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Navigating an indoor transit system using a mobile device

Abstract

Devices, methods, and systems for navigating an indoor area such as an indoor transit system using a mobile device are described herein. The method may include navigating a network of indoor pathways and a plurality of access points for entering/exiting the indoor pathways. The indoor pathways may be mapped and may include a plurality of beacons distributed at designated locations throughout the indoor pathways. The beacons may be detected using a mobile computing device and an indoor location of the mobile computing device may be determined and depicted on the map of the indoor pathways. The location of the mobile computing device may be used to determine a route from the location of the mobile computing device to a destination in or adjacent the mapped indoor pathways.

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Background/Summary

(1) This is a continuation application of co-pending U.S. patent application Ser. No. 17/489,057, filed Sep. 29, 2021, which is a continuation application of U.S. patent application Ser. No. 16/737,677, filed Jan. 8, 2020, now U.S. Pat. No. 11,156,465, which is a continuation application of U.S. patent application Ser. No. 16/258,458, filed Jan. 25, 2019, now U.S. Pat. No. 10,539,424, which claims the benefit of U.S. Provisional Application No. 62/622,412, filed Jan. 26, 2018, all of which are hereby incorporated by reference.

TECHNICAL FIELD

(1) The present disclosure relates generally to devices, methods, and systems for navigating an indoor transit system such as a skyway system or subway system using a mobile device.

BACKGROUND

(2) Many types of navigation systems and applications exist for navigating outdoor areas, such as highways, streets, bicycle paths, trails, etc. For instance, there are many types of mobile apps available for mobile devices that can be used by the user of the mobile device to navigate outdoor areas. Such apps may utilize publicly created and/or existing maps (e.g., street maps, road maps, etc.) in combination with location services of the mobile device that typically leverage the Global Positioning System (GPS), cellular triangularization, and/or WiFi connection to a WiFi hotspot at a known location to identify the current location of the mobile device. However, in some indoor environments, one or more of these location services may not be available or may be otherwise ineffective. GPS signals and cellular data signals can become weak and unreliable in indoor environments. Also, outdoor maps typically do not cover or include sufficient detail of many indoor spaces such indoor transit systems to provide adequate navigation support to the user once in the indoor transit system. What would be desirable is an improved tool to help users navigate indoor spaces such as indoor transit systems.

SUMMARY

(3) The present disclosure generally relates to navigating an indoor area using a computing device. In one example configuration, a method of navigating an indoor transit system may be provided. The indoor transit system may include a network of indoor pathways, a plurality of access points for entering/exiting the indoor transit system, and a plurality of beacons distributed at designated locations throughout the indoor transit system. The method may include detecting one or more of the beacons of the indoor transit system using a mobile computing device (e.g. via Bluetooth) and determining when the mobile computing device is inside the indoor transit system based on the detected one or more of the beacons. The method may further include identifying the location of the mobile computing device within the indoor transit system based on which of the plurality of beacons are detected by the mobile computing device and displaying an indoor map of at least part of the indoor transit system on a user interface of the user's mobile computing device, including the identified location of the mobile computing device. Further, the method may include receiving a destination accessible by the indoor transit system via the user interface of the mobile computing device, computing a route through the indoor transit system to the destination, and displaying on the user interface of the mobile computing device the computed route on the indoor map. In some

cases, the indoor transit system comprises one or more of a skyway system and a subway system.
(4) In another example configuration, a method of navigating an indoor transit system that is situated in a geographic region, where an outdoor map is defined for the geographic region and the outdoor map identifies the geographic location of at least some of the plurality of access points of the indoor transit system. The method may include detecting one or more of the beacons of the indoor transit system using a mobile computing device and determining when the mobile computing device is inside the indoor transit system or outside of the indoor transit system based on the detected one or more of the beacons. When it is determined that the mobile computing device is inside of the indoor transit system, the method may include identifying the location of the mobile computing device within the indoor transit system based on which of the plurality of beacons are detected by the mobile computing device and displaying an indoor map of at least part of the indoor transit system on a user interface of the user's mobile computing device, including the identified location of the mobile computing device. When it is determined that the mobile computing device is outside of the indoor transit system, the method may include identifying the location of the mobile computing device in the geographic region based on location services of the mobile computing device and displaying the outdoor map of at least part of the geographic region on the user interface of the mobile computing device, including the identified location of the user's mobile computing device. The method may further include receiving a destination accessible using at least part of the indoor transit system via the user interface of the mobile computing device, computing a route to the destination that includes at least part of the indoor transit system, and displaying on the user interface of the mobile computing device the computed route.
(5) In a further example configuration, program code for use by a mobile computing device connectable to a network may be provided, where the program code may cause the mobile computing device to execute a method of navigating an indoor transit system such as a skyway system and/or a subway system. The method may include detecting one or more of a plurality of beacons of the indoor transit system by the mobile computing device and determine when the mobile computing device is inside the indoor transit system based on the detected one or more of the beacons. The method may further include identifying the location of the mobile computing device within the indoor transit system based on which of the plurality of beacons are detected by the mobile computing device and displaying an indoor map of at least part of the indoor transit system on a user interface of the mobile computing device, including the identified location of the user's mobile computing device. Further, the method may include receiving a destination accessible by the indoor transit system via the user interface of the mobile computing device, computing a route through the indoor transit system to the destination, and displaying on the user interface of the mobile computing device the computed route on the indoor map.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
(1) FIG. **1** is schematic diagram of an illustrative system for navigating an indoor area using a mobile device in accordance with an embodiment of the present disclosure;
(2) FIG. **2** is a schematic diagram of an illustrative mobile computing device usable for navigating an indoor area or interior of one or more structures in accordance with an embodiment of the present disclosure;
(3) FIG. **3** is a schematic diagram of an illustrative system for navigating an indoor area using a mobile device in accordance with an embodiment of the present disclosure;
(4) FIG. **4** is a schematic diagram of an illustrative display of a mobile application for a mobile computing device;
(5) FIG. **5** is a schematic diagram of an illustrative display of a mobile application for a mobile

computing device;
(6) FIG. **6** is a schematic diagram of an illustrative display of a mobile application for a mobile computing device;
(7) FIGS. **7**A-**7**D are schematic diagrams of illustrative displays of a mobile application for a mobile computing device;
(8) FIGS. **8**A-**8**E are schematic diagrams of illustrative displays of a mobile application for a mobile computing device;
(9) FIG. **9** is a schematic diagram of an illustrative display of a mobile application for a mobile computing device;
(10) FIG. **10** is a schematic diagram of an illustrative method for pinning a location;
(11) FIG. **11** is a schematic diagram of an illustrative method for sending a location from a first user to a second user;
(12) FIGS. **12**A-**12**D are schematic diagrams of illustrative displays of a mobile application for a mobile computing device;
(13) FIGS. **13**A-**13**D are schematic diagrams of illustrative displays of a mobile application for a mobile computing device;
(14) FIG. **14** is a schematic diagram of an illustrative method for displaying a route on a map;
(15) FIG. **15** is a schematic diagram of an illustrative display of a mobile application for a mobile computing device;
(16) FIG. **16** is a schematic diagram of an illustrative display of a mobile application for a mobile computing device;
(17) FIG. **17** is a schematic diagram of an illustrative method for modifying a route between a first location and a second location;
(18) FIGS. **18**A-**18**C are schematic diagrams of illustrative displays of a mobile application for a mobile computing device;
(19) FIG. **19** is a schematic diagram of an illustrative method for requesting emergency assistance;
(20) FIGS. **20**A and **20**B are schematic diagrams of illustrative displays of a mobile application for a mobile computing device;
(21) FIG. **21** is a schematic diagram of an illustrative method for identifying a parking location;
(22) FIG. **22** is a schematic diagram of an illustrative display of a mobile application for a mobile computing device;
(23) FIG. **23** is a schematic diagram of an illustrative method for switching between mobile mapping applications;
(24) FIG. **24** is a schematic diagram of an illustrative display of a mobile application for a mobile computing device; and
(25) FIGS. **25**A and **25**B are schematic diagrams of illustrative displays of a mobile application for a mobile computing device.

DETAILED DESCRIPTION

(26) The present system and approach may incorporate one or more processors, computers, controllers, user interfaces, wireless and/or wire connections, and/or the like, in an implementation described and/or shown.

(27) Devices, methods, and systems for navigating an indoor area of a structure using a computing device (e.g., a mobile device) are described herein. As an example, embodiments of the present disclosure may include an application program code (e.g., a mobile app or mobile application) for navigating an indoor area of (e.g., an interior of) one or more structures. In some cases, two or more structures may include and/or may be connected by an indoor transit system, such as a skyway system, a tunnel system, a subway system, and/or other suitable connecting systems and/or combinations thereof. As used herein, a transit system may include a network of indoor pathways and a plurality of access points for entering and/or exiting the indoor pathways. As used herein, a skyway system (e.g., a transit system that may be or may include a skyway) may refer to and/or

include an above-ground, interlinked connection of enclosed pedestrian footbridges that connect various buildings, such as office buildings, bars and restaurants, hotels, retail and shopping facilities, sports facilities, convention centers, concert facilities, parking ramps and garages, etc., thereby allowing for indoor travel therebetween. Restaurants, shops, and other retail spaces may also be located within the skyway itself.

(28) Existing navigational apps for mobile devices that are useful for navigating outdoor areas (e.g., highways, streets, bicycle paths, trails, etc.) may not be as useful or effective in navigating indoor areas or interiors of one or more structures (e.g., such as indoor transit systems, including skyway systems, tunnel systems, subway systems, etc.). For example, a single, publicly created, or existing map of the indoor area or interiors of one or more structures may not be available, and the Global Positioning System (GPS), cellular coverage, and/or WiFi coverage (e.g., signals from antennas) utilized by the mobile device for the outdoor navigation may be weak, inconsistent, or unavailable in the indoor areas and/or interior of one or more structures.

(29) In the following detailed description, reference is made to the accompanying drawings that form a part hereof. The drawings show by way of illustration how one or more embodiments of the disclosure may be practiced.

(30) These embodiments are described in sufficient detail to enable those of ordinary skill in the art to practice one or more embodiments of this disclosure. It is to be understood that other embodiments may be utilized and that mechanical, electrical, and/or process changes may be made without departing from the scope of the present disclosure.

(31) As will be appreciated, elements shown in the various embodiments herein can be added, exchanged, combined, and/or eliminated so as to provide a number of additional embodiments of the present disclosure. The proportion and the relative scale of the elements provided in the figures are intended to illustrate the embodiments of the present disclosure, and should not be taken in a limiting sense.

(32) As used herein, “a” or “a number of” something can refer to one or more such things, while “a plurality of” something can refer to more than one of such things. For example, “a number of mobile devices” can refer to one or more mobile devices, while “a plurality of mobile devices” can refer to more than one mobile device.

(33) FIG. **1** illustrates a conceptual block diagram of a mobile application **10** for navigating an indoor transit system. In one example, the mobile application **10** may include a rules engine database **12**, a location identification sub-system **14**, a map sub-system **16**, a navigational display, **18**, and/or one or more other suitable databases or sub-systems. In some cases, the rules engine database **12** may include one or more databases including information and/or rules for filtering and/or providing map data to be displayed through the navigational display **18**. Example databases include, but are not limited to, a personal settings database **20**, an external sources database **22**, a facility database **24**, and/or one or more other suitable databases to facilitate outputting the navigational display **18**. Although the mobile application **10** is depicted in FIG. **1** as comprising a variety of components, one or more components may be added to the mobile application **10** and/or one more of the depicted components of mobile application **10** may be separate from the mobile application (e.g. on a remote server) and interact with other components of the mobile application **10** through an application programming interface (API) or the like.

(34) As used herein, a mobile app, a mobile application, and an application program code may include and/or refer to computer readable and/or executable instructions (e.g., a computer program) designed to run on a mobile computing device (e.g., on a mobile device such as a smart phone and/or other suitable mobile computing device). In one example, the mobile application **10** illustrated in FIG. **1** may be run on a smart phone.

(35) Although the indoor area or interior of one or more structures may be described herein primarily with respect to a skyway system, it should be recognized that embodiments of the present disclosure are not so limited. For instance, in some examples, the indoor area or interior of one or

more structures may be one or more of indoor transit systems such as a tunnel system, a subway system, a railway tunnel system, a city sewer system transited by maintenance workers, a mine system transited by miners, among other types of indoor areas or interiors of one or more structures.

(36) The mobile application **10** may receive indoor location inputs via the location identification sub-system **14**. The received indoor location inputs may be used by the mobile application **10** to determine a current location of a computing device on which the mobile application **10** may be loaded (e.g., the current location of the user of the computing device) within the indoor area. The map sub-system **16** may then use the indoor location inputs to select a map for display (skyway map, subway map, etc.) along with the location of the computing device on the selected map in the navigational display **18**.

(37) In some cases, the indoor location inputs as determined by the location and identification sub-system **14** may include communications (e.g., signals) from one or more (e.g., a network of) beacons, where one or more beacons may be located (e.g., installed and/or distributed) at different respective locations (e.g., designated locations) throughout the indoor area or interior of the indoor transit system and/or one or more other structures. Each of the beacons may have a known, designated location within the indoor area or the interior of the one or more structures and the location of the beacon may be identified using the location identification sub-system **14** when the computing device connects to or senses the beacon. Once a location of the computing device is known, the map sub-system **16** may identify a map to display on the navigational display **18**.

(38) In some cases, and to help identify locations of beacons to users, stickers and/or other notifications may be placed in the indoor areas to provide an indication to the user of the computing device that he or she is located within the beacon network, and therefore can utilize the mobile application. In some cases, the mobile application **10** may automatically provide a notification that the computing device is within the beacon network when the computing device senses and/or connects to one or more beacons.

(39) The beacons may be devices capable of direct wireless communication with the computing device, and may facilitate the determination of the location of the computing device within the indoor area. For example, respective beacons of two or more beacons in a network may each have a different predetermined location in the indoor area, and can communicate with the computing device when the computing device is within a particular proximity (e.g., range) of the beacon such that the computing device can determine its location based on the communication (e.g., signal strength) it is receiving from the beacon(s) and a location of beacon(s) from which it is currently receiving signals. In one example, the location and identification sub-system **14** of the mobile application **10** may be configured to determine a location of the beacon based on the predetermined locations for each beacon of the beacon network and a location of the computing device based on a signal strength between the beacon(s) and the computing device. The beacons can be, for example, Bluetooth beacons that can communicate with the computing device via Bluetooth Low Energy (BLE) technology (e.g., as an iBeacon). Further, the communications from the beacons may include (e.g. be) randomized signals that are only decodable (e.g., recognizable) by the mobile application **10** (e.g., the location identification sub-system **14**), to prevent unauthorized use (e.g., hacking) of the beacon network.

(40) Because the computing device (e.g., the user of the computing device) is indoors as determined, for example, by detecting one or more beacons of the beacon network, the mobile application **10** may determine the location of the computing device within the indoor area more quickly and/or more accurately using the communications from the beacons than using GPS, cellular, and/or WiFi signals. GPS, cellular, and/or WiFi signals may be weak or nonexistent in the indoor area or interior of the one or more structures.

(41) The mobile application **10** may include and/or receive attributes or information (e.g., data) relating to one or more indoor areas or interiors of the structures (e.g., indoor area attributes) and

such attributes or information may be received at and/or saved in the facility database **24** or other suitable database. The indoor area attributes or information may be publicly available or uploaded or otherwise provided by facility managers of the one or more structures and/or indoor transit systems connecting the one or more structures. The indoor area attributes may include, for example, maps of the indoor area or interior of the one or more structures, physical attributes of the indoor area or interior of the one or more structures, events associated with the indoor area or interior of the one or more structures, and/or landmarks, features, restaurants, wheelchair accessibility, restrooms, hours of operation, and points of interest in the indoor area or interior of the one or more structures.

(42) In an example in which the indoor area or interior of the one or more structures includes a skyway system, the received and/or stored attributes or information may include locations of entries and exits into and out of the skyway system from the outside, hours during which the entries and exits are opened and closed, locations of doors within the skyway system, hours during which the doors are opened and closed, handicap (e.g., wheelchair) accessible locations within the skyway system, locations of particular buildings or types of buildings (e.g., parking lots, ramps, and garages, sports facilities, concert facilities, convention centers, hotels, restaurants, etc.) within and/or near the skyway system, locations of restrooms and/or elevators within the skyway, locations of concert facilities within or near the skyway system, and/or locations of museums within and/or near the skyway system, among other attributes or information relating to use of the skyway system.

(43) The mobile application **10** may include and/or receive attributes or information (e.g., data) associated with the indoor area or interior of the one or more structures from external data sources and such attributes or information may be received at and/or saved in the external sources database **22** or other suitable database. The attributes or information associated with the indoor area or interior of the one or more structures may include, for example, weather reports for exterior the one or more structures, traffic reports interior of and/or exterior of the one or more structures, news reports, date and time of day, usage reports (e.g., information regarding the availability of public and/or private transportation, the occurrence of crowd drawing events occurring within or near the area, etc.), and/or safety incidents occurring within or near the area, among other types of external information. The external data sources may include third party mobile applications (e.g., applications other than mobile application **10**, which may be provided by the provider of the mobile application or other suitable provider) that interface with the mobile application **10** via an API and/or other suitable technique.

(44) The mobile application **10** may receive personal settings from the user of the computing device and selected personal settings from the user may be received at and/or stored in the personal settings database **20** or other suitable database whether permanently saved or saved for a single use. In one example, a personal setting may be input by the user via a user interface of the computing device, as will be further described herein. The personal settings may include, for example, an intended destination of the user, personal preferences of the user, the personal calendar of the user, special route requirements (e.g., wheelchair accessible, etc.), and/or identifications for the computing devices of friends, family, and/or other acquaintances of the user, among other personal settings.

(45) As shown in FIG. **1**, the map sub-system **16** may output a navigational display **18** of the indoor area or interior of one or more structures based on the received inputs (e.g., the indoor location inputs, the indoor area attributes, the information from external data sources, the personal settings, and/or other suitable inputs). The navigational display **18** may include, for instance, a plurality of mapped route options, a mapped route (e.g., including turn-by-turn directions) through the indoor area to a destination, as well as additional relevant information about the indoor area along the route overlaid on the display (e.g., where the additional relevant information may be provided via visual indicators), as determined using the received inputs which will be further described via the

examples herein. In one example, a sequence (e.g., a flow) of the route mapping and navigation to a selected destination may be included within the navigational display **18**. The navigational display **18** may be provided (e.g., displayed) to a user of the computing device on a display of or associated with the computing device, as will be further described herein (e.g., in connection with FIG. **2**).

(46) The navigational display **18** may be used to display various features and/or functionalities of the mobile application **10**, some of which are depicted in FIGS. **4-25** within a context of a skyway system. Examples of the functionalities of the mobile application **10** that may be depicted via the navigational display **18** may include, but are not limited to: dynamic (e.g., updated) routing based on the hours which the entries, exits, and/or doors of the skyway system are open and closed, usage reports, safety incidents, traffic reports, weather reports, news reports, and/or other suitable attributes or information received from external sources and/or from facility managers of the one or more structures over time; a save-and-share feature that may be used to locate friends, family, and/or other acquaintances of the user of the mobile device; routing based on wheelchair accessibility and/or the location of elevators and/or restrooms (e.g., by detecting and providing a route to the nearest elevator or restroom); an emergency request feature, which a user may use to raise an emergency request with the user's current location; a route to the user's car currently parked in a parking facility; features to change (e.g., hand off) to an outdoor map or third-party mapping application if the user moves outside of the indoor area or interior of the one or more structures, and can be changed back to the navigational display **18** if the user returns to the indoor area or interior of the one or more structures; features to track family, friends, or other acquaintances; features to set up tours; an indication (e.g., alert or warning) to the user if it is detected that the user is going the wrong way (e.g., based on the distance between the user and the destination increasing rather than decreasing); and/or the displaying one or more other functions and/or features of the mobile application **10**.

(47) FIG. **2** illustrates an example of a computing device **26** for use in navigating an indoor area or interior of one or more structures in accordance with an embodiment of the present disclosure. The computing device **26** may be, for instance, a smart phone, tablet, a personal digital assistant (PDA), a personal computer, and/or other suitable computing device. However, configurations of the present disclosure are not limited to a particular type of computing device **26**.

(48) As shown in FIG. **2**, the computing device **26** may include memory **28** and a processor **30** that may communicate with one another such that the processor **30** may execute instructions (e.g., application program code of the mobile application **10**, among other instructions) stored on the memory **28**. The computing device **26** may further include a user interface **32**, a communications port **34**, and/or one or more other suitable components.

(49) The memory **28** may be any type of storage medium that can be accessed by the processor **30** to perform various examples of the present disclosure. For example, the memory **28** may be a non-transitory computer readable medium having computer readable instructions (e.g., computer or application program instructions) stored thereon, such as, for instance, the mobile application **10** previously described in connection with FIG. **1**, that are executable by the processor **30** for navigating (e.g., providing a navigational display for) an indoor area or interior of one or more structures in accordance with the present disclosure. That is, the processor **30** can execute the executable instructions stored in the memory **28** to provide a navigational display for an indoor area or interior of the one or more structures in accordance with the present disclosure.

(50) The memory **28** may be can be volatile or nonvolatile memory. The memory **28** may also be removable (e.g., portable) memory, or non-removable (e.g., internal) memory. For example, the memory **28** may be random access memory (RAM) (e.g., dynamic random access memory (DRAM) and/or phase change random access memory (PCRAM)), read-only memory (ROM) (e.g., electrically erasable programmable read-only memory (EEPROM) and/or compact-disk read-only memory (CD-ROM)), flash memory, a laser disk, a digital versatile disk (DVD) or other optical disk storage, and/or a magnetic medium such as magnetic cassettes, tapes, or disks, among other

types of memory.
(51) Further, although the memory **28** is illustrated as being located in the computing device **26**, embodiments of the present disclosure are not so limited. For example, the memory **28** can also be located internal to another computing resource (e.g., enabling computer readable instructions to be downloaded over the Internet or another wired or wireless connection).
(52) As shown in FIG. **2**, the computing device **26** may include the user interface **32**. A user of the computing device **26** may interact with the computing device **26** via the user interface **32**. For example, the user interface **32** may provide information to and receive information from the user of the computing device **26**. For instance, navigational displays **18** for an indoor area or interior of one or more structures in accordance with the present disclosure may be displayed to the user of the computing device **26** via the user interface **32**.
(53) In some cases, the user interface **32** may include a graphical user interface (GUI) that may have a display **36** (e.g., a screen) that may provide and/or receive information to and/or from the user of the computing device **26**. The display **36** may be, for instance, a touch-screen (e.g., the GUI can include touch-screen capabilities). As an additional example, the user interface **32** may include a keyboard or keyboard functionality, a pointer (e.g., a mouse, touch pad, or touch ball) or pointer functionality, a microphone, a speaker, a light system, a haptic system, a camera, a video camera, and/or other suitable user interface **32** features the user may use to input information into and/or receive information from the computing device **26**. Configurations of the present disclosure, however, are not limited to a particular type(s) of user interface **32**.
(54) The communications port **34** may be any type of communication port(s) and may facilitate wired and/or wireless communication with one or more networks. In one example, the communications port **34** may facilitate communication with one or more networks and/or other devices (e.g., beacons, other computing devices, mobile devices, servers, and/or other suitable devices) through any suitable connection including, but not limited to, radio communication, Ethernet, cellular communication, ZigBee, REDLINK™, Bluetooth, Bluetooth Low Energy (BLE), WiFi, IrDA, dedicated short range communication (DSRC), EnOcean, Near Field Communication (NFC), and/or any other suitable common or proprietary wired or wireless protocol. In one example, the communications port **34** may at least include a port configured to communicate over a Bluetooth connection with a beacon.
(55) FIG. **3** illustrates a block diagram of a system **40** for navigating an indoor area or interior of one or more structures using the computing device **26** in accordance with a configuration of the present disclosure. As shown in FIG. **3**, the system **40** may include a plurality (e.g., network) of beacons **42** (e.g., beacons capable of outputting signals to communicate with computing devices **26**, such as Bluetooth beacons) and the computing device **26** having the mobile application **10**. The plurality of beacons **42** may be distributed at designated locations through an indoor transit system and/or at other locations to facilitate locating a computing device **26** in an indoor area and/or navigating through the indoor transit system. The computing device **26** may receive personal settings from a user **44** and the computing device **26** may receive indoor location inputs from the beacons **42** via the communications port **34** (e.g., the Bluetooth communication port or other suitable communication port). In one example, the computing device **26** may communicate with the beacons **42** over a Bluetooth communications protocol.
(56) Further, as shown in FIG. **3**, the system **40** may include one or more remote servers **46** (e.g., content delivery edge servers and/or other suitable servers), which may be located remotely from computing device **26** and/or the beacons **42**. The computing device **26** may receive (e.g., download) indoor area attributes from third parties through a user of the servers **46** via a network **48**.
(57) The network **48** may include one or more networks and may include one or more types of networks. The network **48** may be a wired and/or wireless network. For example, the network **48** may be a network relationship through which the computing devices and servers can communicate.

Examples of such a network relationships may include one or more of a distributed computing environment (e.g., a cloud computing environment), a wide area network (WAN) such as the Internet, a local area network (LAN), a personal area network (PAN), a campus area network (CAN), or metropolitan area network (MAN), among other types of network relationships. For example, the network **48** may include a number of servers **46** that receive the indoor area attributes, personal settings, and/or external source attributes, and transmit such attributes to the computing device **26** via a wired or wireless network.

(58) As used herein, a "network" may provide a communication system that directly or indirectly links two or more computers and/or peripheral devices and allows users to access resources on other computing devices and exchange messages with other users. A network may allow users to share resources on their own systems with other network users and to access information on centrally located systems or on systems that are located at remote locations. For example, a network may tie a number of computing devices together to form a distributed control network (e.g., cloud).

(59) The network **48** may provide connections to the Internet and/or to the networks of other entities (e.g., organizations, institutions, etc.). Users may interact with network-enabled software applications to make a network request, such as to get a file or print on a network printer. Applications on a computing device may also communicate with network management software, which can interact with network hardware to transmit information between devices on the network.

(60) In some embodiments, the servers **46** from which the computing device **26** may receive the indoor area attributes, personal settings, external source attributes, and/or other suitable attributes or information may not all be in the same physical location (e.g., different servers may be located at different locations). In such embodiments, the computing device **26** may determine which of the servers **46** is located closest to it, and download attributes from that server **46**. For instance, the computing device **26** may automatically default to (e.g., try to download the attributes from) the closest server **46**, then move on to the next closest server **46** if the closest server is unavailable. This may increase the speed at which the computing device **26** receives the attributes or information.

(61) As shown in FIG. **3**, the system **40** may include a database **49** (e.g., map and location content storage database and/or other suitable databases) that may store the attributes or information. The servers **46** may retrieve (e.g., search for and locate) the attributes or information to send to the computing device **26** from the database **49**. As shown in FIG. **3**, the system **40** may include an authoring tool **50** (e.g., a map and location authoring tool or other suitable authoring tool), which may be used (e.g., by an administrator **52** of the system **40**) to create attributes or information (e.g., the maps and location content) to be stored in the database(s) **48**. The communications (e.g., communication protocol) between the computing device **26**, beacons **42**, servers **46**, database(s) **48**, authoring tool **50**, and/or other computing component of the system **40** can be secure communications such as, for instance, HTTPS communications.

(62) FIGS. **4-25** illustrate flow diagrams of how an example of the mobile application **10** operates in one or more illustrative configurations and example screen shots of an illustrative navigational display **18** depicting features of the mobile application **10** in accordance with configurations of the present disclosure. In one example, the navigational display **18** may be output by the mobile application **10** and displayed to the user (e.g., the user **44** or other suitable user) on the display **36** of the computing device **26**. The navigational display **18** illustrated in FIG. **4** depicts a map of a skyway system **60** and the buildings connected by the skyway system **60** (e.g., an overall, high-level view of an indoor area or interior of one or more structures), including a convention center **62** and sports facilities **64**.

(63) The skyway system **60** depicted in FIG. **4** is located in a geographic region (e.g. Minneapolis, Minnesota) and the map (e.g. an outdoor and/or indoor map) depicted in the navigational display **18** may be defined for the geographical region. The map of the geographical region including the

skyway system **60** and depicting at least some outside areas around the skyway system **60** may include at least some entry/exit points or access points for the skyway system **60** and/or other indoor transit systems in the geographic region. In some cases, as a map is zoomed in to show a smaller geographic region, additional details of the smaller geographic region may be depicted in the map on the navigational display **18**.

(64) As shown in FIG. **4**, the navigational display **18** may include a scrollable list **54** (e.g., scrollable in the direction of arrows A) of different types of locations and/or destinations in or connected to the skyway system **60**, such as workspace, eat & drink (e.g., restaurants and bars), parking, sport venues, shops, exhibits, events and others. In the example illustrated in FIG. **4**, the user has selected the parking tab from this scrollable list **54**. Accordingly, the navigational display **18** displays parking visual indicators **66** (e.g., the letter 'P' with a circle around it) overlaid on the map in the navigational display **18** indicating the locations of parking facilities part of and/or connected to the skyway system **60**. Additional or alternative visual indicators may be overlaid on the map in the navigational display **18** when other locations and/or destinations are selected from the scrollable list.

(65) FIG. **5** shows a map of the skyway system **60** (e.g., indoor transit system), as well as a route **58** through the skyway system **60** from a first location (e.g., a current location of a computing device **26** or other suitable location) near the convention center **62** to a second location (e.g., a destination, such as US Bank Stadium **64** in the example of FIG. **5**). In the example illustrated in FIG. **5**, a current location of the computing device **26** is indicated with a current location visual indicator (e.g., a dot) and the destination of the user is shown and labelled in the navigational display **18** as a destination indicator **75** (e.g., a circular dot that includes a symbol of the destination, such as a stadium symbol or other suitable destination symbol).

(66) A current location of the computing device **26** may be determined by detecting one or more beacons **42** associated with and/or located in the mapped skyway system **60**. It may then be determined when the computing device **26** is inside the skyway system **60** based on the one or more beacons **42** (if any) that are detected. In one example, when the computing device **26** detects a beacon **42**, the mobile application **10** may determine (e.g., using the location identification sub-system **14** or other suitable system and/or database) whether the detected beacon **42** has a designated location associated with the skyway system **60**. When the detected beacon **42** has a designated location associated with the skyway system **60**, the mobile application **10** may determine the computing device **26** is within the skyway system **60**. The mobile application **10** may identify a particular location (e.g., a current location) of and/or track the computing device **26** within the skyway system **60** based on which beacon(s) **42** or set of beacons **42** are detected by the computing device **26** and/or a strength of a signal between the detected beacon(s) **42** and the computing device **26**. Once a location of the computing device **26** is known with respect to the skyway system **60**, the current location may be depicted on an indoor map on the navigational display **18**. In some cases, the mobile application **10** may display the current location using a visual indicator **68** on the indoor map at the current location of the computing device **26**.

(67) When the detected beacon(s) **42** does not have a designated location associated with the skyway system **60** (e.g., an indoor transit system displayed in the map on the navigational display **18**), the mobile application **10** may search (e.g., using the map sub-system **16** or other suitable system and/or database) to determine whether the detected beacon **42** has a designated location within one or more other indoor transit systems mapped on a known indoor map, such as a subway system. If the detected beacon(s) **42** has a designated location within one or more other indoor transit system mapped on a known indoor map, the mobile application **10** may display the corresponding known indoor map and identify the current location of the computing device **26** thereon. If the detected beacon(s) **42** does not have a designated location within one or more other indoor transit systems mapped on a known map, the mobile application **10** may continue to monitor for detected beacon(s) **42** having a designated location within a transit system on a known indoor

map, determine the computing device **26** is not within a transit system on a known indoor map, and/or take one or more other suitable actions. In some cases, if it is determined that the mobile device **26** is not within a transit system on a known indoor map, the mobile device **26** may switch to an outdoor map and may use GPS, cellular triangulation or other location service and display the current location of the computing device **26** on the outdoor map.

(68) In some instances, a first location may be entered into the mobile application **10** at a starting location box **76** and the second location may be entered into the mobile application at a destination location box **78** via the user interface **32** of the computing device **26**. The locations entered into the starting location box **76** and the destination location box **78** may be entered and/or received as a street address, a business address, as a nearest bathroom, a nearest restaurant, a bathroom, restaurant, or other feature nearest a place of interest, GPS coordinates, longitudinal/latitude and/or other suitable location identifier. To determine a location of a "nearest" feature, the mobile application **10** may select the noted feature that is closest to a current location of the computing device **26** or specified place of interest and enter that location as the starting and/or destination address.

(69) The first location and the second location may be entered into boxes **76**, **78**, respectively, via the user interface **32** of the computing device **26** (e.g., via typing, voice, and/or other suitable input means). In some cases, one or both of the first location and the second location may be automatically entered into a respective box by the mobile application based on a current location of the computing device **26**, as in the example of FIG. **5**, and/or a location selected in the map depicted on the navigational display **18**. Once the first location (e.g., a current location of the computing device **26**) and the second location (e.g., US Bank Stadium or other suitable destination) are entered, the mobile application **10** may determine one or more routes **58** through the skyway system **60** from the first location to the second location and display the one or more routes **58** in the map on the navigational display **18**.

(70) In some cases, based on personal settings and/or other information or data, the mobile application **10** may determine and/or display one or more routes **58** that extend at least partially through the skyway system **60** or other indoor transit system and at least partially exterior of the skyway system **60** or other indoor transit system (e.g., exterior the network of beacons **42**). In one example, the route **58** may extend from inside the skyway system **60** or other indoor transit system, through an access point of the skyway system **60** or other transit system, along a geographical region exterior of the skyway system **60** or other indoor transit system, through a further access point of the skyway system **60** or other indoor transit system, and back into the skyway system **60** or other indoor transit system to the destination. In another example, the route **58** may extend (e.g. start) from a location outside of the skyway system **60** or other indoor transit system, along at least part of a geographical region exterior of the skyway system **60** or other indoor transit system, through an access point of the skyway system **60** or other indoor transit system, and into the skyway system **60** or other indoor transit system to a destination.

(71) When the route **58** extends along an indoor transit system and then exterior the indoor transit system, the mobile application **10** may facilitate switching between an outdoor map (e.g. third-party outdoor mapping service) and the indoor map. In some cases, the mobile application **10** may initiate a third-party outdoor mapping service (e.g., mobile app), send a starting location or sub-starting location and a destination or sub-destination to the third-party outdoor mapping service when the user exits the indoor transit system. The mobile application **10** may monitor for when the computing device **26** re-enters the indoor transit system and automatically initiate navigating via the navigational display **18** to the destination.

(72) As shown in FIG. **5**, in a destination display **70** (e.g., a menu), the navigational display **18** may display a distance and an estimated time (e.g., based on past movements of the computing device **26** with a user and/or based on general population averages) to the destination from the current location of the user's computing device **26** when following the displayed and/or selected route **58**.

In the example illustrated in FIG. **5**, the destination is located 1.69 miles away from the current location of a user's computing device **26** and it will take approximately forty-five (45) minutes and twenty (seconds) to walk to the destination when following the displayed route **58**, as indicated in the destination display **70**.

(73) The navigational display **18** may include turn-by-turn directions for the entire route. In some cases, a location of each respective turn along the entire route may be labelled in the display with directional visual indicator(s) **74**. For example, a location of a turn along the route may be labelled with directional visual indicators **74** overlaid on the map depicted in the navigation display **18**, as depicted in FIG. **5** (note, only some of the directional visual indicators **74** are labeled for clarity). The directional visual indicator **74** may be a dot that has a smaller diameter than the current location visual indicator **68**, but this is not required and the directional visual indicator **74** may take on one or more other suitable configurations, including, but not limited to, a depiction of a direction of a turn.

(74) The navigational display **18** depicted in FIG. **6** depicts a portion of the mapped route through the skyway system **60** depicted in FIG. **5**, including the current location of the computing device **26** of the user (as indicated by the current location visual indicator **68**). The navigational display **18** may include turn-by-turn directions in a navigation display **72** for the route **58** through the skyway system **60** to a destination selected by the user. In the example depicted in FIG. **6**, the navigational display **18** depicts turn-by-turn directions in the navigation display **72** for a portion of the route depicted on the display. For example, a textual description of the turn depicted in the navigational display **18** (e.g., "then barely turn left after 0 mi") may be depicted in the navigation display **72**.

(75) The navigational displays **18** depicted in FIGS. **7**A-**7**D show an example of a sequence (e.g., flow) of the route mapping and navigation to a selected destination within the navigational display **18** of the mobile application **10**. In FIG. **7**A, the navigational display **18** displays a map including a portion of a skyway system **60**, a current location of the computing device **26** as indicated by the current location visual indicator **68**, and "Eat & Drink" locations, as selected from the scrollable list **54**, which are represented by restaurant visual indicators **80** (e.g., dots, in the example depicted, and/or other suitable configurations) (note, not all restaurant visual indicators are labeled **80** for clarity). In some cases, a textual indicator may be displayed as or with the visual indicators, such as "Your location >" associated with the current location of the computing device **26** or "Restaurant A" associated with a selected restaurant. In some cases, a textual indicator may be displayed when an associated other visual indicator is selected by a user. In some cases, and as shown in FIG. **7**A, the indoor map of the skyway system **60** may be overlaid on top of an outdoor map that shows the streets and other features outside of the skyway system **60**. This may provide context for the indoor map relative to the geographic region around the indoor map.

(76) In FIG. **7**B, the user has selected one of the restaurants, Restaurant A to which to find a route. The user may select the restaurant by, for instance, tapping the restaurant visual indicator **80** in the display for that restaurant. The selection is indicated in the navigational display **18** by a textual indicator (e.g., a restaurant name, such as Restaurant A) overlaid on the display at the location of the selected restaurant and in the destination display **70** being displayed in the navigational display **18**. To initiate the mobile application **10** to obtain one or more routes to the selected destination, a user may select a directions button **82** or voice a direction command to the user interface **32** of the computing device **26**, and/or initiate directions in one or more other suitable manners.

(77) In FIG. **7**C, the navigational display **18** displays a route **58** through the skyway system **60** as determined by the mobile application **10** based on the current location of the computing device **26** (e.g., see "Your location" in the starting location box **76**) and the user selected destination (e.g., see "Restaurant A" in the destination location box **78**). Additionally, the destination display **70** overlaid on the map in the navigational display **18** may provide a distance and an estimated time to the destination (e.g., Restaurant A) from the current location of the computing device **26**. To initiate turn-by-turn navigation directions, a user may select a navigation button **84** in the destination

display **70** or voice a turn-by-turn navigation command to the user interface **32** of the computing device **26**, and/or initiate turn-by-turn navigation in one or more other suitable manners.
(78) Once the turn-by-turn navigation has been initiated by the mobile application **10**, textual descriptions of each turn may be provided in the navigation display **72** and the map may be zoomed in to focus on a portion of the route **58**, but this is not required in all cases. In FIG. **7**D, a textual description of the first turn along the route (e.g., "keep forward and turn left after 69 ft") may be provided in the navigation display **72**, which may be overlaid on the map in the navigational display **18**. Additionally or alternatively, the destination display **70** may continue to display the selected destination and a distance and estimated time to the destination. In some cases, the distance and estimated time to the destination may be updated in real time as updates are calculated due to changes in signal strengths between the computing device **26** and a beacon **42** and/or due to the computing device **26** connecting to or sensing a new or different beacon than a previous sensed or connected beacon.
(79) FIGS. **8**A-**8**E depict an example of a sequence (e.g., flow) of the route mapping and navigation to a selected destination within the navigational display **18** of the mobile application **10** in which the user searches for a destination location. In FIG. **8**A, a user may initiate a search for a place of interest in or connected to the skyway system **60** depicted in the map on the navigational display **18** by selecting a search button **86** and/or other interactions with the user interface **32** of the computing device **26** may be utilized to initiate a search.
(80) Once the search button **86** has been selected and a search has been initiated by the mobile application **10**, a search screen may be displayed in the navigational display **18**, as depicted in FIG. **8**B. The search screen may include a search box and and a results box **90**. If a user wants to search for a place of interest, the user may enter a place of interest or a type of place in the search box **88** (e.g., via a keyboard **92** or via other suitable manners) and the results box **90** may display relevant places of interest with respect to what was entered into the search box **88**. In some cases, prior to entering any terms into the search box **88**, the results box **90** may display places of interest for popular categories of places of interest (e.g., for the categories listed in the scrollable list **54**), but this is not required. If the user sees a desired place of interest in the results box **90**, the user may select the desired place of interest to select the place of interest as a destination.
(81) FIGS. **8**C-**8**E are similar to FIGS. **7**B-**7**D, respectively. For example, in FIG. **8**C, the user has selected a destination and the mobile application **10** may display the destination in the destination display **70** and a user may select the directions button **82** to initiate the mobile application **10** finding directions from a current location of the computing device **26** to the selected destination. In FIG. **8**D, the mobile application **10** has computed a route **58** from the current location of the computing device **26** to the selected destination and displayed the route **58** on the navigational display **18**. The distance and estimated time until arrival at the selected destination may be display in the destination display **70**. Turn-by-turn directions may be initiated by selecting the navigation button **84** in the destination display **70** of FIG. **8**D. The mobile application **10** may depict turn-by-turn directions in the navigation display **72** and distance and estimated time to destination information in the destination display **70**, as depicted in FIG. **8**E. Further, when turn-by-turn navigation has been initiated by the mobile application **10**, the map may zoom in on the current location of the computing device as indicated by the current location visual indicator **68** and an adjacent portion of the route **58**.
(82) FIG. **9** depicts a map of the skyway system **60** in the navigational display **18**, with a pinned location represented by a pinned location visual indicator **94**. The pinned location visual indicator **94** may be a circle with a square in the circle, but other configurations for the pinned location visual indicator **94** are contemplated. In some cases, a textual visual indicator (e.g., "Pinned Location" and/or other suitable label) may be displayed with the pinned location visual indicator **94** and/or displayed in response to selection of the displayed pinned location visual indicator **94**. Further, the destination display **70** may be overlaid on the map depicted in the navigational display

18 and provide a selected pinned location and a directions button **82** initiating the mobile application to compute a route from a current location of the computing device **26** (or other suitable location) to the pinned location in a manner similar to the routing and navigating discussed above with respect to FIGS. **7**A-**8**E. In some cases, the destination display **70** may include a favorites or pin button **96** to initiate pinning a selected location or place of interest. The pin button **96** may be shaped like a heart, as in FIG. **9**, and/or may have one or more other suitable configurations.

(83) FIG. **10** is a flow diagram of an example schematic method **200** that the mobile application **10** may follow to pin a place of interest. The mobile application **10** may be programed to receive **210** a selection of a location (e.g., a place of interest). In response to a selection of a location, the mobile application **10** may display a destination display **70**, as discussed above, which may include the pin button **96**. The mobile application **10** may be programed to ask or inquire **212** whether the pin button **96** has been selected. If the mobile application **10** determines the pin button **96** has been selected with respect to the selected location, the mobile application **10** may save **214** the location as a pinned location in the rules engine database **12** (e.g., in the personal settings database **20**) or in any other suitable database. When the pin button **96** is not selected and/or after saving a location as a pinned location, the mobile application **10** may return to the step of receiving **210** a selection of a location.

(84) FIG. **11** is a schematic flow diagram of an illustrative method **300** that the mobile application **10** may follow to share a current location or pinned location identified in the mobile application **10**. The mobile application may be programmed to receive a selection **310** to share a location from a first user (e.g., a user A). The first user may initiate a location share function of the mobile application **10** by selecting a share button via the navigational display **18** and/or initiating the location share function by interacting with the user interface **32** of the computing device **26** in one or more other suitable manners. Once the mobile application **10** receives or identifies a selection to share a location, the mobile application **10** may initiate **320** a communication tool on the computing device **26**. In instances when the computing device **26** is a mobile device or mobile phone, the mobile application may initiate a texting application, a phone call application, and/or initiate a display with options of communication tools selectable by the user via the user interface **32** of the computing device **26**. Once the communication tool is initiated, the location to share is sent **330** to a second user (e.g., user B). In some cases, the mobile application **10** may interface with one or more communication tools via an API and initiate the communication tool and send the location automatically via the API. In other instances, the mobile application **10** may initiate the communication tool and it will be up to the first user to send the location via the communication tool.

(85) FIGS. **12**A-**12**D depict an example of a sequence of a first user pinning a place of interest and sending the pinned place of interest to a second user via the mobile application **10**. In FIG. **12**A, a destination has been selected as indicated by the textual visual indicator “Restaurant B” adjacent the restaurant visual indicator **80** and the presence of the destination display **70** depicting the name of the selected destination, the directions button **82**, and the pin button **96**. As discussed above, the pin button **96** may be selected to initiate saving a selected location or destination as a pinned location. In some cases, once the pinning function of the mobile application has been initiated, the navigational display **18** may provide a label box **100** in which a label (e.g., “Pinned location” or other label) may be provided via the keyboard **92**, as depicted in FIG. **12**B, and/or otherwise provided via the user interface **32** of the computing device **26**. Once a label has been provided and saved, the label may be used by the mobile application **10** to refer to the place of interest on the map and the navigational display **18** may return to the map with the destination display **70** overlaid, as depicted in FIG. **12**C. To share the pinned location or other suitable location (e.g., a current location of the computing device **26**), a user may select a share button **98** in the destination display **70**. When a pinned location or a destination is selected, selecting the share button **98** may cause the mobile application **10** to initiate sharing the selected location or destination. When no location is

selected, selecting the share button **98** may cause the mobile application **10** to initiate sharing the current location of the computing device **26** and/or one or more previously pinned locations.
(86) Once a share location function of the mobile application **10** has been initiated, the mobile application **10** may initiate a communication tool on the computing device. As discussed above, initiating a communication tool may initiate a specific communication tool or may initiate a communication selection box (e.g., selection box **102**). In some cases, a user may be able to select a communication tool (e.g., a messaging application, an email application, a social media application, etc.) from which to share a location. Once a desired communication tool is selected, the mobile application **10** may automatically send the location or a user may finish sending the location, as discussed with respect to FIG. **11**. Such location share features and/or other share features of the mobile application **10** may facilitate locating (e.g., finding) friends, family, and/or other acquaintances of the user of the computing device **26**.
(87) FIGS. **13**A-**13**D depict an example of a sequence of tracking family, friends, or other acquaintances, such as, for instance, during a high density event inside a building of the skyway system **60** via the mobile application **10**. In some cases, the navigational display **18** and/or the mobile application **10** via the user interface **32** of the computing device **26** may provide alerts if others move too far away or out of the building and/or for other suitable reasons.
(88) FIG. **13**A depicts a map of the skyway system **60** in the navigational display **18**, with the restaurant visual indicators **80** visible due to Eat & Drink being selected from the scrollable list **54** and the current location of the computing device **26** indicated by the current location visual indicator **68**. By selecting the textual visual indicator (e.g., “Your location >”), the navigational display may display a location options menu **104**, as is depicted in FIG. **13**B. The location options menu **104** may display a “Share your location” option to share a current location of the computing device **26** with others, a “Save this location” option to save or pin a current location of the computing device **26** (e.g., save in the personal settings database **20**), a “Pair with others” option to pair a current location of the computing device **26** with others, a “Cancel” option to close out of the location options menu **104**, and/or one or more other suitable options.
(89) In response to selecting the “Pair with others” option from the location options menu, the mobile application **10** may initiate a pair options menu **106** that may be displayed on the navigational display **18**, as depicted in FIG. **13**C. The pair options menu **106** may display a variety of selectable options for configuring a pairing function of the mobile application with users of the application (e.g., as installed on computing devices of other users). For example, from the pair options menu **106**, the user may select people with whom he or she would like to pair (e.g., from contacts on the user's mobile device, contacts on a social media account, contacts associated with the mobile application **10**, etc.), select the length of time for which he or she would like to be paired, select the conditions for when the user would like to receive alerts and/or have alerts provided to the others (e.g., when the user is out of a particular range from the other users, when the user is in a crowded area (e.g., as determined by data of other current users of the mobile application **10** in an area and/or from third-party or external sources), when the user or the others are outside the map area, and/or at other suitable times), and/or the user may have other options from which to select and set up the pair feature of the mobile application **10**. In some cases, other users may have to confirm a pair request before the user may view their paired user visual indicator **108** on the navigational display.
(90) After configuring the pair feature via the pair options menu **106** of the mobile application **10**, the navigational display **18** may depict the map with the location of other paired users as shown and labelled in the display depicted in FIG. **13**D. The users with whom the user is paired may be identified by a paired user visual indicator **108**. Although the paired user visual indicator **108** is depicted as a circle with a sketched person therein, the paired user visual indicator **108** may take on one or more other suitable configurations including, but not limited to, user personalized configurations, profile images, etc.

(91) Further, an alert may be provided in the navigational display **18** based on alert conditions set when configuring the pair feature of the mobile application **10**. As shown in FIG. **13**D, two of the paired user visual indicators **108** may have an alert visual indicator **110** associated therewith indicating an alert is active for those paired users. In some cases, when the mobile application **10** receives a selection of the alert visual indicator **110**, the mobile application may indicate on the navigational display **18** a reason for the alert with respect to that user.

(92) FIG. **14** is a schematic flow diagram of an illustrative method **400** that the mobile application **10** may follow when implemented on the computing device (e.g., the computing device **26**) to provide a route from a first location or destination to a second location or destination. After receiving the first location and the second location, the mobile application may identify **410** one or more routes from a first location to a second location based on map data in a map sub-system (e.g., the map sub-system **16** or other suitable map sub-system). The map sub-system may contain map data usable for routing between two locations on the map. The one or more routes that are identified may be compared **412** to information and data in a rules engine database (e.g., the rules engine database **12** or other rules engine database) or other information and data. Based on the information and data in the rules engine and/or other information and data, one or more route from the first location to the second location may be selected **414**. In one example, only the routes that meet the requirements in the information and data to which the routes are compared are selected. In another example, one or more routes that do not meet the requirements in the information and data to which the possible routes are compared may be selected in addition to the routes that do meet the requirements in the information and data. After selecting the desired one or more routes, the mobile application **10** may display **416** the selected one or more routes on the navigational display **18**. If the selected routes include one or more routes that did not meet the requirement information and data to which the possible routes were compared, such routes may be displayed on the navigational display **18** with an indication that the route did not meet the requirements of the information and data. In some cases, if there is a large number of possible routes, the mobile application **10** may be configured to display just the top two or three routes based on distance, estimated time to arrival, and/or other suitable factors.

(93) FIG. **15** depicts the navigational display **18** with two routes **58** displayed thereon. The route **58** depicted in gray is a route that did not meet the requirement information and data to which possible routes were compared. For example, the route **58** depicted in gray may have failed to meet the requirement information and data due to a door being locked or closed at an estimated time of traveling the route **58**, as indicated by building closure information stored in the facility database **24** in the rules engine database **12** or other suitable data and information source. As depicted in FIG. **15**, the route **58** in gray may include a path closed visual indicator **112** at any suitable location along or adjacent the closed route **58**. In some cases, the path closed visual indicator **112** may be located at or adjacent the portion of the path that is closed. The mobile application **10** may dynamically route a user and may provide at least a second route **58** when a primary route or other route is closed or otherwise does not meet requirement information and data. In FIG. **15**, an alternative route **58** is depicted in black and meets the requirement information and data to which it was compared. As such, the mobile application **10** may be configured to dynamically route users from a first location to a second location based on obtained or received requirement information and data, including facility data.

(94) FIG. **16** depicts the navigational display **18** with two routes **58** displayed thereon. The route **58** depicted in gray is a route that did not meet the requirement information and data to which possible routes were compared. For example, the route **58** depicted in gray may have failed to meet the requirement information and data due to a safety incident occurring (e.g., maintenance is occurring at a location along the route, and/or other safety issue is occurring) in the skyway system **60** at an estimated time of traveling the route **58**, as indicated by external source or third party information stored in the external sources database **22** in the rules engine database **12** or other suitable data and

information source. As depicted in FIG. **16**, the route **58** in gray may include a safety/maintenance visual indicator **114** at any suitable location along or adjacent the closed route **58**. In some cases, the safety/maintenance visual indicator **114** may be located at or adjacent the portion of the path at which the safety issue or maintenance is occurring. The mobile application **10** may dynamically route a user and may provide at least a second route **58** when a primary route or other route is closed or otherwise does not meet requirement information and data. In FIG. **16**, an alternative route **58** is depicted in black and meets the requirement information and data to which it was compared. As such, the mobile application may be configured to dynamically route users from a first location to a second location based on obtained or received requirement information and data, including third party and/or external source data.

(95) In some cases, part of the indoor transit system may be closed based on a schedule. For example, some doors along the indoor transit system may be locked at 9:00 PM-5:00 AM on weekdays, and 11:00 PM-8:00 AM on weekends. The computed route may take into account the schedule such that the computed route does not traverse through those parts of the indoor transit system when they are scheduled to be closed, but may include those same parts when they are scheduled to be open.

(96) FIG. **17** is a schematic flow diagram of an illustrative method **500** that the mobile application **10** may follow when implemented on the computing device **26** to dynamically modify a route from a first location to a second location that is displayed on the navigational display **18**. The method **500** may include receiving **510** a selection to modify a route between a first location and a second location. In some cases, a user may initiate a route modification feature of the mobile application **10** by interacting with the user interface **32** of the computing device **26**. In response to receiving a selection to modify a route, options for modifying personal settings of a user may be displayed **512** to a user via the navigational display **18** or other suitable display. The method may include receiving **514** a selection of a personal setting option. Once a selection of a personal setting is received, the personal setting selection may be saved (e.g., saved permanently or for a single use in the personal settings database **20**). Then, possible routes from the first location to the second location may be compared to the rules engine database **12** or other requirement information and data updated in view of the selected update to a user's personal settings for the mobile application **10**. Once an updated or modified route is identified, the updated or modified route(s) that meet the updated requirement information and data in view of the selected personal settings may be displayed **518** on the navigational display **18**.

(97) FIGS. **18**A-**18**C depict an example of a sequence (e.g., flow) of modifying a route through the skyway system **60** based on a personal settings selection by a user. In one example, a user may update or modify its personal settings selection by changing settings for wheelchair accessible routes, locations of restrooms, locations of restaurants, and/or one or more other suitable settings.

(98) FIG. **18**A depicts a navigational display **18** with a route on a map from a first location (e.g., the current location, as entered in the starting location box **76**) to a second location (e.g., Restaurant A, as entered in the destination location box **78**). The navigation display **18** may also include the destination display **70** with the navigation button **84** and a distance and estimated time until arrival at the destination. Further, the navigational display **18** may include a modify route box **116** overlaid on the map depicted in the navigational display **18**. When a user selects (e.g., taps or otherwise selects via the user interface **32** of the computing device **26**) the modify route box **116**, the navigational display **18** may display a modification options box **118**, as depicted in FIG. **18**B. The modification options box **118** may include a “Wheelchair friendly route” option for selecting a personal setting that requires routes to be wheelchair friendly, a “Routes with restrooms” option for selecting a personal setting that requires routes to include at least one publicly accessible restroom along the route, a “Routes with restaurants” option for selecting a personal setting that requires routes to include at least one restaurant along the route, a “Cancel” option to exit out of the modification options box **118**, and/or one or more other suitable selectable options.

(99) Selecting one or more options may result in the mobile application **10** dynamically updating a route to reflect the updated personal settings and displaying the updated route in the navigational display **18**. FIG. **18**C depicts an updated route in view of the updated personal setting. Although the updated route **58** depicted in FIG. **18**C does not appear to be different than the route **58** in FIG. **18**A, a user may know the route **58** has been updated to reflect personal setting selections because an updated personal settings box **120** may be overlaid on the map in the navigational display **18** indicating selected personal settings. In the example of FIG. **18**C, the updated personal settings box **120** indicates the route **58** is a wheelchair friendly route.

(100) FIG. **19** is a schematic flow diagram of an illustrative method **600** that the mobile application **10** may follow when implemented on the computing device **26** to initiate emergency assistance. The method **600** may include receiving **610** a selection of an emergency request option. A user may be able to initiate an emergency request option in one or more manner. In one example, a user may initiate an emergency request option on the computing device **26** independent from the mobile application **10** (e.g., through selecting a button or sequence of actions to initiate emergency assistance). In another example, a user may initiate an emergency request option via the mobile application **10** (e.g., through selecting a button or a sequence of actions integrated into the mobile application). Even when an emergency request has been initiated independent of the mobile application **10**, the location of the computing device **26** may be obtained from the mobile application via an API or other mechanism and sent to the appropriate emergency response providers. In response to receiving a selection of an emergency request option, the mobile application **10** may initiate **612** a communications tool. Once a communication tool has been initiated, an emergency request may be sent **614** to emergency response providers along with an indoor location, as determined through the mobile application **10**. In some cases, the mobile application **10** may automatically populate an emergency response request and send it via text message or a voice call without waiting for a user to select a communication tool, but this is not required. Settings (e.g., auto populate, auto send, which communication tool to use, etc.) for the emergency request feature of the mobile application may be saved in the personal settings database **20**, but this is not required.

(101) FIGS. **20**A and **20**B depict an example of a sequence (e.g., flow) of navigational displays **18** of the mobile application **10** that may be provided when requesting emergency assistance. FIG. **20**A depicts a navigational display **18** with a map of the skyway system **60** depicted thereon and a current location visual indicator **68** on the map. A user may select an emergency request option by interacting with the user interface **32** of the computing device **26** in one or more manners. In one example, a user may select and hold a button of the user interface to initiate the emergency request option of the mobile application **10** and/or perform one or more other actions to initiate the emergency request option. Once an emergency request option has been initiated, the navigational display **18** may depict an emergency request box **122**, as depicted in FIG. **20**B. The emergency request box **122** may include an “EMERGENCY” option for indicating an emergency is occurring at a location of the computing device **26**, a “Request assistance” option for indicating assistance is needed, but that it may not be due to an emergency situation, a “Cancel” option to exit out of the emergency request box **122**, and/or one or more other suitable selectable options. In one example, when the mobile application **10** receives a selection of the “EMERGENCY” option, the mobile application **10** may initiate a communication tool and automatically send an indoor location of the computing device **26** to emergency response providers and request help, but this is not required. In another example, when the mobile application receives a selection of the “Request assistance” option, the mobile application **10** may request further input from a user including, but not limited to, input concerning what type of assistance may be needed, is assistance time sensitive, what communication tool to use to request assistance, additional information to provide with the request for assistance, and/or other types of input concerning requested assistance, but this is not required.

(102) FIG. **21** is a schematic flow diagram of an illustrative method **700** that the mobile application

10 may follow when implemented on the computing device **26** to identify a location of a parked vehicle (e.g., a car, a bike, a boat, and/or other suitable means for transportation) within which the computing device **26** may be traveling. The method **700** may include the mobile application **10** observing **710** an accelerometer of the computing device **26** or other suitable accelerometer. The mobile application **10** may observe the accelerometer readings (e.g., outputs or measurements) through an API, but this is not required. As the accelerometer readings are being read and/or otherwise observed, the mobile application **10** may be computing whether **712** there has been a deceleration to a stop in the data output from the accelerometer. If the answer is no there has been no detected deceleration to a stop, the method **700** returns to observing **710** outputs from the accelerometer. If there has been a deceleration to a stop, the mobile application **10** may determine whether **714** the computing device **26** is located in a parking location. If the answer is no the computing device **26** is not located at a parking location, the method **700** may return to observing **710** outputs form the accelerometer. If there has been a deceleration to a stop and the computing device **26** is located in a parking location, the mobile application may mark **716** the current location of the computing device **26** the location of a parked vehicle.

(103) Although the method **700** describes a technique of monitoring readings from an accelerometer to determine when a vehicle has been parked, techniques using additional or alternative measurements may be utilized by the mobile application **10** to determine when a vehicle has been parked. In one example, in addition to or as an alternative to monitoring accelerometer readings, GPS signals, cellular signals, WiFi signals, and/or other signals may be monitored over time to facilitate determining when a computing device **26** is in a vehicle and when the vehicle has been parked. In another example, in addition to or as an alternative to monitoring accelerometer readings, the mobile application **10** may identify a vehicle has been parked by interfacing with a third-party application (e.g., a third party application that obtains GPS signals, Cellular signals, WiFi signals, makes a parked vehicle determination, and/or otherwise contains information and/or data related to movement of a vehicle) and receiving or obtaining an indication from the third-party application that a vehicle in which the computing device **26** may be traveling has parked. Other techniques are contemplated.

(104) The mobile application **10** may identify a parking location via sensed beacons **42** and by comparing sensed beacon data to facility data in a facility database **24**. Additionally or alternatively, the mobile application **10** communicate with other mobile applications or third party mobile applications (e.g., applications that provide a different function than the mobile application **10**, even if the applications are provided by the same entity as provides the mobile application **10**) via an API or other suitable communication mechanism to identify a parking location and/or for other suitable purposes.

(105) The process of detecting when a vehicle is parked and/or a location of a parked vehicle may be performed in the background by the mobile application **10**, without initiation by a user. Alternatively, a user may initiate a vehicle park monitoring feature in the mobile application **10** (e.g., in a personal settings database and/or at one or more other locations). In some cases, the mobile application **10** may continually monitor readings from the accelerometer and initiate a process for detecting a location of a parked vehicle (e.g., the method **700** or other suitable method for detecting a location of a parked vehicle) in response to detecting an increase in acceleration of the computing device **26** and/or other pattern in accelerometer readings that may be associated with the computing device **26** being in vehicle. Alternatively or in addition, the mobile application **10** may continually monitor third-party apps for indications that the computing device **26** may be in a moving vehicle and initiate a process for detecting a location of a parked vehicle in response to receiving or obtaining an indication that the computing device **26** may be in a moving vehicle.

(106) FIG. **22** depicts the navigational display **18** with a map of the skyway system **60** and a current location of the computing device **26** indicated by the current location visual indicator **68**. Additionally, the navigational display **18** may display the location of a parked vehicle as indicated

by the parking visual indicator **66**. In some cases, the parking visual indicator **66** indicating a location of a parked vehicle may only be visible when parking is selected from the scrollable list **54** and in other cases, the parking visual indicator **66** indicating a location of a parked vehicle may be displayed on the navigational display **18** without parking being selected from the scrollable list **54**. Further, although the parking visual indicator **66** indicating a location of a parked vehicle are depicted in the figures as a same element or configuration as that indicating a parking location, this is not required. If the parking visual indicators **66** indicating a location of a parked vehicle and the parking visual indicators **66** indicating a parking location are the same shape, the respective parking visual indicators **66** may have different features or indicators (e.g., different colors, added symbols, added shapes, etc.) to indicate their separate meanings to users. Alternatively or in addition, the parking visual indicators **66** indicating a location of a parked vehicle and the parking visual indicators **66** indicating a parking location may be different shapes or distinct objects.

(107) FIG. **23** is a schematic flow diagram of an illustrative method **800** that the mobile application **10** may follow when implemented on the computing device **26** to switch between an indoor map and an outdoor map (e.g. third party mapping application). In some cases, a single application may have access to an indoor map and an outdoor map. In other applications, one application may have access to the indoor map and another application may have access to an outdoor map. In some cases, the mobile application **10** may create routes that extend between the indoor map and the outdoor map. In some cases, the mobile application **10** may be in communication with an outdoor mapping application (e.g. Google maps) via an API or other suitable mechanism. The mobile application **10** may be configured to detect when the computing device **26** is outside the indoor transit system (e.g. not detecting beacons **42** of the indoor transit system). When the computing device **26** is outside the indoor transit system, the mobile application **10** may automatically reference an outdoor map and/or initiate an outdoor mapping application. When the mobile application detects it is inside the indoor transit system, the mobile application **10** may automatically reference the indoor map and/or initiate an indoor mapping application.

(108) The method **800** may include determining whether a beacon **42** is detected by determining if the computing device **26** has received a signal from or is in connection with a beacon **42** of an indoor transit system, as shown at **810**. When a beacon **42** is detected, the method **800** may include determining whether the location of the computing device **26** is in a mapped region of the indoor transit system. Sometimes, maps may only be available for part of the indoor transit system. In some cases, a location of the computing device **26** may be determined based on the detected beacon **42** and/or the signal strength from the detected beacon(s) (e.g. using the location identification sub-system **14** or other suitable system). When the beacon **42** is detected and the location of the computing device **26** is located in a mapped region, the method **800** may include depicting or showing **814** a determined indoor location of the computing device **26** on the indoor map on the navigational display **18** using the mobile application.

(109) When it is determined that a beacon **42** has not been detected or a location of the computing device **26** relative to the detected beacon **42** is not located on the indoor map, an indication the that user is outside a map coverage area may be shown, as shown at **816** (e.g., shown in the navigational display **18** of the mobile application **10**). When showing the indication that the user is outside of a coverage area, an outdoor map may be automatically referenced and/or an outdoor (e.g., a third-party) mapping service application may be initiated as shown at **818**.

(110) In some cases, switching between the indoor map and an outdoor map, or between an indoor mapping service (e.g., the mobile application **10**) and an outdoor mapping service (e.g., third-party mapping applications displaying an outdoor map), may be automatically performed by the mobile application **10** (e.g., using the location and identification sub-system **14**) without initiation by a user. In one example, a user may exit a mapped indoor area or interior of one or more structures while following an indoor route on the mobile application **10** and as the user exits the network of beacons (e.g., exits the indoor transit system, such as the skyway system **60**), the mobile

application **10** may automatically reference an outdoor map and/or initiate an outdoor mapping service to the same destination that the route in the mobile application **10** was directing the user, and cause an outdoor map to display a current location of the computing device **26**. Similarly, when a user is following a route on an outdoor mapping service, the mobile application **10** may recognize a computing device **26** on which the mobile application **10** is located has entered a network of beacons **42**, and may then automatically reference an indoor map and provide a route to the same destination the outdoor mapping service was taking the user. In another example, when a user is following a route on an outdoor mapping service, the mobile application **10** may indicate a closest entry point to a mapped indoor area or interior of one or more structures. In some cases, the mobile application may utilize information or data (e.g., weather data or other suitable data) to indicate the user should be routed inside at a particular location or entry point due to a street riot, a change in weather conditions, or other undesirable condition outdoors.

(111) FIG. **24** depicts the navigational display **18** with a map of the skyway system **60** and a current location of the computing device **26** indicated by the current location visual indicator **68**. Additionally, the navigational display **18** may include an outside area box **124** indicating to a user that the computing device **26** is outside of a network of beacons **42**. In some cases, the outside area box **124** may include a text description such as "YOU SEEM TO BE OUTSIDE OUR MAP AREA" and "We can send the nearest entry to your default map app installed on your device. Once you reach the entry point, relaunch this app.", but other text descriptions may be utilized. Although FIG. **24** depicts the current location visual indicator **68** in the skyway system **60**, such a location may be a last mapped location of the computing device **26**. In some cases, the mobile application **10** may be configured to depict a location of a computing device **26** or user on its map using other location techniques (e.g., GPS, cellular triangulation, etc.) when the computing device **26** has been determined to be outside of the network of beacons **42**.

(112) FIGS. **25**A and **25**B depict an example of a sequence (e.g., flow) of following an exhibit or tour through an indoor area or interior of one or more structures. Further, the navigational display **18** may depict a tour through an indoor area or interior of one or more structures that may be set up as a sequence (e.g., a series) of places of interest, such as exhibits for a museum, guided tours, or orientations of a building (e.g., for new hires of an organization), etc. A user may scroll through the scrollable list **54** to access a desired exhibit or tour with which to participate.

(113) FIG. **25**A depicts the navigational display **18** with a map of the skyway system **60** and a current location of the computing device **26** indicated by the current location visual indicator **68**. Further, FIG. **25**A depicts the current location visual indicator **68** near a museum **126** that includes a plurality of exhibits as indicated by exhibit visual indicators **128** connected by a path (e.g., gray dashes connecting the exhibit visual indicators **128** and/or other suitable paths in the navigational display **18**). When a user passes by an exhibit or a place of interest in a tour (e.g., like a checkpoint), the navigational display **18** may be updated accordingly. In some cases, when a user passes by an exhibit or place of interest in a tour, a textual description (e.g., "Exhibit **1**" or other suitable textual description) may be displayed on the navigational display **18** based on information and data in the rules engine database and/or other suitable information and data. In some cases, the navigational display **18** may include an exhibit description box **130** that may be selected by a user (e.g., by tapping on the box and/or interacting with the user interface **32** of the computing device **26**) to begin the tour and/or exhibit. In some cases, a title of the exhibit and/or tour may be provided in the exhibit description box **130** (e.g., "Medieval Exhibits Tour", as depicted in FIG. **25**A, or other suitable title or description).

(114) FIG. **25**B depicts a navigational display **18** similar to that in FIG. **25**A, but with the current location visual indicator **68** within the museum **126** adjacent Exhibit **1**. As the computing device traverses from exhibit-to-exhibit or place of interest to place of interest, an exhibit counter or tour counter in the exhibit description box **130** may provide a visual indication of where the computing device **26** and associated user is at with respect to the overall exhibit and/or tour. For example, in

FIG. **25**B, the positioning of the current location visual indicator is one fourth (¼) of the way done with the exhibit/tour. Such a feature may facilitate a user identifying how long an exhibit or tour might take to complete.

(115) A recap may be provided in the following. The present disclosure generally relates to navigating an indoor area such as an indoor transit system, using a computing device. In one example configuration a method of navigating an indoor transit system may be provided. The indoor transit system may include a network of indoor pathways, a plurality of access points for entering/exiting the indoor transit system, and a plurality of beacons distributed at designated locations throughout the indoor transit system. The method may include detecting one or more of the beacons of the indoor transit system using a mobile computing device and determining when the mobile computing device is inside the indoor transit system based on the detected one or more of the beacons. The method may further include identifying the location of the mobile computing device within the indoor transit system based on which of the plurality of beacons are detected by the mobile computing device and displaying an indoor map of at least part of the indoor transit system on a user interface of the mobile computing device, including the identified location of the mobile computing device. Further, the method may include receiving a destination accessible by the indoor transit system via the user interface of the mobile computing device, computing a route through the indoor transit system to the destination, and displaying on the user interface of the mobile computing device the computed route on the indoor map. In some cases, the indoor transit system comprises one or more of a skyway system and a subway system.

(116) The destination may be received as a street address. The destination may be received as a business name.

(117) The indoor transit system may be situated in a geographic region. The outdoor map may be defined for the geographic region and the outdoor map may identify the geographic location of at least some of the plurality of access points of the indoor transit system.

(118) Switching from displaying the indoor map of at least part of the indoor transit system on the user interface of the mobile computing device to displaying the outdoor map may occur when the mobile computing device determines that the mobile computing device is no longer inside the indoor transit system based on the detected one or more of the beacons.

(119) The route may extend along at least part of the indoor transit system and at least part of the outdoor map. The route may extend from inside the indoor transit system, through an access point to outside of the indoor transit system, along at least part of the outdoor map, through a different access point of the indoor transit system, and back into the indoor transit system to the destination. The route may extend from a location outside of the indoor transit system, along at least part of the outdoor map, through an access point of the indoor transit system and back into the indoor transit system to the destination. The route may extend from a location outside of the indoor transit system, along at least part of the outdoor map, through an access point of the indoor transit system and back into the indoor transit system to the destination.

(120) The methods discussed herein may include displaying turn-by-turn instructions as the mobile computing device traverses the computed route.

(121) The destination may be received as a nearest bathroom. The bathroom nearest to the identified location of the mobile computing device may be determined and entered as the destination.

(122) At least part of the indoor transit system may be closed based on a schedule. The computed route may take into account the schedule such that the computed route does not traverse through those parts of the indoor transit system when they are scheduled to be closed but may include those same parts when they are scheduled to be open.

(123) Computing the route through the indoor transit system to the destination may include checking to see if a wheelchair accessible route setting is set, and if so, computing the route through the indoor transit system to the destination using only wheelchair accessible parts of the

indoor transit system.
(124) In another example configuration, a method of navigating an indoor transit system may be provided. The indoor transit system may include a network of indoor pathways, a plurality of access points for entering/exiting the indoor transit system, and a plurality of beacons distributed at designated locations throughout the indoor transit system. The indoor transit system may be situated in a geographic region, where an outdoor map is defined for the geographic region and the outdoor map identifies the geographic location of at least some of the plurality of access points of the indoor transit system. The method may comprise detecting one or more of the beacons of the indoor transit system using a mobile computing device and determining when the mobile computing device is inside the indoor transit system or outside of the indoor transit system based on the detected one or more of the beacons. When it is determined that the mobile computing device is inside of the indoor transit system, the method may include identifying the location of the mobile computing device within the indoor transit system based on which of the plurality of beacons are detected by the mobile computing device and displaying an indoor map of at least part of the indoor transit system on a user interface of the mobile computing device, including the identified location of the mobile computing device. When it is determined that the mobile computing device is outside of the indoor transit system, the method may include identifying the location of the mobile computing device in the geographic region based on location services of the mobile computing device and displaying the outdoor map of at least part of the geographic region on the user interface of the mobile computing device, including the identified location of the mobile computing device. The method may further include receiving a destination accessible using at least part of the indoor transit system via the user interface of the mobile computing device, computing a route to the destination that includes at least part of the indoor transit system, and displaying on the user interface of the mobile computing device the computed route.
(125) The methods disclosed herein may include switching from displaying the indoor map of at least part of the indoor transit system on the user interface of the mobile computing device to displaying the outdoor map when the mobile computing device determines that the mobile computing device is no longer inside the indoor transit system based on the detected one or more of the beacons.
(126) The route may extend along at least part of the indoor transit system and at least part of the outdoor map. The route may extend from inside the indoor transit system, through an access point to outside of the indoor transit system, along at least part of the outdoor map, through a different access point of the indoor transit system, and back into the indoor transit system to the destination. The route extends from a location outside of the indoor transit system, along at least part of the outdoor map, through an access point of the indoor transit system and back into the indoor transit system to the destination. The route extends from a location outside of the indoor transit system, along at least part of the outdoor map, through an access point of the indoor transit system and back into the indoor transit system to the destination.
(127) In further example configuration, a computer readable medium having stored thereon in a non-transitory state a program code for use by a mobile computing device connectable to a network may be provided, where the program code may cause the mobile computing device to execute a method of navigating one or more of a skyway system or a subway system. The method may include detecting one or more of a plurality of beacons of the indoor transit system by the mobile computing device and determine when the mobile computing device is inside the indoor transit system based on the detected one or more of the beacons. The method may further include identifying the location of the mobile computing device within the indoor transit system based on which of the plurality of beacons are detected by the mobile computing device and displaying an indoor map of at least part of the indoor transit system on a user interface of the mobile computing device, including the identified location of the mobile computing device. Further, the method may include receiving a destination accessible by the indoor transit system via the user interface of the

mobile computing device, computing a route through the indoor transit system to the destination, and displaying on the user interface of the mobile computing device the computed route on the indoor map.

(128) Although specific embodiments have been illustrated and described herein, those of ordinary skill in the art will appreciate that any arrangement calculated to achieve the same techniques can be substituted for the specific embodiments shown. This disclosure is intended to cover any and all adaptations or variations of various embodiments of the disclosure.

(129) It is to be understood that the above description has been made in an illustrative fashion, and not a restrictive one. Combination of the above embodiments, and other embodiments not specifically described herein will be apparent to those of skill in the art upon reviewing the above description.

(130) The scope of the various embodiments of the disclosure includes any other applications in which the above structures and methods are used. In the foregoing Detailed Description, various features are grouped together in example embodiments illustrated in the figures for the purpose of streamlining the disclosure. This method of disclosure is not to be interpreted as reflecting an intention that the embodiments of the disclosure require more features than are expressly recited in each claim. Rather, inventive subject matter lies in less than all features of a single disclosed embodiment.

Claims

1. A method for tracking a plurality of mobile devices in a facility, the method comprising: detecting a location of a first mobile device from amongst the plurality of mobile devices in the facility; rendering on a display of the first mobile device, one or more options, wherein an option of the one or more options corresponds to pairing of the first mobile device with a second mobile device different from the first mobile device; pairing the first mobile device with the second mobile device based on a selection of the option by a user of the first mobile device; and generating an alert on at least one of the first mobile device and the second mobile device in response to determining if: a distance between the first mobile device and the second mobile device exceeds a pre-defined range, or at least one of the first mobile device and the second mobile device is in a crowded area, or at least one of the first mobile device and the second mobile device is out of a map area of the facility.

2. The method of claim 1, wherein rendering on the display of the first mobile device, one or more options further comprises: rendering at least one option on the display, wherein the at least one option corresponds to: sharing the location of the first mobile device with at least one mobile device from amongst the plurality of mobile devices in the facility, wherein the at least one mobile device is different from the first mobile device; saving the location of the first mobile device in a database; and closing of the one or more options rendered on the display of the first mobile device.

3. The method of claim 1, wherein in response to the selection of the option by the user, rendering one or more pairing options on the display, wherein the one or more pairing options comprises at least one of: one or more first contacts on the first mobile device; one or more second contacts on the first mobile device, wherein the one or more second contacts are rendered based at least in part on a frequency of pairing; and one or more third contacts associated with a social media account of the user.

4. The method of claim 1, further comprising defining, by the user, a duration of time for which the first mobile device is to be paired with the second mobile device and the distance between the first mobile device and the second mobile device.

5. The method of claim 1, further comprising: confirming a pair request by the second mobile device for pairing the first mobile device with the second mobile device; and displaying, on the display of the first mobile device, a first visual indicator that comprises an identifier of a paired

user, wherein the paired user uses the second mobile device.
6. The method of claim 5, further comprising displaying a second visual indicator associated with the paired user, wherein the second visual indicator is indicative of the alert generated in response to determining if: the distance between the first mobile device and the second mobile device exceeds the pre-defined range, at least one of the first mobile device and the second mobile device is in the crowded area, or at least one of the first mobile device and the second mobile device is out of the map area of the facility.
7. The method of claim 6, further comprising: displaying a reason for the alert with respect to the paired user on the display of the first mobile device.
8. A system to track a plurality of mobile devices in a facility, the system comprising: a processor; and a memory communicatively coupled to the processor, wherein the memory comprises one or more instructions which when executed by the processor cause the processor to: detect a location of a first mobile device from amongst the plurality of mobile devices in the facility; render on a display of the first mobile device, one or more options, wherein an option of the one or more options corresponds to pairing of the first mobile device with a second mobile device different from the first mobile device; pair the first mobile device with the second mobile device based on a selection of the option by a user of the first mobile device; and generate an alert on at least one of the first mobile device and the second mobile device in response to determining if: a distance between the first mobile device and the second mobile device exceeds a pre-defined range, or at least one of the first mobile device and the second mobile device is in a crowded area, or at least one of the first mobile device and the second mobile device is out of a map area of the facility.
9. The system of claim 8, wherein the processor is further configured to: render at least one option on the display of the first mobile device, wherein the at least one option corresponds to: sharing the location of the first mobile device with at least one mobile device from amongst the plurality of mobile devices in the facility, wherein the at least one mobile device is different from the first mobile device; saving the location of the first mobile device in a database; and closing of the one or more options rendered on the display of the first mobile device.
10. The system of claim 8, wherein the processor is further configured to: render one or more pairing options on the display, wherein the one or more pairing options comprises at least one of: one or more first contacts on the first mobile device; one or more second contacts on the first mobile device, wherein the one or more second contacts are rendered based at least in part on a frequency of pairing; and one or more third contacts associated with a social media account of the user.
11. The system of claim 8, wherein the processor is further configured to receive from the user, a duration of time for which the first mobile device is to be paired with the second mobile device and the distance between the first mobile device and the second mobile device.
12. The system of claim 8, wherein the processor is further configured to: confirm a pair request by the second mobile device for pairing the first mobile device with the second mobile device; and display on the display of the first mobile device, a first visual indicator that comprises an identifier of a paired user, wherein the paired user uses the second mobile device.
13. The system of claim 12, wherein the processor is further configured to display a second visual indicator associated with the paired user, wherein the second visual indicator is indicative of the alert generated in response to determining if: the distance between the first mobile device and the second mobile device exceeds the pre-defined range, at least one of the first mobile device and the second mobile device is in the crowded area, or at least one of the first mobile device and the second mobile device is out of the map area of the facility, and wherein the processor is further configured to display a reason for the alert with respect to the paired user on the display of the first mobile device.
14. A non-transitory, computer-readable storage medium having stored thereon executable instructions that, when executed by one or more processors cause the one or more processors to:

detect a location of a first mobile device from amongst a plurality of mobile devices in a facility; render on a display of the first mobile device, one or more options, wherein an option of the one or more options corresponds to pairing of the first mobile device with a second mobile device different from the first mobile device; pair the first mobile device with the second mobile device based on a selection of the option by a user of the first mobile device; and generate an alert on at least one of the first mobile device and the second mobile device in response to determining if: a distance between the first mobile device and the second mobile device exceeds a pre-defined range, or at least one of the first mobile device and the second mobile device is in a crowded area, or at least one of the first mobile device and the second mobile device is out of a map area of the facility.

15. The non-transitory, computer-readable storage medium of claim 14, wherein the one or more processors is further configured to: render at least one option on the display of the first mobile device, wherein the at least one option corresponds to: sharing the location of the first mobile device with at least one mobile device from amongst the plurality of mobile devices in the facility, wherein the at least one mobile device is different from the first mobile device; saving the location of the first mobile device in a database; and closing of the one or more options rendered on the display of the first mobile device.

16. The non-transitory, computer-readable storage medium of claim 14, wherein the one or more processors is further configured to: render one or more pairing options on the display, wherein the one or more pairing options comprises at least one of: one or more first contacts on the first mobile device; one or more second contacts on the first mobile device, wherein the one or more second contacts are rendered based at least in part on a frequency of pairing; and one or more third contacts associated with a social media account of the user.

17. The non-transitory, computer-readable storage medium of claim 14, wherein the one or more processors is further configured to receive from the user, a duration of time for which the first mobile device is to be paired with the second mobile device and the distance between the first mobile device and the second mobile device.

18. The non-transitory, computer-readable storage medium of claim 14, wherein the one or more processors is further configured to: confirm a pair request by the second mobile device for pairing the first mobile device with the second mobile device; and display on the display of the first mobile device, a first visual indicator that comprises an identifier of a paired user, wherein the paired user uses the second mobile device.

19. The non-transitory, computer-readable storage medium of claim 18, wherein the one or more processors is further configured to display a second visual indicator associated with the paired user, wherein the second visual indicator is indicative of the alert generated in response to determining if: the distance between the first mobile device and the second mobile device exceeds the pre-defined range, at least one of the first mobile device and the second mobile device is in the crowded area, or at least one of the first mobile device and the second mobile device is out of the map area of the facility.

20. The non-transitory, computer-readable storage medium of claim 19, wherein the one or more processors is further configured to display a reason for the alert with respect to the paired user on the display of the first mobile device.