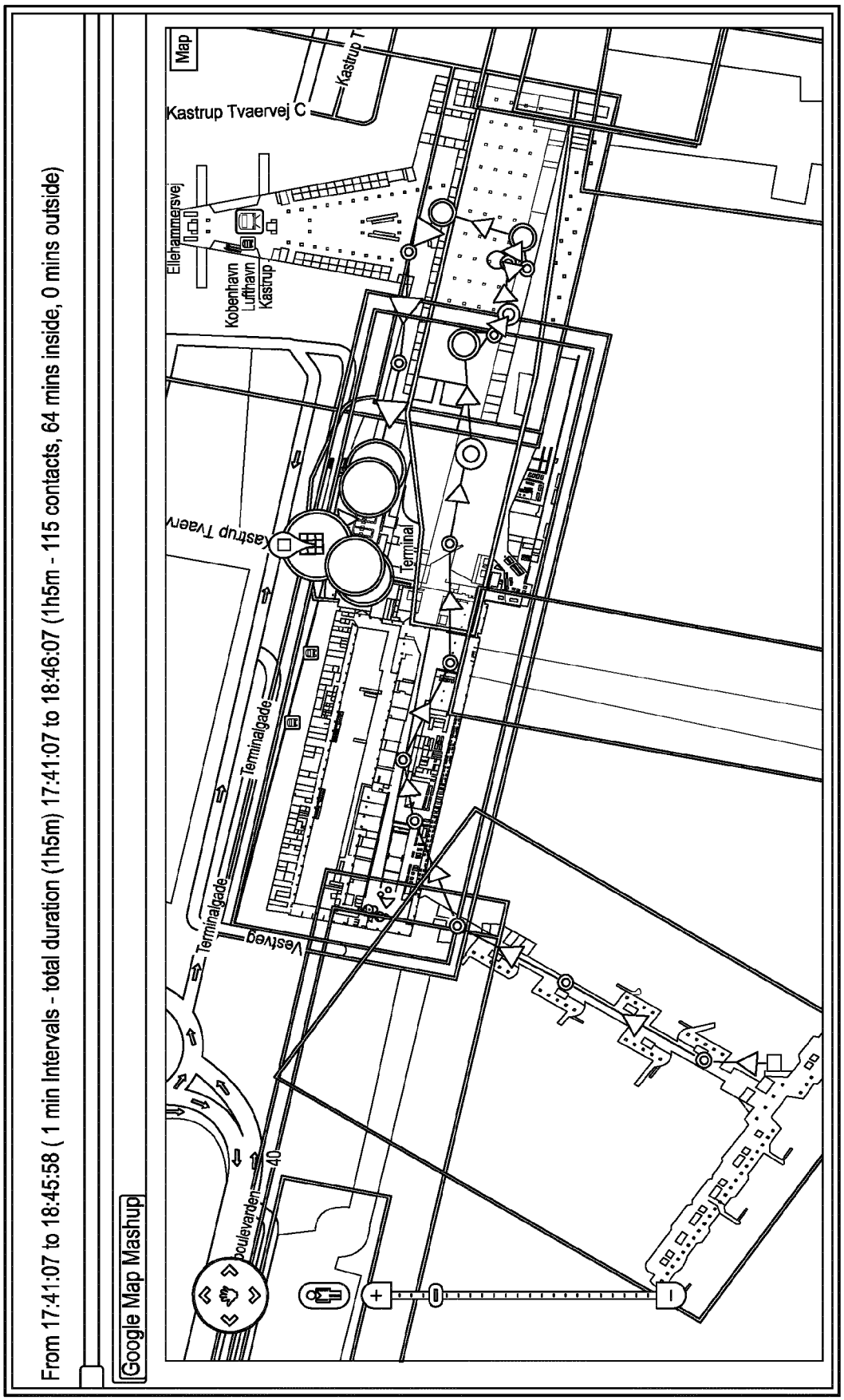
From 17:41:07 to 18:45:58 (1 min Intervals - total duration (1h5m) 17:41:07 to 18:46:07 (1h5m - 115 contacts, 64 mins inside, 0 mins outside)
Google Map Mashup
Map
Kastrup Tvaervej C
Kastrup T
Ellehammersvej
Kobenhavn Lufthavn Kastrup
Kastrup Tvaerv
Terminal
Terminalgade
Terminalgade
Vestvej
Boulevarden
40

FIG. 3

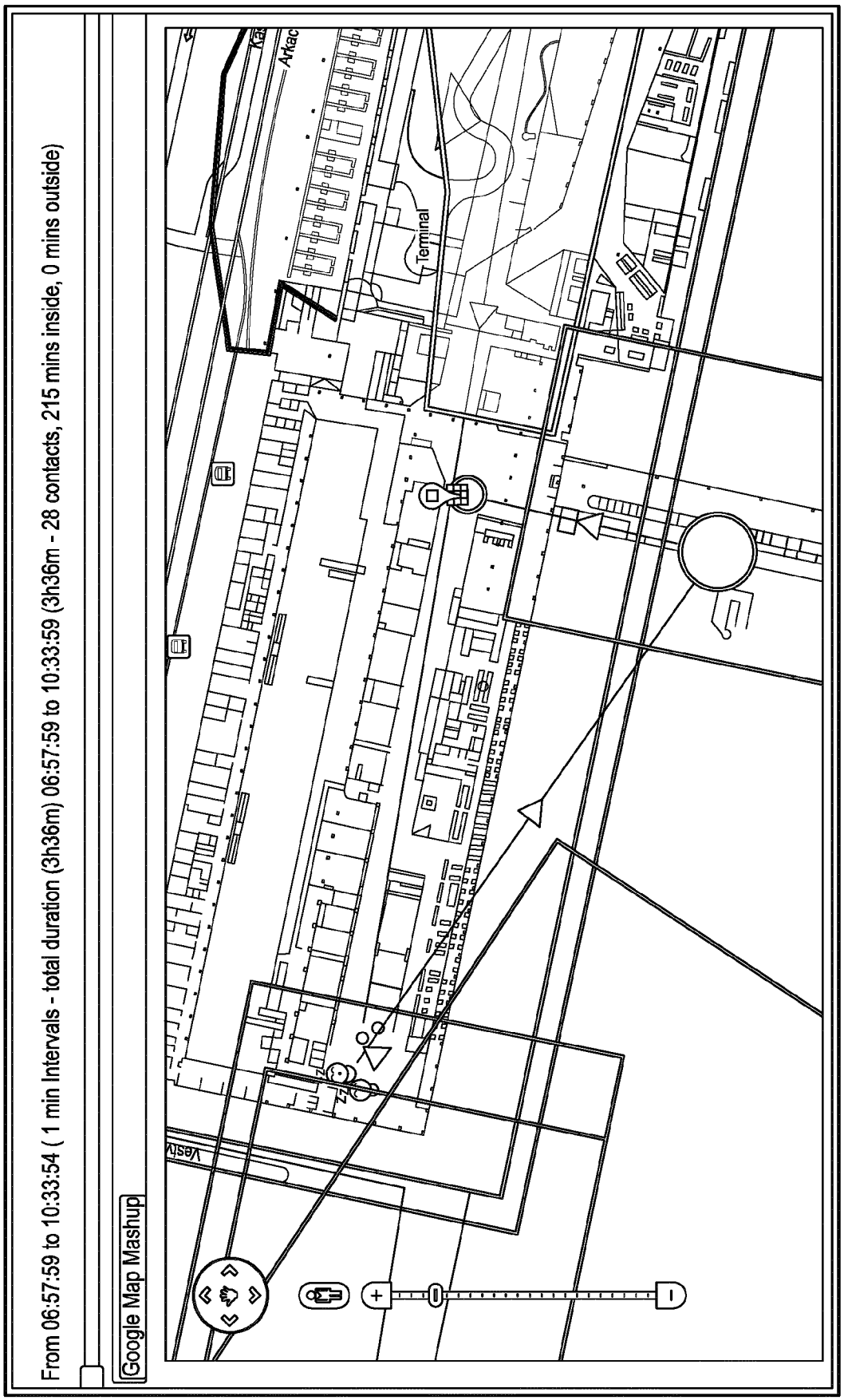
From 06:57:59 to 10:33:54 (1 min Intervals - total duration (3h36m) 06:57:59 to 10:33:59 (3h36m - 28 contacts, 215 mins inside, 0 mins outside)
Google Map Mashup
Terminal

FIG. 4

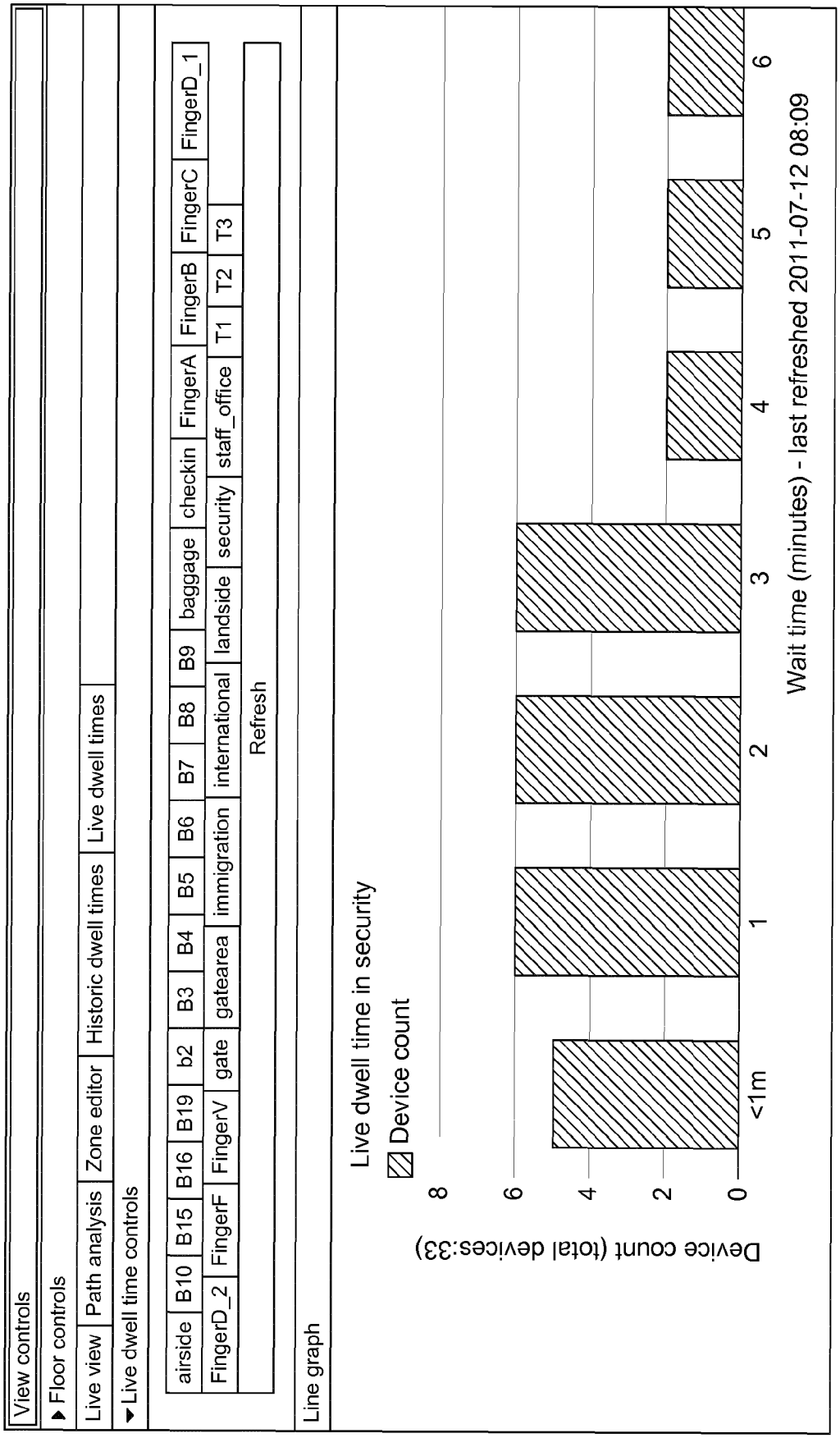
View controls
Floor controls
Live view
Path analysis
Zone editor
Historic dwell times
Live dwell times
Live dwell time controls
airside
B10
B15
B16
B19
b2
B3
B4
B5
B6
B7
B8
B9
baggage
checkin
FingerA
FingerB
FingerC
FingerD_1
FingerD_2
FingerF
FingerV
gate
geatearea
immigration
international
landside
security
staff_office
T1
T2
T3
Refresh
Line graph
Live dwell time in security
Device count
Device count (total devices:33)
0
2
4
6
8
<1m
1
2
3
4
5
6
Wait time (minutes) - last refreshed 2011-07-12 08:09

FIG. 5

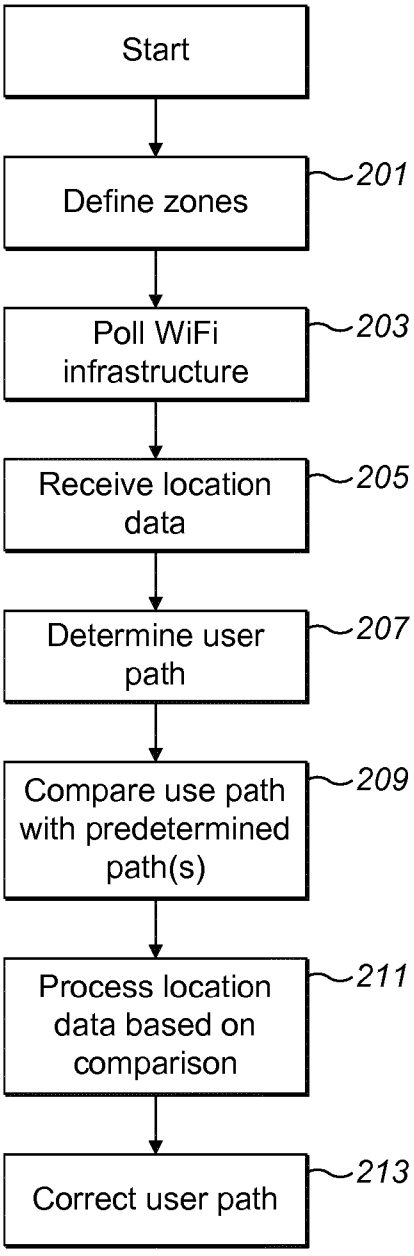
Start
Define zones
201
Poll WiFi infrastructure
203
Receive location data
205
Determine user path
207
Compare use path with predetermined path(s)
209
Process location data based on comparison
211
Correct user path
213

FIG. 6

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2009091553 A **[0006]**
- US 2010197318 A **[0006]**

716210/KOT

FELHASZNÁLÓI PROFILOZÁS ELEMZETT FELHASZNÁLÓI ÚTVONALBÓL VALÓ HELYADATOK SEGÍTSÉGÉVEL

Szabadalmi igénypontok

1. Rendszer felhasználó profilozására, amely a következőket tartalmazza:

   a. kiszolgáló (107), amely arra van kialakítva, hogy vegye a felhasználóval társított kommunikációs eszköz helyadatait, a helyadatok meghatározzák a kommunikációs eszköz érzékelt helyét számos különböző időpontban, a kiszolgáló (107) továbbá arra van kialakítva, hogy vegye a helyadatokkal társított sorrendadatokat, jelezve azt a sorrendet, amelyben a helyadatokat meghatározták, ahol a kiszolgáló (107) továbbá arra van kialakítva, hogy összehasonlítsa a vett helyadatokat a zónaadatokkal, amelyek meghatározzák zónák sokaságát, és hogy társítsák a vett helyadatokat a zónák sokaságából való egyik zónával; és
   b. útvonal, amely meghatározza az eszközt a felhasználói útvonalnak a zónák első sorozatán keresztül való meghatározására;

   ahol a kiszolgáló (107) továbbá arra van kialakítva, hogy profilozza a felhasználót egy vagy több előre meghatározott felhasználói típusként az előre meghatározott útvonal alapján.

2. Az 1. igénypont szerinti rendszer, ahol az eszközt meghatározó útvonal arra van kialakítva, hogy meghatározás az útvonalat a helyadatokkal társított zónaadatok és a sorrendadatok alapján.

3. Az 1. igénypont szerinti rendszer, amely továbbá tartalmaz egy összehasonlítót a felhasználó meghatározott útvonalának egy vagy több előre meghatározott útvonallal való összehasonlítására, minden egyes előre meghatározott útvonal meghatározza a zónák második sorozatát, valamint a felhasználónak az összehasonlítás alapján való profilozására.

4. Az 1 – 3. igénypontok egyike szerinti rendszer, ahol a zónák társítva vannak egy beltéri és egy kültéri hellyel, különösen egy vagy több kórházzal, egyetemmel, arénával és repülőtérrel, és előnyösen ahol minden egyes zóna társítva van egy vagy több leszállóhellyel, repülőgép-forgalmi, bejelentkezési, biztonsági, kiskereskedelmi, csomag, bevándorlási, vámmentes, étel, étel-kiskereskedelmi és kaputerületi zónákkal.

5. Az előző igénypontok egyike szerinti rendszer, amely továbbá tartalmaz egy adminisztrációs felületet (106) az egyes zónák meghatározására.

6. Az előző igénypontok egyike szerinti rendszer, ahol a kiszolgáló (107) arra van kialakítva, hogy társítsa a felhasználót egy vagy több előre meghatározott felhasználói típussal, amely tartalmaz induló utas, érkező utas, tranzit utas, reptéri személyzet vagy köszöntő ügynök típust a zónák meghatározott első sorozata alapján.

7. Az előző igénypontok egyike szerinti rendszer, ahol a zónaadatok társítva vannak egy repülőtér különböző termináljainak sokaságával és előnyösen az egyes terminálokkal társított zónaadatok különböző zónák sokaságát tartalmazzák különböző szinteken.

8. Az előző igénypontok egyike szerinti rendszer, ahol minden egyes zóna egy sokszögletű alak alapján van meghatározva és előnyösen ahol az egyes zónákat meghatározó adatok társított adatokat tartalmaznak, amelyek meghatározzák a hozzáférési pont helyét a sokszögön belül.

9. Az előző igénypontok egyike szerinti rendszer, amely továbbá tartalmazza azon adatok tárolását, amelyek meghatározzák a zónák sokaságát egy zónaadat összetevőben (102).

10. Az előző igénypontok egyike szerinti rendszer, amelyben a kiszolgáló (107) arra van kialakítva, hogy megszavaztasson egy további kiszolgálót, hogy olyan helyadatokat kérjen, amelyek társítva vannak azokkal az eszközökkel, amelyek elmozdultak egy korábbi szavazási kérés óta, ahol a szavazási kérések előnyösen ismétlődőek és társítva vannak rendszertelen időkben vett helyadatokkal.

11. Az előző igénypontok egyike szerinti rendszer, amelyben a helyadatok továbbá időpecsét adatokat tartalmaznak, és előnyösen ahol a felhasználó társítva van egy vagy több előre meghatározott felhasználói típussal az időpecsét adatok alapján.

12. A 11. igénypont szerinti rendszer, ahol a rendszer arra van kialakítva, hogy meghatározzon egy időszakot, amikor egy felhasználó egy vagy több zónán belül van, és előnyösen ahol a rendszer társítja a felhasználót egy vagy több előre meghatározott felhasználói típussal, ha az időszak hosszabb, mint egy előre meghatározott érték, és előnyösen ahol az egy vagy több előre meghatározott felhasználói típus tartalmaz egy reptéri személyzet felhasználói típust.

13. A 11. vagy 12. igénypont szerinti rendszer, ahol a kiszolgáló (107) továbbá arra van kialakítva, hogy meghatározzon egy tartózkodási időt, amely társítva van egy vagy több zónával egy felhasználónak egy zónán belüli első érzékelése és utolsó érzékelése közötti időpecsétjének különbsége alapján.

14. A 13. igénypont szerinti rendszer, ahol a kiszolgáló (107) arra van kialakítva, hogy társítsa a felhasználót egy vagy több felhasználói típussal a tartózkodási idő alapján.

15. Eljárás felhasználó profilozására, amely a következőket tartalmazza:

a. a felhasználóval társított kommunikációs eszköz helyadatainak vétele, a helyadatok meghatározzák a kommunikációs eszköz érzékelt helyét számos különböző időpontban;

b. a helyadatokkal társított sorrendadatok vétele arra a sorrendre vonatkozóan, amelyben a helyadatok meg lettek határozva, az eljárást a következőkkel

jellemezve:

c. a vett helyadatok összehasonlítása a zónák sokaságát meghatározó zónaadatokkal;

d. a vett helyadatok társítása a zónák sokaságának egyikével;

e. a felhasználói útvonal meghatározása a zónák első sorozatán keresztül; és

f. a felhasználó profilozása egy vagy több előre meghatározott felhasználói típusként a meghatározott útvonal alapján.