(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 657 916 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
30.10.2013 Bulletin 2013/44

(51) Int Cl.:
G07C 5/08 *(2006.01)* ***G07C 5/00*** *(2006.01)*

(21) Application number: **13165072.3**

(22) Date of filing: **24.04.2013**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **24.04.2012 US 201213454792**

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(54) Mobile asset auto manager display

(57) A method of monitoring a plurality of assets 10 using a mobile device 44, including determining a position of the mobile device 44, identifying one of the plurality of assets in proximity to the mobile device, and accessing from the mobile device data relating to the one of the plurality of assets 10. Also disclosed is a system for monitoring a plurality of assets 10 using a mobile device 44 including a location server 60 in communication with the mobile device, the location server configured for determining a location of the mobile device 44, an application server 48 in communication with the location server, the plurality of assets 10, and the mobile device 44, the application server 48 configured for monitoring the status of the plurality of assets 10, and sending to the mobile device 44 a status of one of the plurality of assets 10, wherein the one of a plurality of assets is closest in proximity to the mobile device 44.

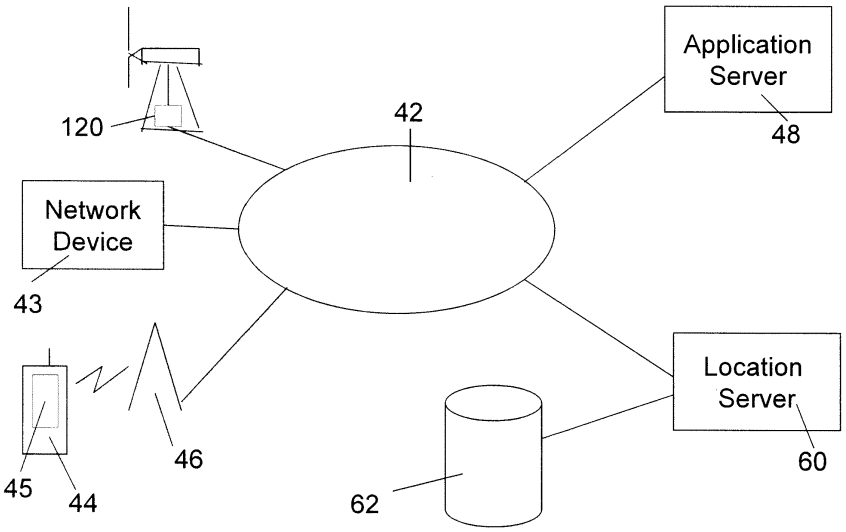

Figure 4

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Description

[0001] Embodiments of the disclosure are directed to applications involving mobile telecommunications, and more particularly, to a system and method for automatically displaying data particular to an asset when in the vicinity of that asset.

[0002] Managing a large number of assets that are spread over a relatively large geographic area may be cumbersome. It is especially difficult in the case where the assets look similar to each other. For example, a wind farm with multiple wind turbines may span several acres, with little or no distinction in the visual appearance among each of the wind turbine generators. Likewise, multiple, visually indistinct assets such as turbines or boilers may be located in a sprawling facility. Notwithstanding the similar appearance of these assets, each of the assets may have its own unique operation or maintenance characteristics and schedules. For employees responsible for these assets, identifying each individual asset quickly and without error is crucial for the efficient operation and maintenance of the entire wind farm or facility.

[0003] From a control room, it is relatively easy to select controls that will enable an operator to monitor any particular asset. However, for maintenance or asset management functions, the control room may need to communicate with personnel in the field or facility. As such, it may be beneficial to monitor the status of the assets when out in the field or the facility, rather than from in a control room isolated from the field. There is no efficient or accurate method or system for doing so.

[0004] There is a need to be able to provide data that is generally available in a control room to a field engineer or technician in a manner that enables the field engineer or technician to quickly and accurately identify the asset in order to be able to provide management and maintenance services thereon.

[0005] The following presents a simplified summary that describes some aspects or embodiments of the subject disclosure. This summary is not an extensive overview of the disclosure. Indeed, additional or alternative embodiments of the subject disclosure may be available beyond those described in the summary.

[0006] The disclosure is directed to a method of monitoring a plurality of assets using a mobile device, including determining a position of the mobile device, identifying one of the plurality of assets in proximity to the mobile device, and accessing from the mobile device data relating to the one of the plurality of assets.

[0007] The disclosure is further directed to a system for monitoring a plurality of assets using a mobile device, including a location server in communication with the mobile device, the location server configured for determining a location of the mobile device and an application server in communication with the location server, the plurality of assets, and the mobile device, the application server configured for monitoring the status of the plurality of assets, and sending to the mobile device a status of one of the plurality of assets, wherein the one of a plurality of assets is closest in proximity to the mobile device.

[0008] Accordingly, data normally available in the control room is able to be quickly and accurately accessed by a field technician or engineer on a mobile device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The following description is better understood when read in conjunction with the appended drawings.

Figure 1 is a schematic illustration of a plurality of assets spread over an area;

Figure 2 is a schematic illustration wind turbine in accordance with an embodiment;

Figure 3 is a schematic illustration of a side view of a wind turbine in accordance with an embodiment;

Figure 4 is an example embodiment of a network for communication with one or more assets;

Figure 5 is an example illustration of a display showing the status of one of a plurality of assets in accordance with the disclosure; and

Figure 6 is a flow chart showing an embodiment of a method of the disclosure.

[0010] Reference will now be made in detail to the various embodiments of the invention, one or more examples of which are illustrated in the figures. Each example is provided by way of explanation of the embodiment and is not meant as a limitation thereof. For example, features illustrated as part of one embodiment may be incorporated with respect to other embodiments. It is intended that any such modifications and variations are included herewith.

[0011] With reference to Figure 1, there is shown an embodiment having an area 12 which may include multiple assets 10 located thereon. The area 12 may be acreage of land or an area within a facility. The multiple assets 10 may include multiple turbines, wind turbines, boilers, or any other assets that may be tracked and monitored. While the present disclosure may be applied to multiple environments, including but not limited to a facility having a turbine or a boiler, by way of example only, the disclosure will first be described with respect to a facility whose plurality of assets 10 are numerous wind turbines, one of which is shown in as wind turbine 100 in Figure 2.

[0012] With respect to Figure 2, there is shown a schematic drawing illustrating a wind turbine 100 according to an embodiment. The wind turbine 100 includes a tower 2 on top of which a nacelle 6 is mounted. A rotor 4 is equipped with rotor blades 8 in, for example, a three blade configuration rotatably mounted to the nacelle 6. Kinetic energy is captured from the wind by the rotor blades 8

and urges rotor 4 to rotate about its rotation axis. Rotor 4 is coupled to an electric generator (not shown), either directly or through a gear box. Driven by rotor 4, the electric generator generates electric power which can then be fed to a utility grid or the like.

[0013] Figure 3 illustrates a wind turbine 100 according to an embodiment. A global positioning system ("GPS") receiver 110 is mounted at wind turbine 100. GPS receivers (110) are known in the art and communicate with a series of satellites comprising the global navigation satellite system through microwave signals illustrated as GPS signals 50. GPS receiver 110 is capable of determining the location of the wind turbine 100. It will be understood that other satellite-based navigation systems may be used, for example, a European-based satellite and receiver system known as GALILEO may be used. Additionally, other techniques for determining the location of the wind turbine may be used, for example, triangulation techniques whereby a receiver on the wind turbine 100 measures signals transmitted from a plurality of transmitters. Moreover, the location of the wind turbine 100 may be hard-coded in a programmable memory associated with the wind turbine 100, either at the wind turbine 100 itself or in an application server 48 as will be described with reference to Figure 4. Hard coding may include absolute geographical longitudinal and latitudinal data, or it may include a relative position within a grid developed specifically for the location.

[0014] Figure 3 illustrates that the GPS receiver 110 is installed at nacelle 6 of the wind turbine 100. Although GPS receiver 110 may be installed at any suitable location at the wind turbine or close to the wind turbine, positioning of GPS receiver 110 at the nacelle provides a good window to the satellites and therefore, good reception of the GPS signals 50. Nacelle 6 may also include one or more sensors 112 which monitor various aspects of the operation of the wind turbine.

[0015] Furthermore, wind turbine 100 may include a communication device 120 which is adapted to transmit information to remote recipients or remote computers across network 42. Information available to the communications device 120 may be provided from the GPS receiver 110 or the one or more sensors 112. Communication device 120 may be wired or wireless. In one example, communication device 120 includes an internet connection. In another embodiment, communication device includes a local area network connection. In another embodiment, communications device 120 may be a near field communication (NFC) transmitter communicating using Bluetooth or other NFC communications protocol. Communication device 120 may include a processor to consolidate data from the one or more sensors 112 prior to transmission to the network 42.

[0016] The one or more sensors 112 on wind turbine 100 may transmit data through the communication device 120 to network 42. With reference to Figure 4, which in an illustrative embodiment, network 42 may be the Internet, which may, for example, transmit data using IP protocols. However, in other example embodiments, the network 42 may additionally or alternatively include another intranet, extranet, a private network, a public network, a wide area network, a local area network, and the like, or any other combination thereof. The network may also be any other type of wired or wireless network. Examples of a wireless network may be a Long Term Evolution (LTE) network, also known as 4G, or any type of cellular network, including but not limited to, those based upon Global System for Mobile Communications (GSM), Code Division Multiple Access (CDMA), Wideband Code Division Multiple Access CDMA (WCDMA), 3rd Generation Partnership Project (3GPP), Enhanced Data Rates for GSM Evolution (EDGE), or any other type of cellular network, and may also be any other type of wireless network, including Wi-Fi, Worldwide Interoperability for Microwave Access (WiMAX), wireless local area network (WLAN), another IEEE 802.XX network, or any other type of wireless network capable of transmitting data to and from communication device 120. Multiple assets 10 may be connected to network 42.

[0017] Also attached to or in communication with the network 42 are one or more network devices 43 such as workstations or other computing devices, it being understood by those skilled in the art that such network devices may also include netbook computers, laptop computers, tablet computers, personal digital assistants (PDA's), internet-enabled mobile telephones, smart phones, and any other network device capable or sending or receiving data to and from the Internet. Network devices 43 may be located in a control room local or remote to area 12.

[0018] Also attached to or in communication with the network 42 is a mobile device 44 in communication to the network 42 through communications tower 46. The mobile device 44 is representative of any appropriate type of device that can communicate on a wireless network. Example devices include any type of wireless receiver or transceiver device (e.g., cell phone, tablet computersmart phone, pager, PDA, PC, specialized broadcast receiving device, satellite radio receiver, satellite phone, and television). Example devices can comprise any appropriate mobile device, such as, for example, a portable device, a variety of computing devices including (a) a portable media player (b) a portable computing device, such as a laptop, a tablet computer, personal digital assistant ("PDA"), a portable phone, such as a cell phone or the like, a smart phone (e.g., iPhone, Blackberry, Android-based phone, etc.), a Session Initiation Protocol (SIP) phone, a video phone, a portable email device, a thin client, a portable gaming device, etc., (c) consumer electronic devices, such as TVs, DVD players, set top boxes, monitors, displays, etc., (d) a public computing device, such as a kiosk, an in-store music sampling device, an automated teller machine (ATM), a cash register, etc., (e) a navigation device whether portable or installed in-vehicle and/or (f) a non-conventional computing device, such as a kitchen appliance, a motor vehicle control (e.g., steering wheel), etc., or a combination thereof. For

example purposes only, the mobile device 44 may also be referred to as a smartphone, though clearly not limited to such. The mobile device 44 may have a display 45, which may be a touch screen or other type of display.

[0019] Also attached to and in communication with the network 42 may be one or more servers, including but not limited to application server 48 and a location server 60. The application server 48 may be any type of server computer capable of running an application program. The application server 48 may run an application program which monitors the condition or status of the plurality of assets 10, including tracking real time status of the various sensors and systems, maintenance records and schedules, and operational control programs for the plurality of the assets 10. The assets 10 may be equipment for capturing wind energy or turbines for generating energy or any other type of assets 10. The application server 48 may track the above-identified data for any or all of the individual assets 10 such as wind turbine 100. The application server 48 may also specifically identify each of the assets 10 and associate a geographic location with each of the assets 10.

[0020] The location server 60 tracks the location of mobile device 44 or a plurality of such devices and stores that location data in location database 62. The location of the mobile device 44 may be determined by methods known to those skilled in the art, including but not limited to, GPS, a GPS, time delay of arrival, triangulation, or any other type of location determination algorithm or methodology.

[0021] The mobile device 44 may have an application client resident thereon for monitoring the condition of assets 10. The application client may be configured to display on display 45 the status of any of the assets 10 being monitored by the application server 48. For example and with reference to Figure 5, the application client may include display 45 which displays the data relating to the nearest asset 10 relative to the mobile device 44 and may include, for example, a menu that provides selections to retrieve one or more of asset identification, asset location, asset operational status, asset operational schedule, asset maintenance status, asset maintenance schedule, asset fault data and any other asset data. The data identified in Figure 5 and herein is exemplary only and any actual data may or may not include any or all of the example status categories and may include any additional categories of data and still fall within the scope of this disclosure.

[0022] The mobile device 44 may also serve as a portable data collector. One or more inputs to the mobile device 44 may be made from one or more of the assets 10 using known communication techniques, including but not limited to a USB or other wired connecting, or Wi-Fi, Bluetooth or other wireless communications connection.

[0023] Facilities can span several kilometers, and wind farms may span several square miles. The assets 10 that are monitored by a condition monitoring software in the application server 48 and the mobile device 44 client may be physically scattered throughout the facility. In operation, handling large number of assets 10 is enhanced. With reference to Figure 6, there is shown a flow chart which is illustrative of an example method for monitoring the condition or status of the assets 10. At 80, the location of the mobile device 44 is determined. The location may be determined by any one of a number of methodologies, including but not limited to, GPS, a GPS, time delay of arrival, triangulation, or any other type of location determination algorithm or methodology. At 82, the asset 10 in closest proximity to the mobile device 44 is identified. This may be done by comparing the location of the mobile device 44 to the location of a plurality of assets 10, which locations of the assets 10 may have been previously determined and stored at the application server 48. At 84, the condition or status data of the closest asset 10 is accessed. The condition of the closest asset 10 may be received from the application server 48 or it may be derived by the mobile device 44 from information received from the application server 48. The condition may, for example, include asset operational status, asset operational schedule, asset maintenance status, asset maintenance schedule, asset fault data, and any other asset data. At 86, the condition or status data of the closest asset 10 is displayed on display 45 of mobile device 44. Thus, the current location information of the field engineer is utilized to help the field engineer identify which assets are near them are under anomaly or require maintenance. The method also allows portable data collectors to filter the data collection routes shown to the field engineer to include only the routes which are very close to the field engineer's current location. The disclosure may enhance the accuracy of uploaded data to the portable data collector of the mobile device 44.

[0024] There may be variations of the method of Figure 6 that fall within the scope of this disclosure and appended claims. For example, the data for the nearest asset 10 may be uploaded to the mobile device 44 acting as a portable data collector. The condition or status data of the nearest asset 10 may be automatically displayed on the display 45 of the mobile device 44 or may be retrieved by a command issued by the mobile device 44. The display may be limited to the data from one asset 10 or may include data from a plurality of assets 10 in close proximity to the mobile device 44. In addition to data populated on a display 45, data may be transmitted through voice communications or an alarm or any other type of mechanism. The technical effect of the system and method is to enable the management and / or maintenance data to a field engineer using a mobile device 44 in an efficient and accurate manner.

[0025] In accordance with another embodiment, data relating to one or more of the assets 10 may be sent from the application server 48 to the mobile device 44 based on the location of the mobile device 44 as determined by the location server 60. For example, the location server 60 may determine that the mobile device 44 is located in close proximity to one of the plurality of assets 10 which

requires service and send a notification or other data to that mobile device 44 while the mobile device is in close proximity to the asset 10. The data may be sent via SMS, text, MMS, or any other type of wireless data communications and may, for example, include an audio or visual alarm to alert the user of the mobile device 44 that data has been or is being sent to the mobile device 44.

[0026] In addition to the use of a location server 60 to determine the location of the mobile device 44, an alternative may include using near field communications protocols such as Bluetooth, or alternatively, RFID communications, to determine the location of the mobile device 44 in relation to the assets 10 or as a relative position within the area 12. Near field communications modules may be positioned across area 12 that broadcast relative location information that can aid the mobile device 44 to locate the nearest asset 10.

[0027] It should be understood that this invention may be applicable to the automatic displays based on location or based on a command from the mobile device. One or more assets 10 may be preprogrammed into the mobile device to guide the user of the mobile device 44 through the plurality of assets 10, thereby creating a route through the area 12 to one or more specific assets within that area 12. While the disclosure has been described with respect to wind farms, other assets types including but not limited to steam turbines may also be considered to be within the scope and breadth of the disclosure.

[0028] With respect to the various embodiments of the various figures, it is to be understood that other similar embodiments may be used or modifications and additions can be made to the described embodiments. This written description uses such examples to disclose the invention, including the best mode, and also to enable any person skilled in the art to practice the invention, including making and using any devices or systems and performing any incorporated methods. The patentable scope of the invention is defined by the claims, and may include other examples that occur to those skilled in the art. Such other examples are intended to be within the scope of the claims if they have structural elements that do not differ from the literal language of the claims, or if they include equivalent structural elements with insubstantial differences from the literal languages of the claims. Therefore, apparatuses, systems and methods for turbine clearance flow reduction should not be limited to any single embodiment, but rather should be construed in breadth and scope in accordance with the appended claims.

Claims

1. A method of monitoring a plurality of assets (10) using a mobile device (44), comprising:

determining a position of the mobile device (44);
identifying one of the plurality of assets (10) in proximity to the mobile device (44); and
accessing from the mobile device (44) data relating to the one of the plurality of assets (10).

2. The method of claim 1, wherein the mobile device (44) has an application program executing thereon, wherein the application program automatically displays the data relating to the one of the plurality of assets (10) as part of the accessing step.

3. The method of claim 1 or claim 2, wherein the determining step is performed using one of a global positioning system, an assisted global positioning system, and a triangulation system.

4. The method of claim 3, wherein each of the plurality of assets (10) has location information associated therewith, and wherein the identifying step is performed by comparing the location information and the position of the mobile device.

5. The method of any preceding claim, wherein one of the plurality of assets (10) comprises a near field communications transmitter and wherein the determining step is performed by receipt by the mobile device (44) of a transmission from the transmitter.

6. The method of any preceding claim, wherein the one of the plurality of assets (10) is closest in proximity to the mobile device (44).

7. The method of any preceding claim, wherein the one of a plurality of assets (10) is one of a wind turbine generator, a turbine, and a boiler.

8. The method of any preceding claim, further comprising receiving data at the mobile device (44) from one of the plurality of assets (10).

9. The method of claim 8, further comprising sending the received data to an application server (48).

10. A system for monitoring a plurality of assets (10) using a mobile device (44), comprising:

a location server (60) in communication with the mobile device (44), the location server configured for determining a location of the mobile device;
an application server (48) in communication with the location server (60), the plurality of assets (10), and the mobile device (44), the application server (48) configured for monitoring the status of the plurality of assets, and sending to the mobile device (44) a status of one of the plurality of assets (10), wherein the one of a plurality of assets (10) is closest in proximity to the mobile device (44).

11. The system of claim 10, wherein the mobile device (44) is configured for receiving the status of the one of plurality of assets (10) from the application server (48).

12. The system of claim 10 or claim 11, wherein the mobile device (44) is configured for receiving the status of the one of the plurality of assets (10) from the one of the plurality of assets and forwarding the status to the application server (48).

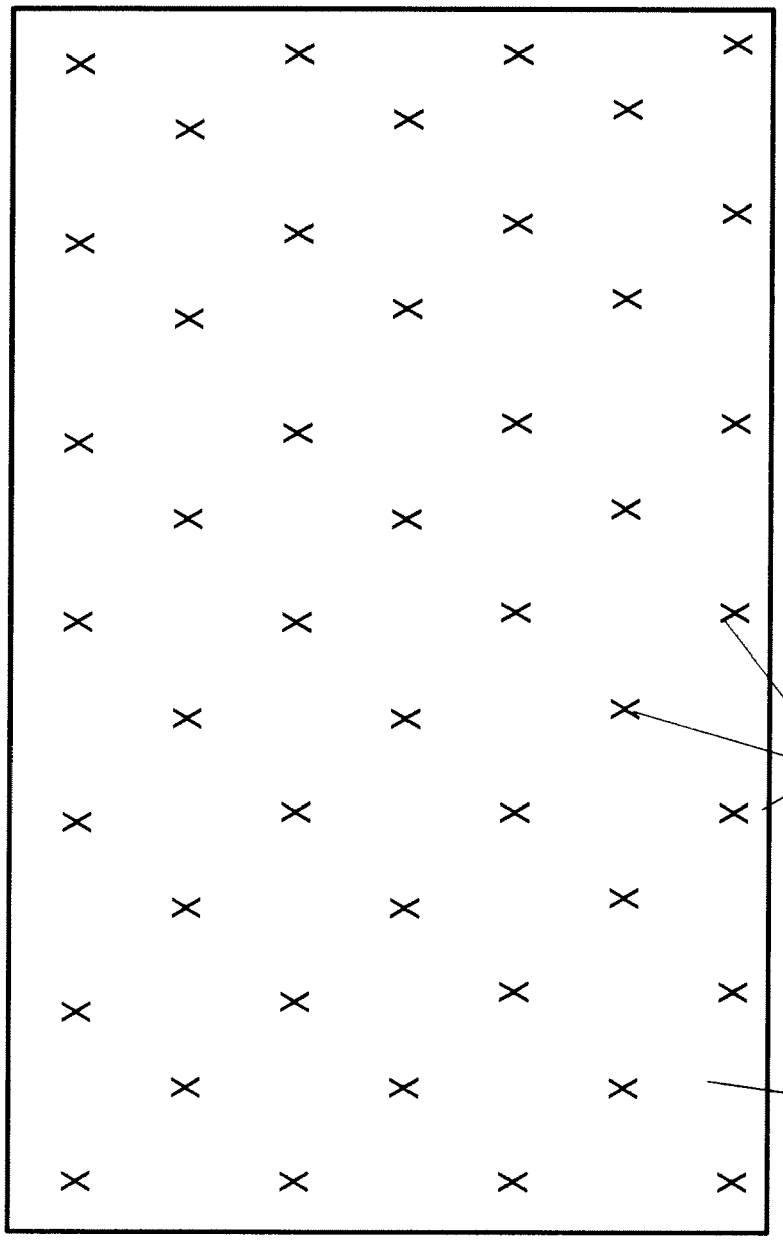

Figure 1

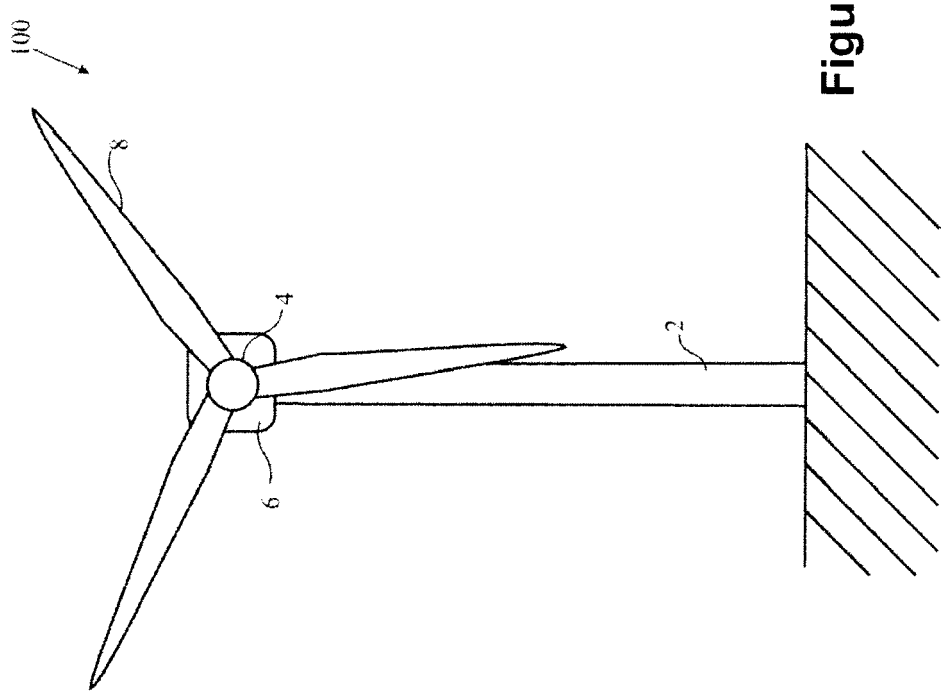

Figure 2

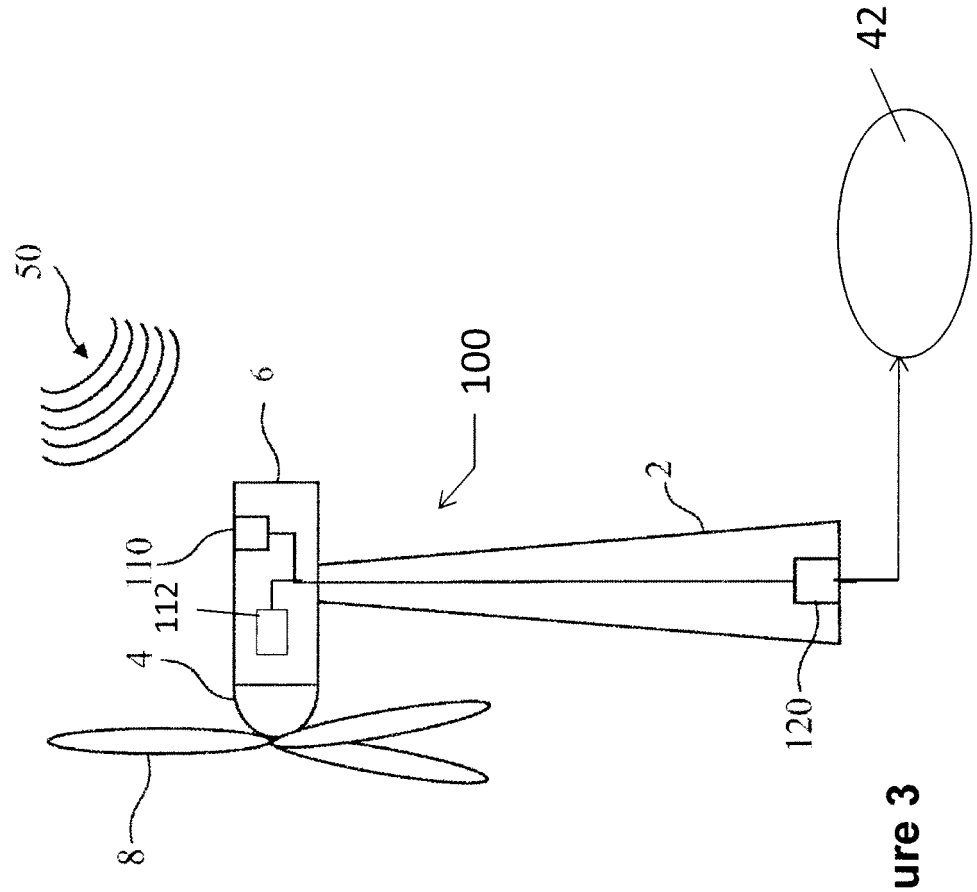

Figure 3

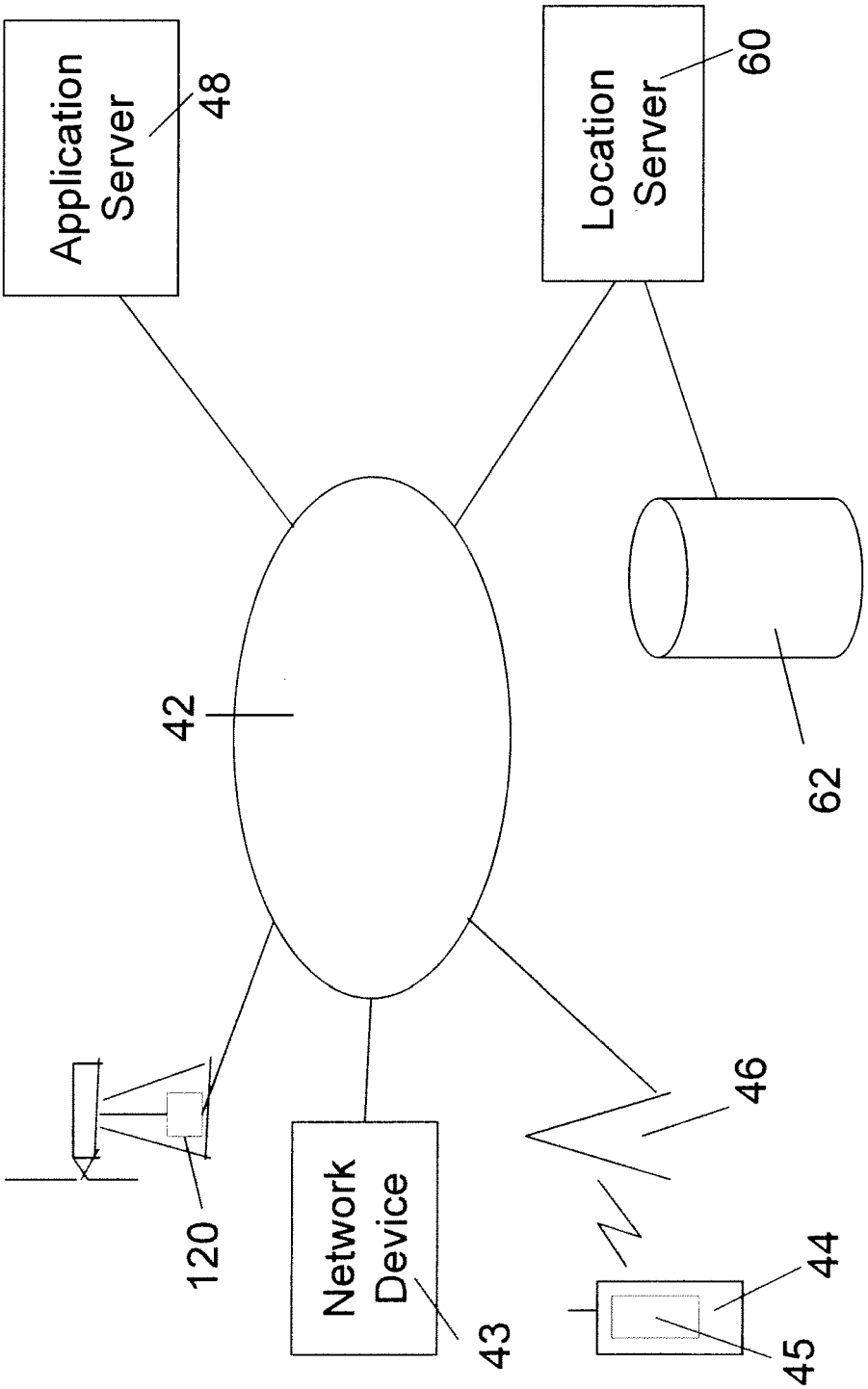
Application Server
48
Location Server
60
42
62
120
Network Device
43
46
44
45

Figure 4

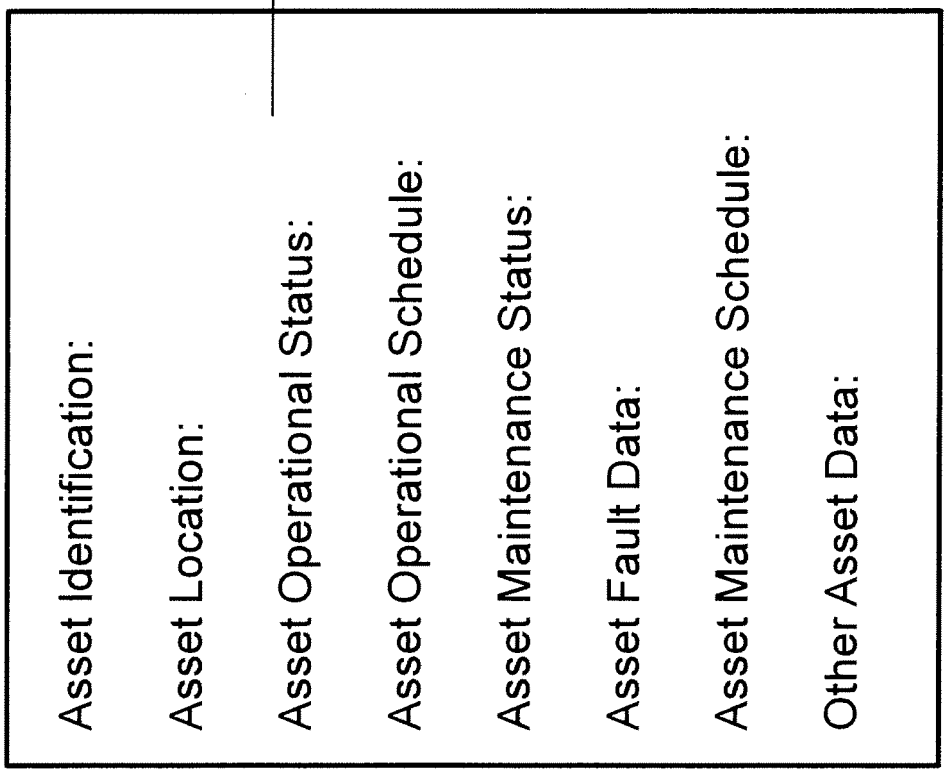
45
Asset Identification:
Asset Location:
Asset Operational Status:
Asset Operational Schedule:
Asset Maintenance Status:
Asset Fault Data:
Asset Maintenance Schedule:
Other Asset Data:

Figure 5

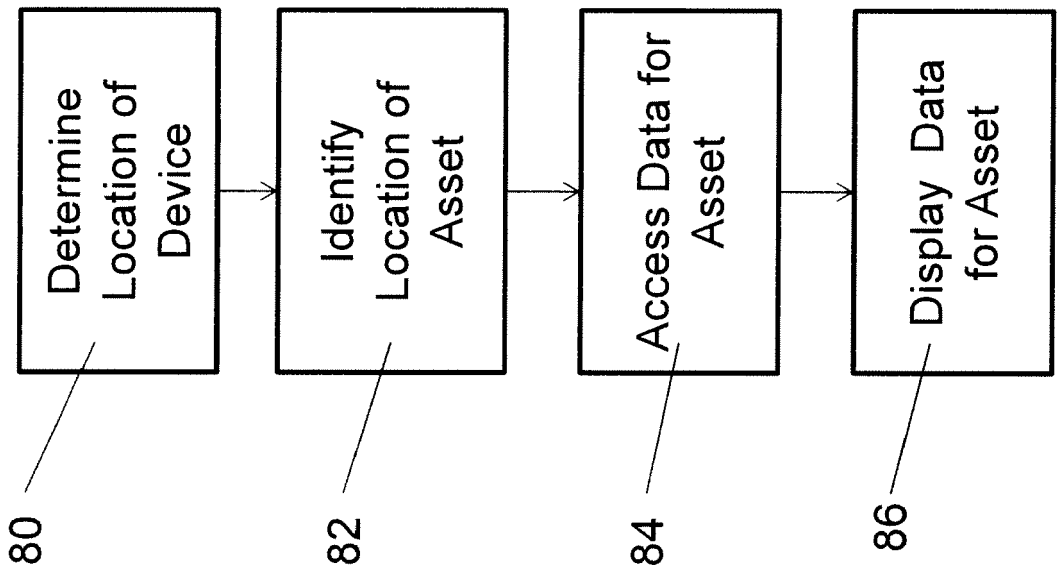
Determine Location of Device
Identify Location of Asset
Access Data for Asset
Display Data for Asset
80
82
84
86

Figure 6