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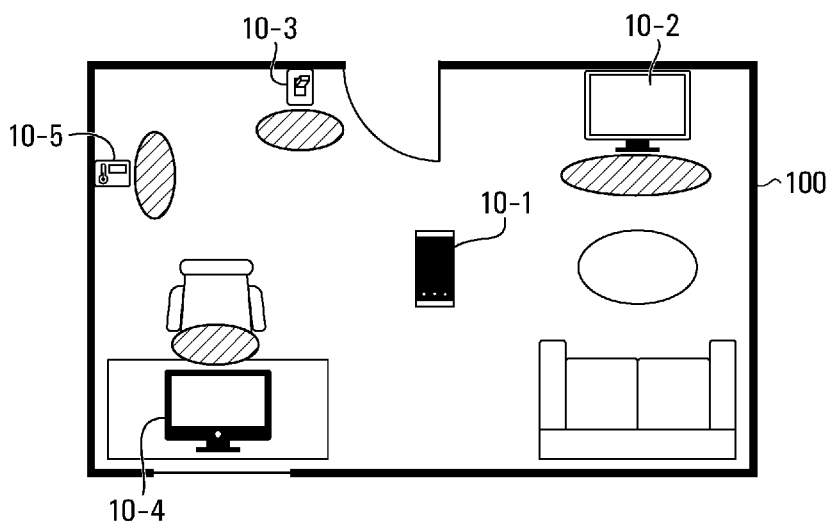


FIG. 8A

(57) Abstract: A method of locating interoperable devices at a location, comprising receiving from a guest device at the location a query over a network to a location server. The query includes an indicator of location of the guest device, and an identifier of the guest device. The method includes querying a data store, to identify a set of proximate interoperable devices at the location, using the indicator of location; identifying permitted proximate interoperable devices from the set of proximate interoperable devices, for which contact permission by the guest device has been granted; and dispatching a message over the network to each of the permitted proximate interoperable device causing them to emit a beacon signal, that is audible or visible at the location.



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INTEROPERABLE DEVICE LOCATION

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to US Provisional Application No. 62/342541 filed May 27, 2016, the contents of which are hereby incorporated by reference.

TECHNICAL FIELD

[0002] This relates to mobile devices, and more particularly to locating other devices of interest that are in proximity to a mobile device.

BACKGROUND

[0003] Mobile electronic devices are often interoperable with other devices, and wish to establish connections to other devices. This is particularly so for mobile devices that are configured to establish physical (e.g. mechanical) connections to other devices. US Patent No. 9,312,633, the contents of which are hereby incorporated by reference, for example discloses devices capable of physical and electrical interconnection by way of magnetic connectors.

[0004] Although interconnection is often desirable, locating devices for interconnection is often difficult, particularly if the devices are mobile, or the environment in which they are operating is unfamiliar, or changing.

[0005] Accordingly, there remains a need for facilitating the interconnection of electronic, and particularly mobile, devices.

SUMMARY

[0006] According to an aspect, there is provided a method of locating interoperable devices at a location, comprising receiving from a guest device at the location, a query over a network to a location server, the query including an indicator of location of the

guest device, and an identifier of the guest device; querying a data store, to identify a set proximate interoperable devices at the location, using the indicator of location; identifying permitted proximate interoperable devices from the set of proximate interoperable devices, for which contact permission by the guest device has been granted; and dispatching a message over the network to each the permitted proximate interoperable device, causing each the permitted proximate device to emit a beacon signal, that is audible or visible at the location.

[0007] According to another aspect, there is provided a method of interconnecting first and second devices, each including a physical connector, the method comprising sending from the first device a near range query signal; receiving from a second device, an indicator that the second device is within a defined proximity of the first device; generating at the first device, an indicator of relative position of the second device to the first device, to allow the first device to be guided to the second device for interconnection by way of its physical connector.

[0008] Other features will become apparent from the drawings in conjunction with the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] In the figures which illustrate example embodiments,

[0010] **FIG. 1** depicts multiple electronic devices, in communication with a network and server, exemplary of embodiments;

[0011] **FIG. 2** schematically depicts two proximate devices, exemplary of embodiments;

[0012] **FIG. 3** is a block diagram of an example device;

[0013] **FIG. 4** is a block diagram of memory at the device of **FIG. 3**;

[0014] **FIGS. 5A** and **5C** are flow charts of blocks performed at the device of **FIG. 3**;

[0015] **FIGS. 5B** and **5D** are flow charts of blocks performed at the server of **FIG. 1**;

[0016] **FIGS. 6A** and **6B** illustrates the devices of **FIG. 1** in an environment proximate other devices;

[0017] **FIG. 7** illustrates a screen of an example device of **FIG. 1**;

[0018] **FIGS. 8A** and **8B** illustrates responding proximate devices in an environment; and

[0019] **FIG. 9A-9D** illustrate exemplary electronic devices in point to point communication.

DETAILED DESCRIPTION

[0020] **FIG. 1** illustrates a plurality of mobile devices **10-1**, **10-2**, **10-3**, **10-4** (individually and collectively devices **10**) in communication with a network **12**. Example devices **10** are detailed further with reference to **FIGS. 2** to **4** and may be based on devices disclosed in greater detail in U.S. patent No. 9,312,633.

[0021] **FIG. 2** schematically depicts two such devices **10-1** and **10-2**. Each device **10** may include a housing **40** defined by respective external surfaces. Device **10** can be any suitable electronic devices that interface with one another to provide complementary functions as described herein. At least one of devices **10** may be a mobile computing device. For clarity in the discussion below, mobile computing devices **10** are commonly referred to as “mobile devices” or “devices” for brevity.

[0022] Example devices include, without limitation, cellular phones, cellular smart-phones, wireless organizers, pagers, personal digital assistants, computers, laptops, handheld wireless communication devices, wirelessly enabled notebook computers, portable gaming devices, tablet computers, televisions, monitors, thermostats,

speakers or any other portable electronic device with processing and communication capabilities. In at least some embodiments, devices as referred to herein can also include, without limitation, peripheral devices such as displays, printers, touchscreens, projectors, digital watches, cameras, digital scanners and other types of auxiliary devices that may communicate with another computing device.

[0023] In one example, each of devices **10** may be a smartphone, or one may be a smartphone and the other a peripheral device (e.g., a speaker, a keyboard, a display screen, a camera). In another example, one device may be a touchscreen enabled device and the other a type of communication device (e.g., a router, alarm panel, home automation interface, thermostat, or the like) for connection to other devices. As will be apparent, other types of computing devices **10** can be envisaged that benefit from interconnection and interoperability.

[0024] Further, in some embodiments, devices **10** may be of the same type – generally identical in structure and components. In other embodiments exemplified below, devices **10** (or a similar device) may interoperate with other different yet compatible devices, in a manner exemplified herein. As depicted, each device **10** include a touch display **50**.

[0025] Touch display **50** may, for example, be capacitive display screens that include a touch sensing surface. Such a display may be integrated as a single component. Alternatively, touch display **50** may include suitably arranged separate display and touch components. Touch display **50** may be adapted for sensing a single touch, or alternatively, multiple touches simultaneously. Touch display **50** may sense touch by, for example, fingers, a stylus, or the like. Touch display **50** may return the coordinates of any touch or touches for use by a process or device **10**. Likewise, touch display **50** may be used to display pixelated graphics – in the form of computer rendered graphics, video and the like.

[0026] In some embodiments, a composite display formed as a larger interconnected screen, allows input to be received one or more interconnected touch display **50** of another device **10**.

[0027] Each of mobile devices **10** includes respective connectors **44** for allowing interconnection of devices **10**. In the example illustrated in **FIG. 2**, device **10-1** and **10-2** includes four connectors **44a**, **44b**, **44c**, **44d** (individually and collectively connector(s) **44**). Device **10-1** and **10-2** are illustrated as interconnected by way of connectors **44a** and **44b**.

[0028] In depicted embodiments connectors **44** are magnetic connectors capable of magnetically mechanically interconnecting devices **10** and further optionally creating an electrical connection between devices **10**, as detailed in the '633 Patent.

[0029] Connectors **44** may for example be physical connectors to a serial communications port, such as a USB port, or the like. In a particular embodiment, connectors **44** may be magnetic connectors, as detailed in PCT Publication No. WO 2015/070321, the contents of which are hereby incorporated by reference.

[0030] Although connectors **44** have been shown at the corners of each edge of device **10**, other location of connectors **44** may be envisaged. For example, connectors on each of devices **10** can be located at the centre of the top, bottom, left and right edges of the devices, as for example illustrated in US Patent Application No. 15/013,750, the contents of which are hereby incorporated by reference. Additionally, although four connectors have been shown, the number of connectors provided on devices **10** may vary from device to device, and may depend on the type of device.

[0031] Devices **10-1** and **10-2** shown in **FIG. 2** have been illustrated in combination, with particular exemplary connector and device form factor and geometry. Of course, alternate configurations, layout, and positioning for the connectors and alternate size and layout of the devices are possible.

[0032] Similarly, although two interconnected devices **10-1**, **10-2** are shown in **FIG. 2**, multiple (e.g., three or more) interconnected devices can be envisaged having alternate connector configurations, layout, and position and alternate size and layout of device **10**. Other geometries of devices **10**, for example, generally rectangular with rounded corners, oval, or rounded in shape, may be contemplated by a person skilled

in the art. Example devices having different geometries are for example illustrated in US Patent Application No. 15/013,750.

[0033] An example hardware architecture of device **10** is further detailed with reference to **FIG. 3**. As illustrated, device **10** includes a processor **21**, processor readable memory **27**, and input/output (I/O) interface **23**; a network interface **25**; and a position receiver **29**. Device **10** may further include touch display **50**; one or more audio transducers **32**. Connectors **44** may be in communication with processor **21** by way of I/O interface **23**.

[0034] Processor **21** may be a suitable processor forming part of processing core **42**, and may include a numerical processor, and a graphics processor. In embodiments, processor **21** may be a RISC processor having an ARM based architecture, and may for example, be a suitable mobile processor manufactured by Qualcomm, Mediatek, Apple or the like. In other embodiments, processor **21** may be based on the x86 architecture. In yet other embodiments, processor **21** may be a custom processor.

[0035] Device **10** further includes a position receiver **29**. In the depicted embodiment the position receiver **29** may be a receiver capable of receiving a satellite position signal, for example, from a global positioning (GPS) satellite **16** or other satellites such as one or more GNSS satellites. Alternatively, or additionally receiver **29** may receive an indoor positioning signal, from a suitable indoor positioning system (IPS). IPS systems are, for example, disclosed at https://en.wikipedia.org/wiki/Indoor_positioning_system. Position receiver **29** may further be capable of receiving a position signal and optionally a beacon signal from a known location. In the depicted embodiment position receiver **29** may be a relatively high accuracy location receiver – capable, for example, of determining the position of device **10** within several metres and preferably within the centimetre range. In alternate embodiments, position receiver **29** may be a combination of hardware and software capable of determining the location of device **10**, using location services.

[0036] Network **12** (**FIG. 1**) is a packet switched network and may include several local area and wide area networks, and may include the public internet. Devices **10** may communicate with network **12** by way of a network interface which may take the form of a Wi-Fi or cellular network interface, for example, compliant with one or more wireless networking standards including the IEEE802.11 family of standards; GSM; GPRS; 3G; 4G; 5G; LTE; or similar standards.

[0037] Network interface **25** may include one or more radios for data (and optional voice) communication with a complementary wireless network, using, for example, one or more wireless networking standards including the IEEE802.11 family of standards; GSM; GPRS; 3G; 4G; 5G; LTE; or similar standards.

[0038] A server **20** hosts a database **22** that allows location registration of each of devices **10** by way of network **12**. Server **20** may be a conventional database server, and may therefore include a processor, memory storing database **22**, processor executable instructions to access database **22**, and to perform methods detailed herein. The database may be a relational database – such as an SQL database, or other database or datastore. Database **22** stores one or more database structures (e.g. database tables) that store device identification information, device location, owner information, guest information, and permission information, as further detailed below for each device **10**. As will be appreciated, database **22** may be updated periodically (i.e. at defined intervals) and will allow searching of proximate devices; devices with like OwnerIDs; devices that allow specific guests; and other searching and manipulation of the data, using a suitable program instructions at server **20**. Device identification information, owner information, guest information, and permission information may be input at use interface of a device **10**, and provided to server **20**. In particular, and as will become apparent, exemplary of embodiments, proximate interoperable devices **10** with suitable permission are able to locate each other through use of server **20**, by dispatching suitable queries to server **20** over network **12**, that are processed and responded to by server **20**, as detailed herein. Interoperable, in this context, may refer to the ability of one device to communicate and/or otherwise interact with another device, either directly or indirectly. In some embodiments this

may simply mean that one device can cause another to signal its location. In other embodiments this may mean that one device (e.g. device **10-1**) may control or change settings of another. In yet other embodiments, this may mean establishing a communication link or channel and/or physical or logical interconnection of the devices.

[0039] FIG. 4 illustrates an example organization of software within memory **27** of device **10**. As illustrated, memory **27** may host an operating system **34**; a location services application **36**; user applications **38**; and data **39**. Operating system **34** may be Android; Linux; Windows; iOS; or similar software. It may take the form of an embedded system, or be loaded from persistent storage.

[0040] Exemplary applications within applications **38**, allows devices each of devices **10** to operate in a manner desired/required by its end user. Additionally, an application within applications **38** at device **10** allows an initiating device **10** to locate other complementary devices, to allow intercommunication and optional interconnection with the other devices.

[0041] Devices **10** may for example be located in an environment **100** as illustrated in FIG. 6A-6B and 8. Within the environment of FIG. 6A, a device **10-1**, acting an initiating device, may wish to locate proximate devices **10-2**, **10-3**, **10-4**, etc. and therefore allow intercommunication with and potential interconnection with these other devices.

[0042] Environment **100** may be a house, an apartment, a room, or the other location. In the depicted embodiment device **10-1** may be a mobile device – such as a cell phone, remote control, or music player, while device **10-2**, **10-3**, **10-4** and **10-5** may be stationary. For example, device **10-5** may be a thermostat, device **10-2** may be a light switch, device **10-3** may be a television, device **10-4** may be a stationary computing device. Other combinations of devices **10** in an environment **100** will be apparent to those of ordinary skill.

[0043] Blocks performed by device **10-1** acting as an initiating (guest) device are illustrated in **FIG. 5A** and **5C**; blocks performed by server **20** (**FIG. 1**) are illustrated in **FIG. 5B** and **5D**. In block **S502**, owner information may be provided by device **10-1** to server **20** that receives such information over network **12** and maintains it within database **22** in block **S552** (**FIG. 5B**). Blocks **S502** to **S504** may be periodically repeated, with each of devices **10-1** to **10-4** when powered up contacting server **20** over network **12** to create a suitable record (if no such record exists) or alternatively cause their respective record to be updated. In particular, in block **S504**, each device **10** periodically provides its location in terms of coordinates (e.g. latitude, longitude and altitude) as gleaned from its location receiver **29**, along with an optional time stamp. In addition to GPS coordinates, location data in the form of text strings that indicate the location of the device, e.g., the name of the room; name of a local area network; or the like. For example, a device **10** may be labelled “bedroom”, “kitchen”, “boardroom”, “suzy’s room”, etc. Device **10** may be determined to be proximate if it is in the same room and/or proximate the same local area network. Server **20** thus stores location information specific to devices **10** within database **22**, generally in real time.

[0044] Accordingly, server **20** may be queried to obtain the location or identities of other devices. A device **10** (e.g. device **10-1**) may initiate such a query as illustrated in **FIG. 5C**. Specifically, in block **S506**, device **10-1** dispatches proximate device query/request to server **20**. In response to receiving the query in block **S556**, a processor at server **20** may query database **22** in blocks **S558** – **S560** to identify proximate devices **10** (in block **S558**) for which device **10-1** has access permission (in block **S560**). In particular, server **20** may simply locate devices **10** proximate device **10-1** (e.g. at the same location, or within a defined radius of device **10**) – for example by querying devices with the radius, or proximate a similar wi-fi network, etc in block **S558**. Server **20** may for example identify devices **10** within a certain distance as calculated from the coordinates of device **10-1** and the remaining devices in block **S558**.

[0045] Additionally, or alternatively server **20** may identify which of the proximate devices **10** for which device **10-1** has access permission in block **S560**. For such

permitted proximate devices, the GuestID or OwnerID may include the OwnerID of device **10-1**, or may otherwise indicate that device **10** may access/intercommunicate with it. Permission may, of course, be otherwise indicated – either expressly or otherwise. Server **20** may further convert device location information to relative device location information allowing it to calculate which of these devices are within a defined radius of device **10-1**.

[0046] Server **20** using this information may then either send an indicator of devices proximate device **10-1** to device **10-1** and /or notify those proximate devices of the query by device **10-1** in block **S562** and **S564** over network **12**. Device **10-1** may receive the list in block **S508** respond with a notification to the user that complementary devices are near in block **S510**, and/or otherwise update its user interface as detailed below..

[0047] For example, as illustrated in **FIG. 6B**, device **10-1** may respond with a visual indicator – by for example, highlighting the entire periphery of display **50** at device **10-1**. By contrast, in the absence of proximate complementary devices, display **50** need not display any indicator, or an indicator that no devices are proximate (as for example depicted in **FIG. 6A**).

[0048] Proximate devices **10-2** to **10-5** may, for example, be identified to device **10-1** by server **20**, by their device name, location (or distance – for example in meters from device **10-1**), network ID, IP address, or the like.

[0049] In an embodiment, server **20** may provide one or more messages to device **10-1** that identify approximate devices by their device type and/or relative location, as for example illustrated in **FIG. 6B**. In an embodiment, the relative location of each of devices **10-2-10-5**, proximate device **10-1**, may be graphically displayed on a display **50** of device **10-1**.

[0050] Additionally, proximate devices **10-2**, **10-3**, **10-4** and **10-5**, may be signalled with a complementary message from server **20** to emit a beacon signal. The beacon signal may local – to be received at device **10-1**. The beacon signal may be a radio

signal, an audible, visible or other signal that may allow the locating of devices **10-2**, **10-3**, **10-4**, and **10-5** within location by device **10-1**. The complementary message may further cause devices **10-2** to **10-5** to assume a state for intercommunication with device **10-1**.

[0051] Optionally, the beacon signal may be customized by the user. Customization may be effected at device **10** or optionally stored at server **20**. For example, when highlighting the periphery of display **50**, the colour may be associated with a particular user and may be pre-selected by the user.

[0052] The beacon signal may also be customized according to the degree of permissions granted to device **10-1** as stored at database **22**, (as a guest) beacon may be different than a beacon provided to the owner. A combination of settings at device **10** and data stored in database **22** may control the nature of the beacon signal.

[0053] For example, devices **10-2** to **10-5** may emit an audible tone, vibrate, “power on” or “wake up”, etc. in response to receiving a message from server **20**. Devices **10-2** to **10-5** may also optionally enter a pairing or connection mode. Device **10-1** may also be provided with the identity of one or more messages indicating proximate devices to which device **10-1** may communicate and/or interconnect.

[0054] As device **10-1** moves within location **100**, its display **50** may be updated by application **38** and/or other proximate devices **10** may be signalled of movement within location **100** by server **20**.

[0055] Additionally, and optionally, as location information at server **20** is updated by device **10-1**, server **20** may signal other devices **10-2** to **10-5** that device **10-1** is now proximate (or more proximate). Alternatively, devices **10-2** to **10-5**, more proximate may be signalled to emit higher volume sounds or more visible indicators as device **10-1** become proximate. Additionally, device **10-1** may signal relative proximity to other devices to a user by way of its user interface.

[0056] For example, as depicted in **FIGS. 6A-6B**, and **7**, the proximity of each device may be indicated on the screen of device **10-1** and portions of the screen of

device **10-1** that are most proximate to one of the other devices may be lit up. Thus, in **FIG. 6A**, display **50** does not identify any proximate device. In **FIG. 6B**, device **10-1** illustrates that devices are proximate is indicated by lighting the periphery of screen **50** of device **10-1**, and providing a list of proximate devices.

[0057] In **FIG. 7** the relative location of devices **10-2** to **10-5** are indicated by bars reflective of the relative locations of these devices to the device **10-1**, on screen **50** of device **10-1**. Again, as device **10-1** moves, the screen may be updated to reflect movement.

[0058] Updating of display **50** may be done by processor **21** of device **10-1** calculating its relative location to other devices **10-2** to **10-5**.

[0059] Of note, there may be other proximate device in environment that may not be interoperable with device **10-1** including device **10** that may not have permissions to interoperate with device **10-1**. These devices, will not respond to a request to identify proximate device, initiated by device **10-1**, as server **20** will not dispatch a message to such devices, nor identify them to device **10-1**.

[0060] **FIGS. 8A** and **8B** schematically illustrate devices **10-2** to **10-5** emitting an audible or visual beacon signal in response to being instructed to do so by server **20** in block **S562**, in response to a request by device **10-1**, acting as an initiating device. As illustrated in **FIG. 8A**, compatible devices **10-2**, **10-3**, **10-4**, and **10-5**, in response to receiving a message over network **12** (**FIG. 1**) may emit a visual or audible signal perceptible by a user at device **10-1**, allowing the user to physically locate devices **10-2**, **10-3**, **10-4**, and **10-5**. Optionally, closer devices may emit a more pronounced beacon signal. For example, as schematically illustrated in **FIG. 8B**, devices **10-2**, **10-4** and **10-5** may emit an audible signal, while device **10-3** need not. Optionally, the intensity of the beacon signal may vary as device **10-1** moves within environment **100**. Optionally, the beacon signal emitted by each device **10-2** to **10-5** may be controlled through interaction with a user interface at display **50** of device **10-1**, thus allowing a user of device **10-1** to pinpoint the location of a particular device **10**.

[0061] Once device **10-1** is sufficiently proximate to one of the other devices (e.g. device **10-2**), device **10-1** may establish a communication channel that is point to point with a proximate device and/or be physically interconnect to the proximate device. For example, connectors **44** of devices **10-1** and **10-2** may be interconnected as in **FIG. 2**, and devices **10-1** and **10-2** may establish an electrical connection and/or a communication link as described in the '633 Patent. Alternatively, the point-to-point communication channel may be established using near field communication (NFC); Bluetooth; or other suitable wireless protocol.

[0062] In yet other alternative embodiment, detailed in **FIGS. 9A-9D**, devices **10-1** and **10-6** or **10-7** (like devices **10**, detailed above) may allow for their location without use of server **20**. For example, as detailed in **FIG. 9A**, device **10-1** may sense proximity of device **10-6** by use of a proximity sensor – in the form of a hall effect sensor; magnetic sensor; RF sensor; or the like. In response to sensing device **10-6**, device **10-1** may update its screen **50** as described above to signal proximity of device **10-6**.

[0063] Of course, the above described embodiments are intended to be illustrative only and in no way limiting. The described embodiments are susceptible to many modifications of form, arrangement of parts, details and order of operation. The invention is intended to encompass all such modification within its scope, as defined by the claims.

WHAT IS CLAIMED IS:

1. A method of locating interoperable devices at a location, comprising:

receiving from a guest device at the location, a query over a network to a location server, said query including an indicator of location of said guest device, and an identifier of said guest device;

querying a data store, to identify a set proximate interoperable devices at the location, using said indicator of location;

identifying permitted proximate interoperable devices from said set of proximate interoperable devices, for which contact permission by said guest device has been granted; and

dispatching a message over said network to each said permitted proximate interoperable device, causing each said permitted proximate device to emit a beacon signal, that is audible or visible at said location.
2. The method of claim 1, further comprising dispatching from said location server to said guest device, a list of said permitted proximate interoperable devices.
3. The method of claim 1, further comprising dispatching from said location server to said guest device, a message to display a relative location of said permitted proximate interoperable devices.
4. The method of claim 3, wherein said beacon signal varies in dependence on an identity of the guest device.

5. The method of claim 3, wherein said beacon signal varies in dependence on the location of the guest device.
6. The method of claim 1, wherein said beacon signal further comprises a radio frequency signal received at said guest device.
7. The method of claim 1, wherein said beacon signal further comprises an infrared signal received at said guest device.
8. The method of claim 1, wherein said indicator of location includes a geographic indicator, obtained using a satellite signal.
9. The method of claim 1, wherein said indicator of location includes text indicative of location.
10. The method of claim 1, wherein said indicator of location includes a geographic indicator, obtained using an indoor positioning system.
11. The method of claim 1, further comprising establishing a point to point communication channel between said guest device and at least one of said proximate interoperable devices.
12. The method of claim 1, further comprising causing said guest device to present at least one indicator of relative position of said guest device to said permitted proximate interoperable devices.
13. The method of claim 12, wherein relative position of said guest device to said permitted proximate interoperable devices are generated at said guest device from said indicator of location of said guest device and an indicator of location of said permitted proximate interoperable devices.

14. The method of claim 12, wherein relative positions of said guest device to said permitted proximate interoperable devices are communicated from said server to said guest device.

15. The method of claim 12, wherein said at least one indicator of relative position comprises a graphical indicator in the direction of said permitted proximate interoperable devices.

16. The method of claim 15, wherein said graphical indicator includes illuminating a portion of a screen of said guest device proximate one of several physical connectors at said guest device, and said permitted proximate interoperable devices.

17. The method of claim 16, wherein said portion of said screen is illuminated with a brightness inversely proportional to a distance between said guest device and said permitted proximate interoperable devices.

18. The method of interconnecting first and second devices, each including a physical connector, said method comprising:

sending from said first device a near range query signal;

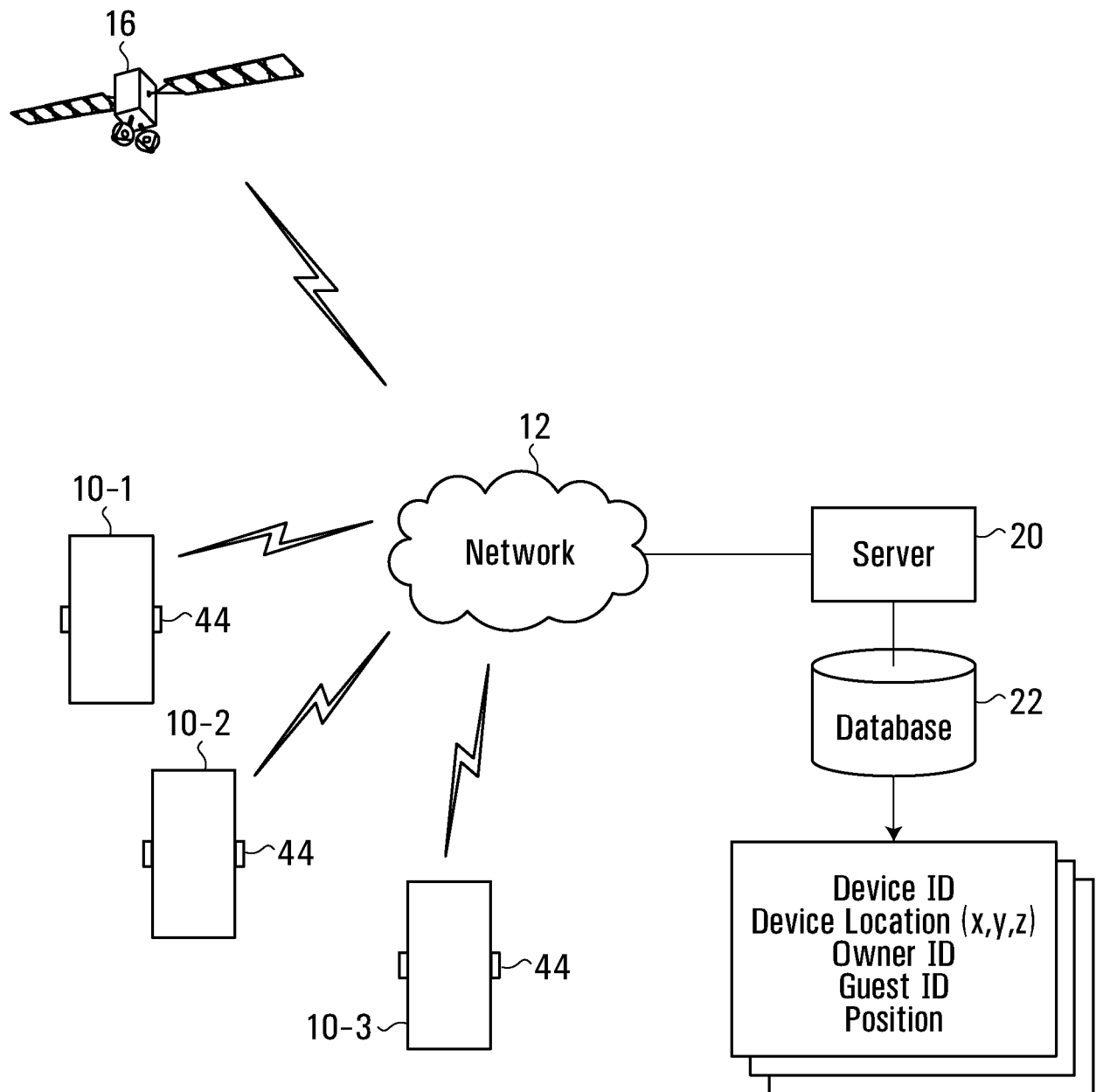
receiving from a second device, an indicator that said second device is within a defined proximity of said first device;

generating at said first device, an indicator of relative position of said second device to said first device, to allow said first device to be guided to said second device for interconnection by way of its physical connector.

19. The method of claim 18, wherein said receiving comprises receiving said indicator at one of multiple sensors at said first device, wherein that one of said sensors allows said first device to determine a relative position of said second device.

20. The method of claim 18, wherein said indicator allows said first device to approximate at least one of distance and relative location to said second device.
21. The method of claim 20, wherein said indicator comprises an indicator of position derived from a satellite signal.
22. The method of claim 21, further comprising emitting at least one of a visible or audible indicator that said second device is in proximity at said first device.

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**FIG. 1**

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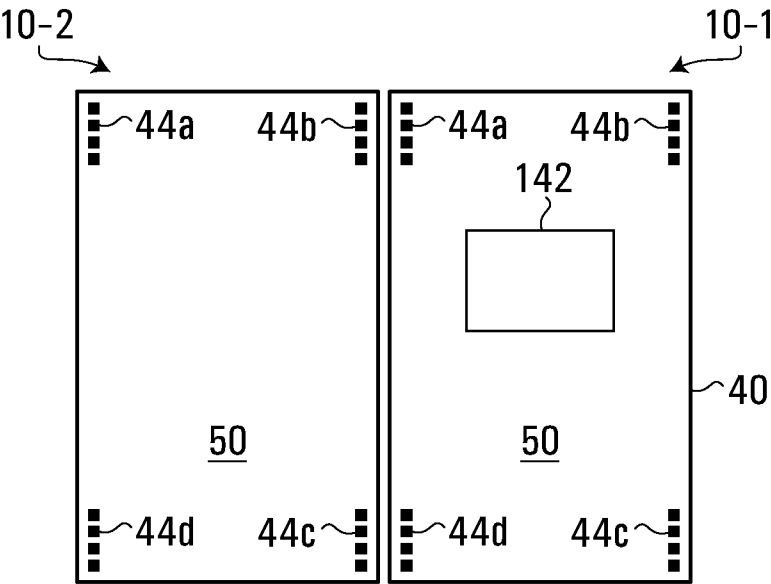


FIG. 2

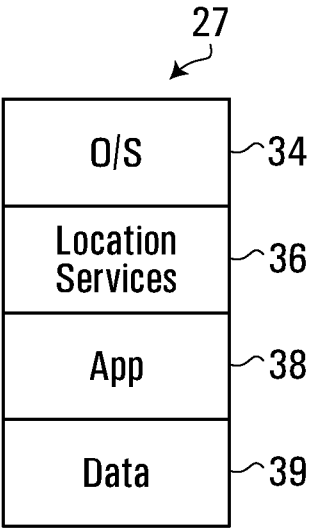


FIG. 4

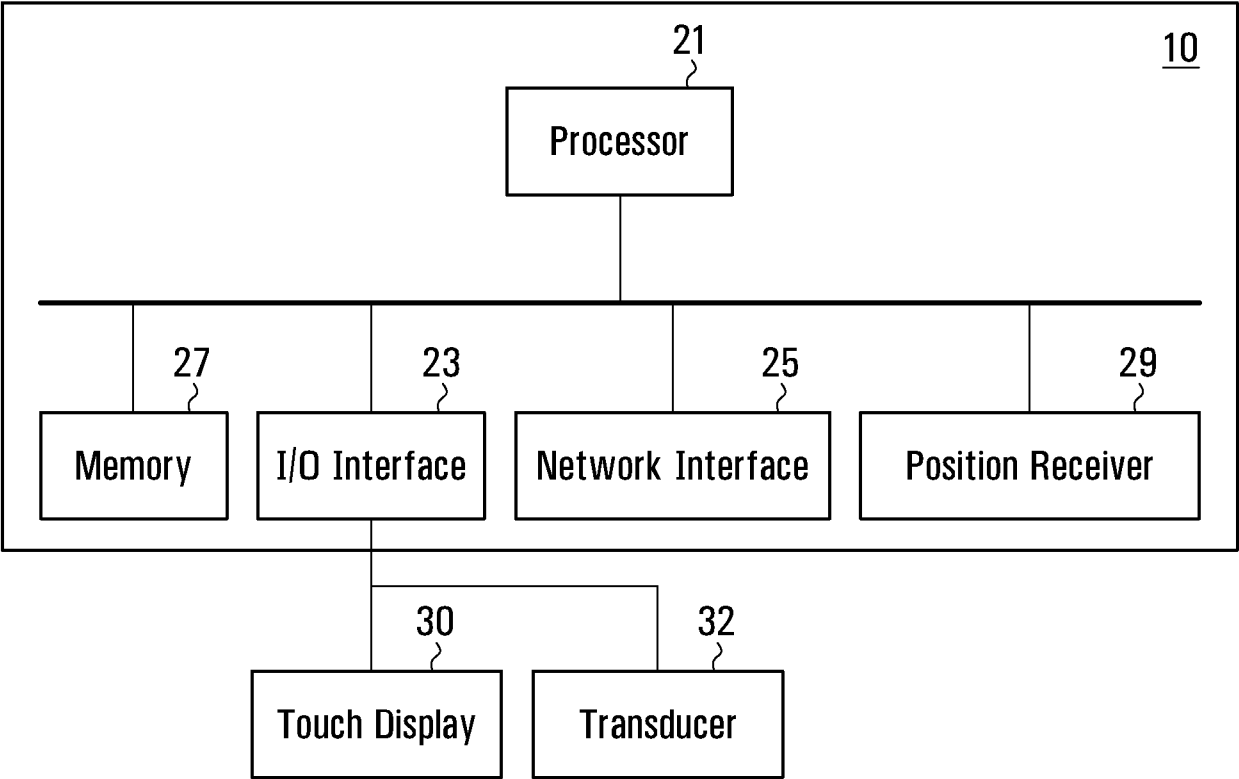
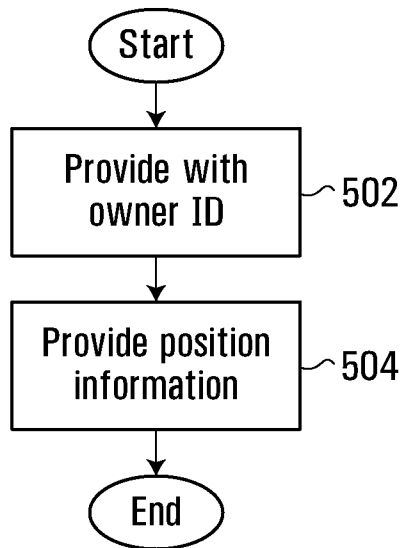
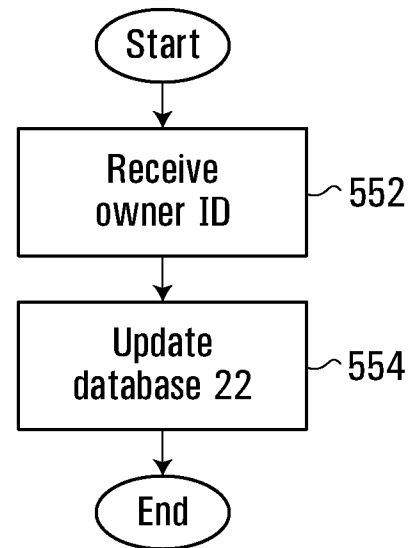
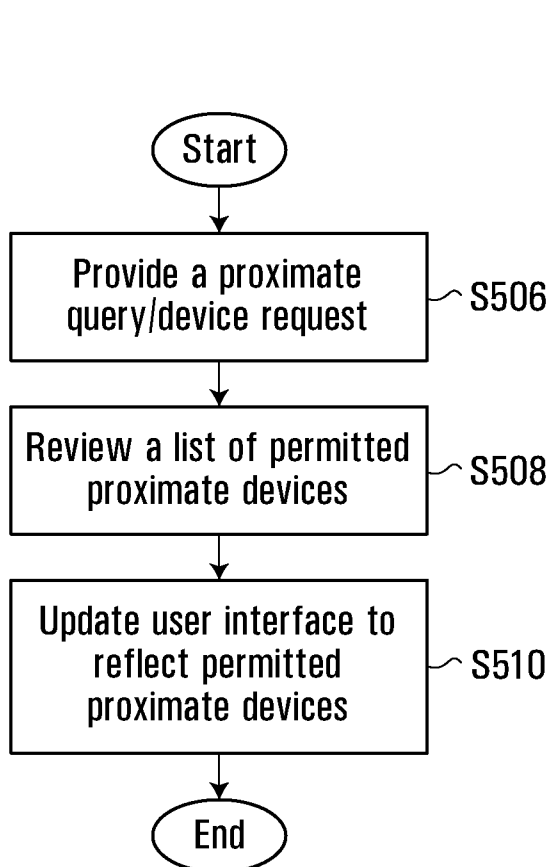
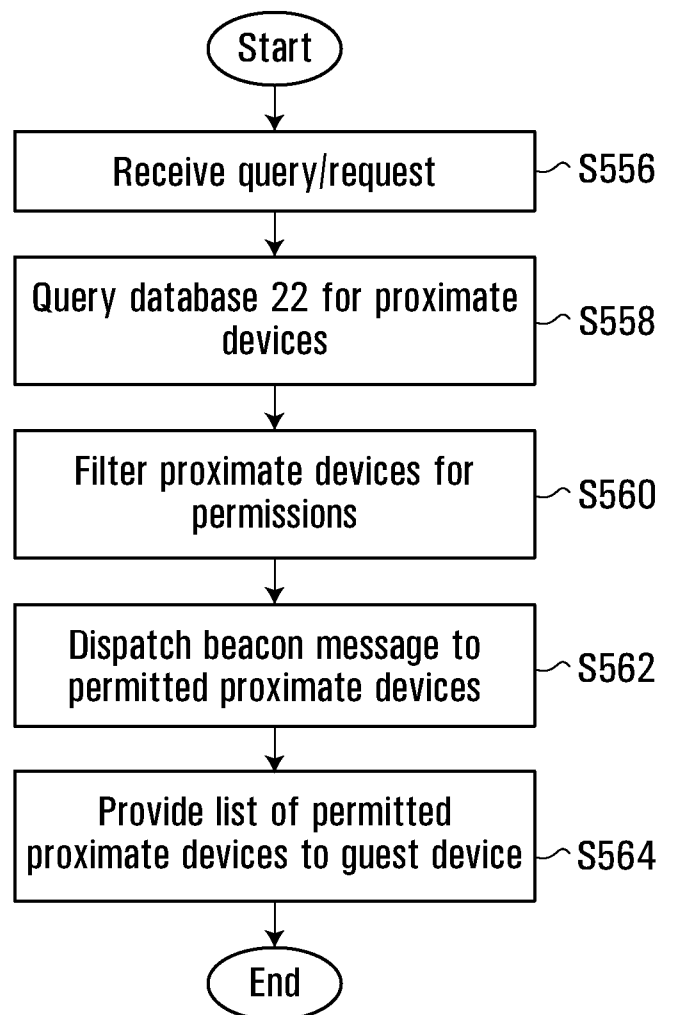


FIG. 3

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**FIG. 5A****FIG. 5B****FIG. 5C****FIG. 5D**

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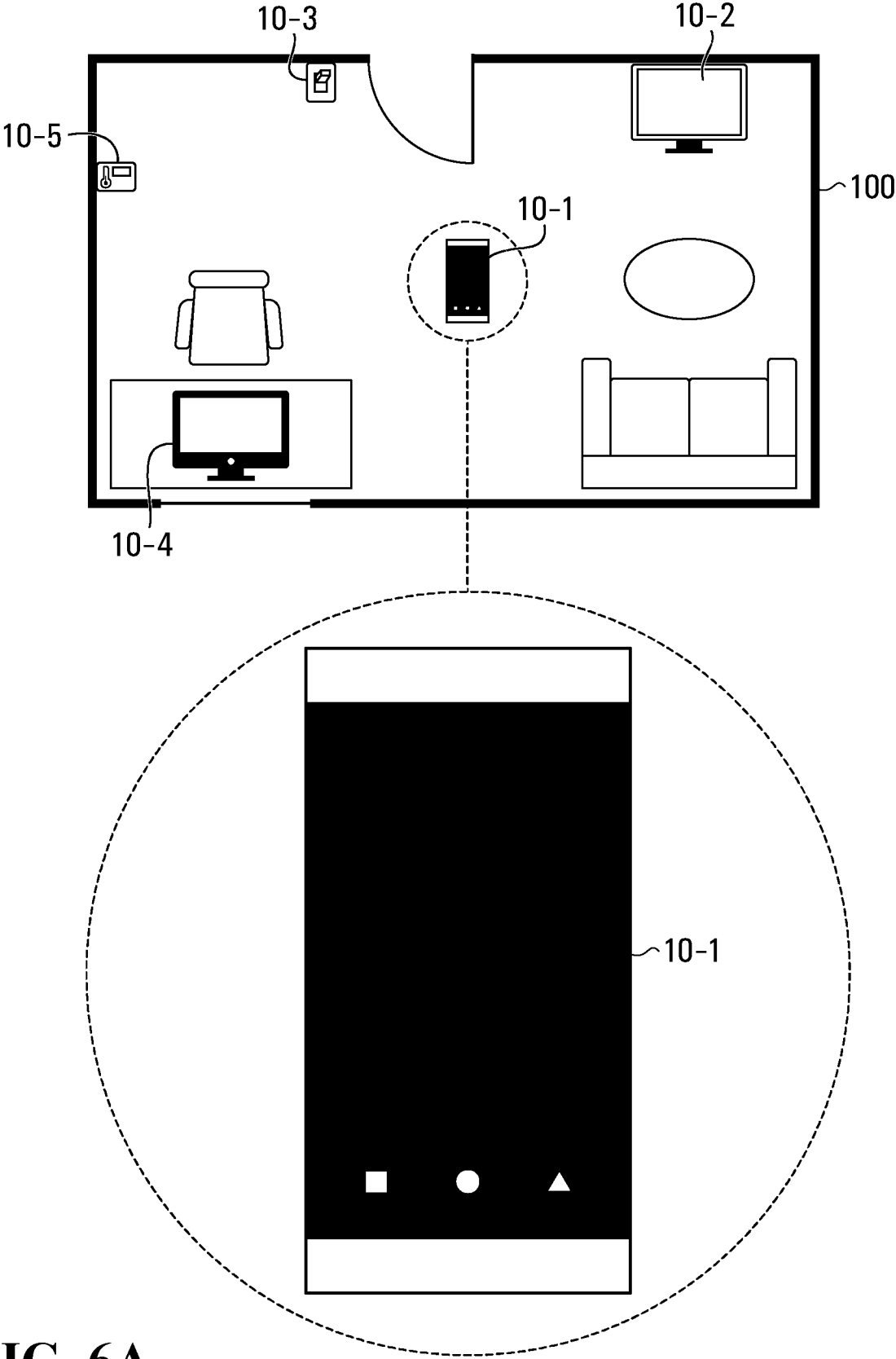


FIG. 6A

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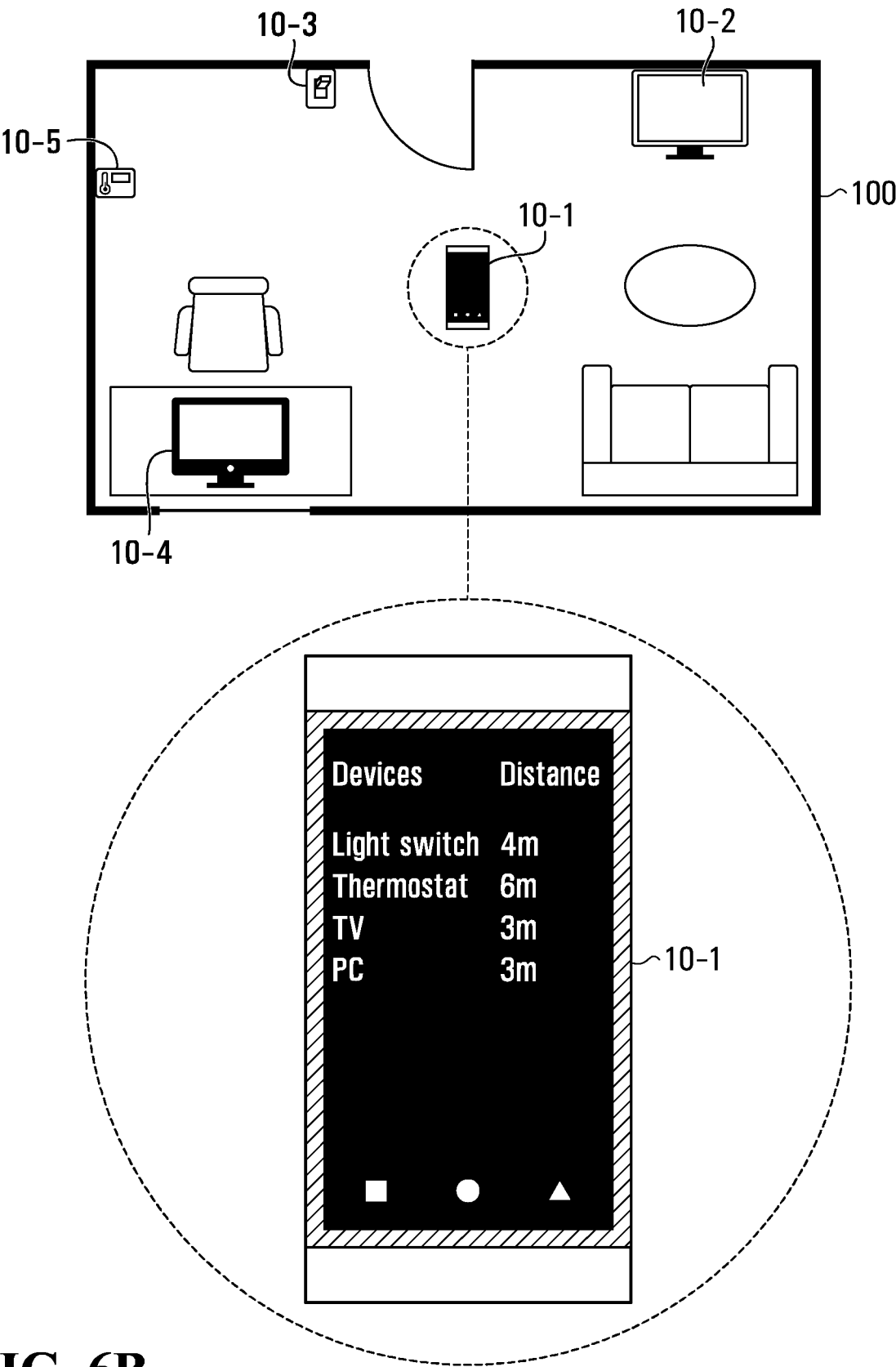


FIG. 6B

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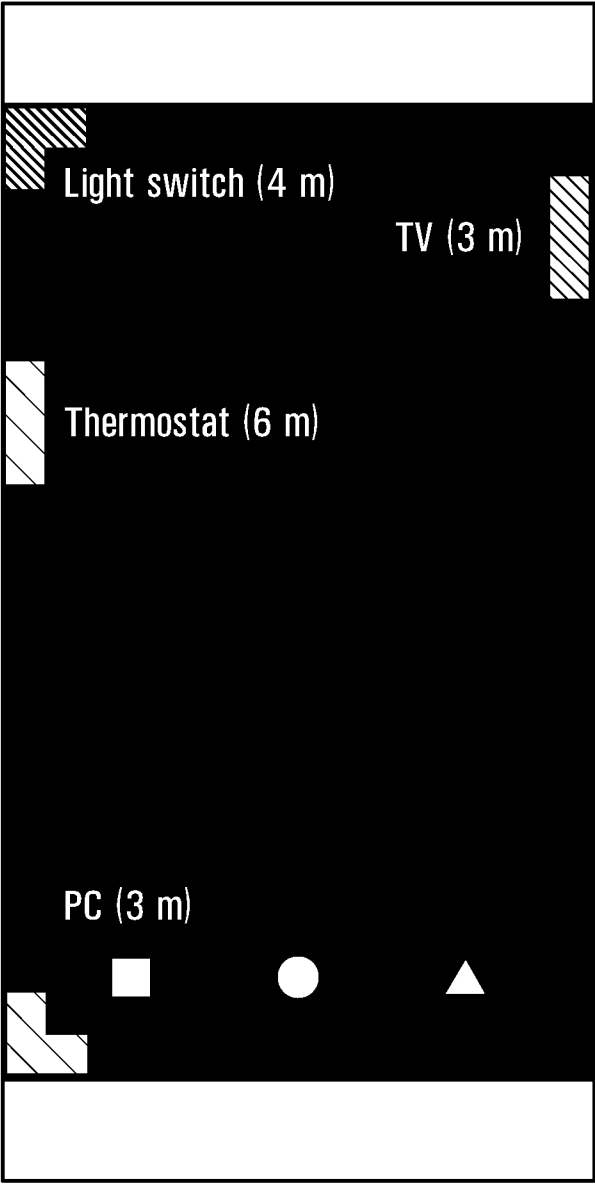


FIG. 7

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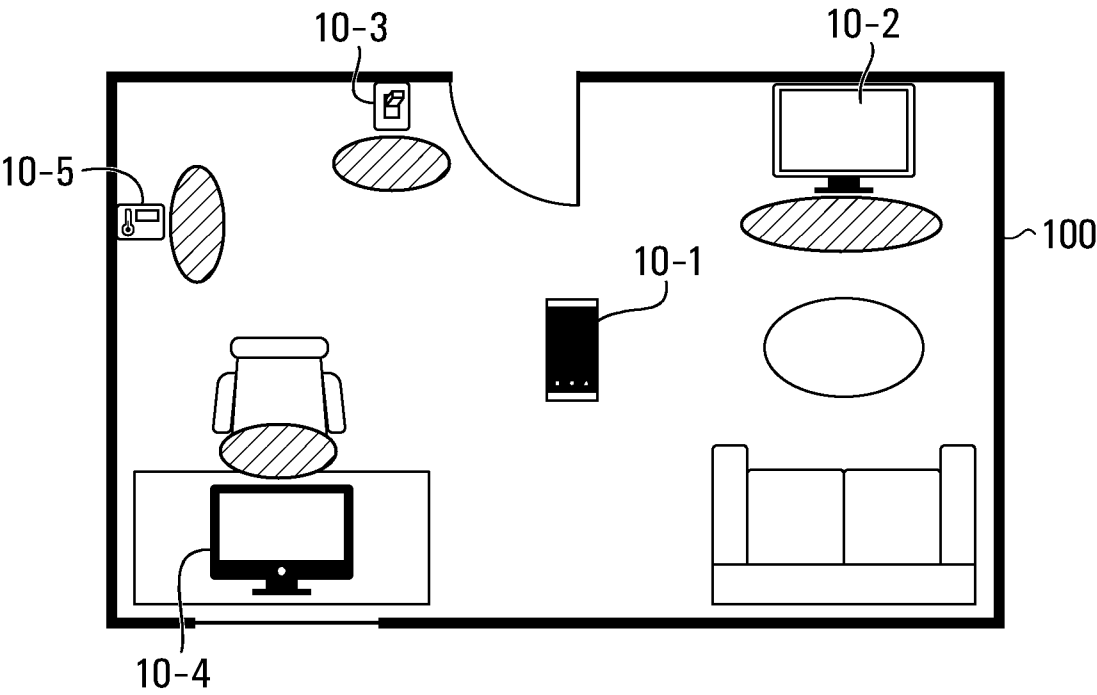


FIG. 8A

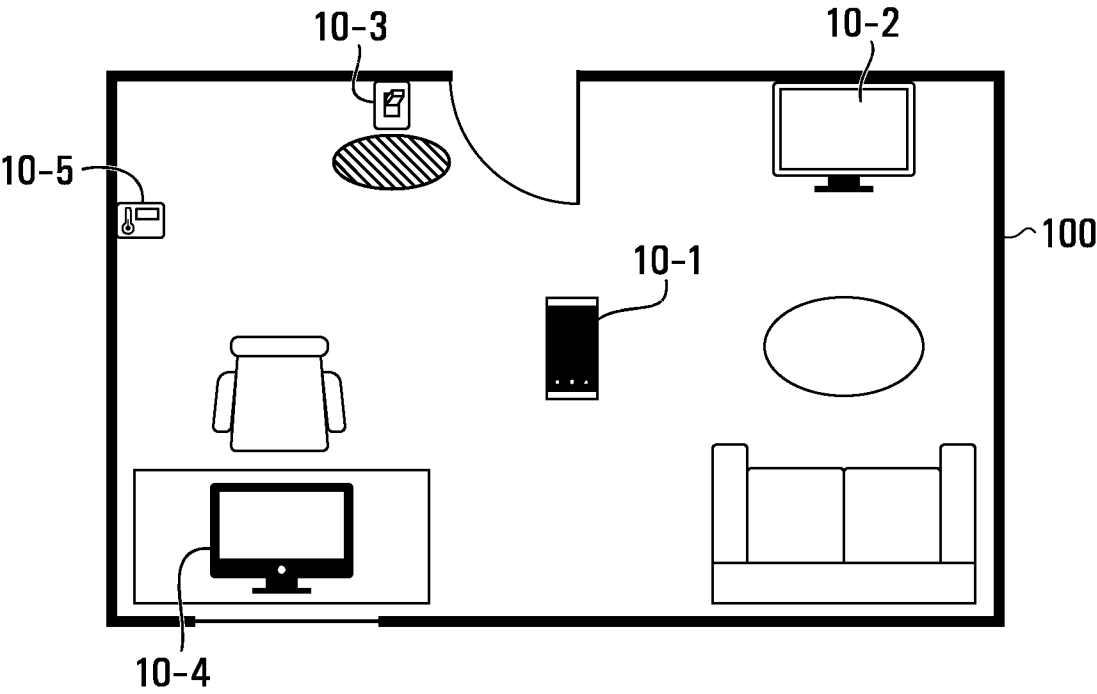


FIG. 8B

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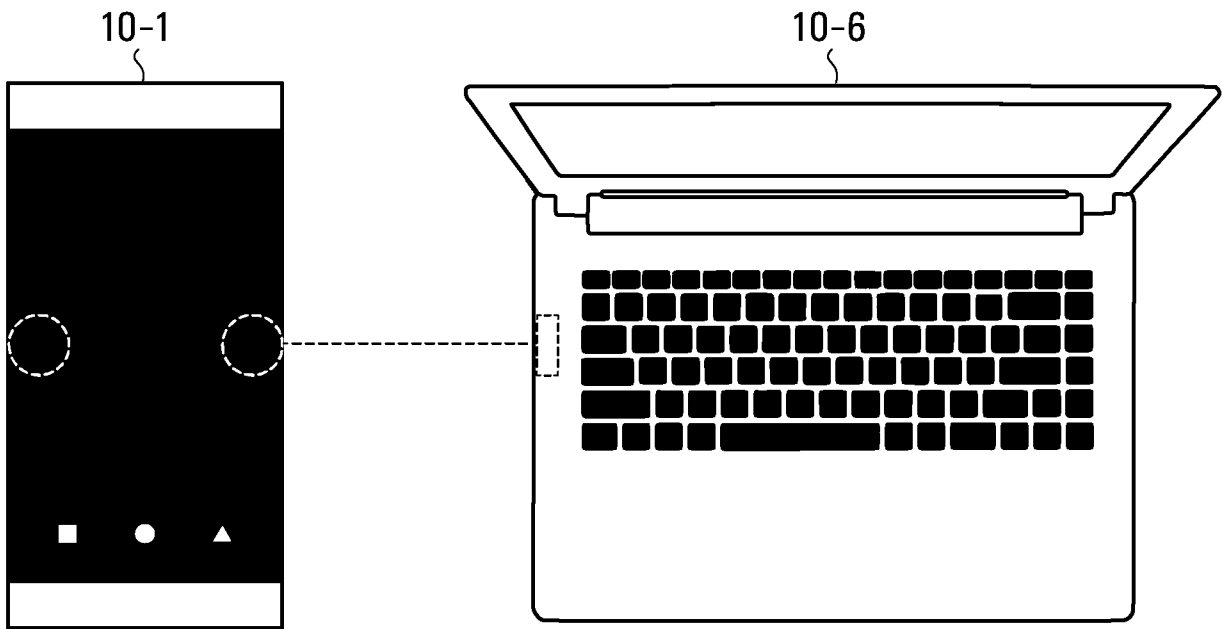


FIG. 9A

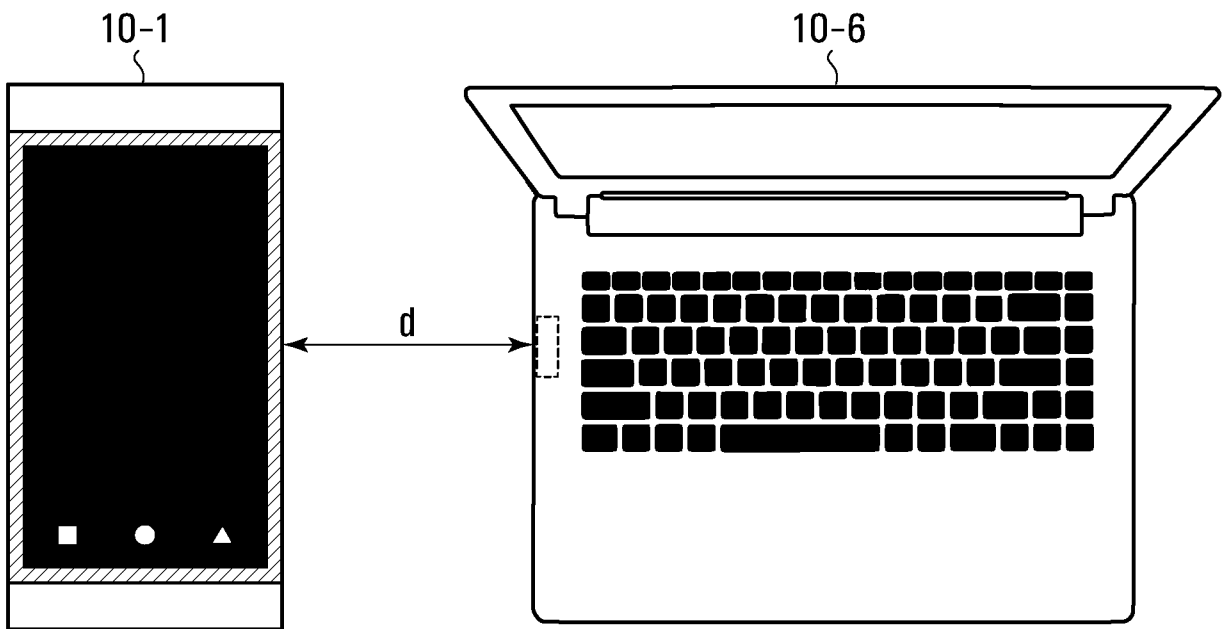


FIG. 9B

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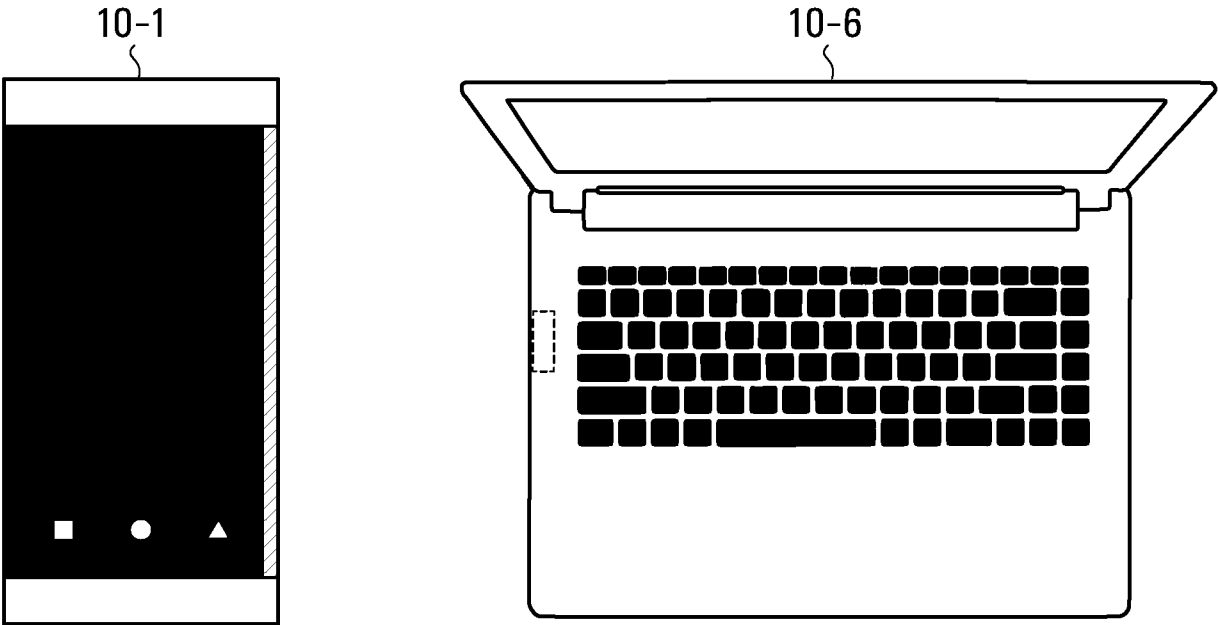


FIG. 9C

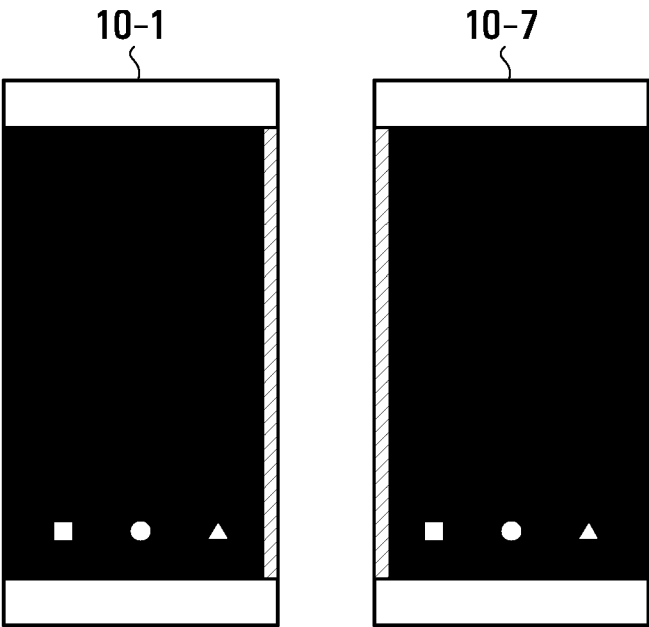


FIG. 9D

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/CA2017/050644

A. CLASSIFICATION OF SUBJECT MATTER
IPC: **H04W 4/20** (2009.01) , **H04W 88/06** (2009.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04W 4/20 (2009.01) , H04W 88/06 (2009.01)

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

Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)
Databases: Google Patents, Questel Orbit, Canadian Patent Database (Intellect), IEEE Xplore
Keywords: device, location, interop, beacon, proximate, audio, visual, locate, position, relative, interoperable, signal, permission, indicate, permit, identif, near, GPS, identifier,

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US9294428B2 (Nordstrom et al.) 22 March 2016 (22-03-2016) *col. 6, lines 32-37, 49-63; col. 7, lines 22-40; col 8, lines 5-35, 39-51; col.10, lines 29-45; col. 11, lines 19-26; col. 12, lines 22-50; col. 14, lines 34-48; col. 24, lines 28-31; col 29, lines 61-67; col. 32, line 59 to col. 33, line 21*	1-17

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

☒ See patent family annex.

* "A" "E" "L" "O" "P"	Special categories of cited documents: document defining the general state of the art which is not considered to be of particular relevance earlier application or patent but published on or after the international filing date document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) document referring to an oral disclosure, use, exhibition or other means document published prior to the international filing date but later than the priority date claimed	"T" "X" "Y" "&"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art document member of the same patent family
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Date of the actual completion of the international search
26 September 2017 (26-09-2017)

Date of mailing of the international search report
26 September 2017 (26-09-2017)

Name and mailing address of the ISA/CA
Canadian Intellectual Property Office
Place du Portage I, C114 - 1st Floor, Box PCT
50 Victoria Street
Gatineau, Quebec K1A 0C9
Facsimile No.: 819-953-2476

Authorized officer

Darren Cassidy (819) 635-4278

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CA2017/050644**Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of the first sheet)**

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

1. ☐ Claim Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

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

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

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

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

See extra sheet attached at the end of this report.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claim Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim Nos.: 1-17

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/CA2017/050644

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
US9294428B2	22 March 2016 (22-03-2016)	US2013185368A1 EP2805568A1 EP2805568A4 US2016164823A1 US9584464B2 US2017134919A1 US9763070B2 WO2013109793A1	18 July 2013 (18-07-2013) 26 November 2014 (26-11-2014) 16 December 2015 (16-12-2015) 09 June 2016 (09-06-2016) 28 February 2017 (28-02-2017) 11 May 2017 (11-05-2017) 12 September 2017 (12-09-2017) 25 July 2013 (25-07-2013)

Lack of Unity

The claims are directed to a plurality of inventive concepts as follows:

Group A - Claims 1-17 are directed to a method of locating interoperable devices at a location, comprising:
receiving from a guest device at the location, a query over a network to a location server;
querying a data store, to identify a set of proximate interoperable devices at the location;
identifying permitted proximate interoperable devices from said set of proximate interoperable devices; and
dispatching a message over said network to each said permitted proximate interoperable device, causing each said permitted proximate device to emit a beacon signal, that is audible or visible at said location; and

Group B - Claims 18-22 are directed to the method of interconnecting first and second devices, each including a physical connector, said method comprising:
sending from said first device a near range query signal;
receiving from a second device, an indicator that said second device is within a defined proximity of said first device; generating at said first device, an indicator of relative position of said second device to said first device, to allow said first device to be guided to said second device for interconnection by way of its physical connector.

The groups of inventions are not so linked as to form a single general inventive concept. The claims must be limited to one inventive concept as set out in PCT Rule 13.