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(54) **Title:** NETWORK BASED MAINTENANCE REQUEST SERVICE

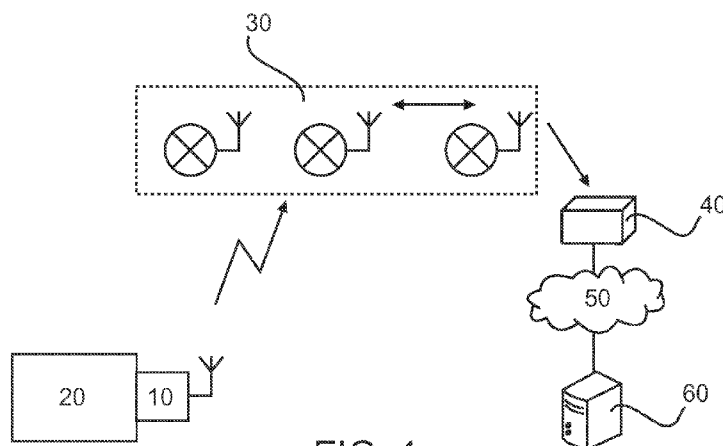


FIG. 1

(57) **Abstract:** Network based maintenance request service The present invention relates to an apparatus, system and method for re-questing maintenance service via a communication network (30), wherein a service request is triggered by activating a user interface at an equipment or location (20) to which the service request is related, and a service request message with service-related informa-tion of the equipment or location (20) is automatically generated and transmitted to a destination address of a service provider via the communication network (30) in response to the triggering. An effortless maintenance request system can thereby be built on top of an existing building network, e.g. a lighting control network.

NETWORK BASED MAINTENANCE REQUEST SERVICE

5 FIELD OF THE INVENTION

The present invention relates to an apparatus, system, method and computer program product for requesting maintenance service via a communication network such as – but not limited to – a ZigBee Light Link (ZLL) network for intelligent lighting solutions.

10 BACKGROUND OF THE INVENTION

Facilities such as offices, hospitals, industry, hospitality or schools have to deal with broken equipments (e.g. broken coffee machine), lack of supply (e.g. toilet paper) and other issues requiring maintenance. Facilities such as assisted living, hospital and retail may to deal with assistance requests from inhabitants or customers. These situations could occur
15 anytime and a facility manager or maintenance service provider needs to be informed so that actions can be taken to restore the broken equipments, refill the supplies or provide other maintenance or assistance services.

There are several means to request such maintenance services.

First, a service requester may contact a service provider by calling a service
20 number displayed on the broken equipment or visible in the serviceable location or by filling in an online service request form on the website of the service provider. The address of the website may again be displayed on the broken equipment, or displayed on a company internal intranet. Both cases require some effort from the requester. In the first case, the requester will have to take note of the phone number and make a phone call to request for the service.
25 Similar effort is needed in the second case if the web address is displayed on the equipment. If the web address is displayed in the tenant website, effort is needed to locate/find the right link.

Second, the broken equipment may be equipped with a self reporting mechanism, which upon detection of service needs, automatically and electronically reports the service needs to the service provider. Equipments such as printers may have this self
30 reporting capability built into the equipment. This approach is the most convenient since no effort from the user is needed. However, it requires intelligence and a communication means to be built into the equipment. It is most suitable for equipments that are inherently built with communication means, such as (network) printers.

Third, the service requester may contact the service provider by scanning quick response (QR) codes displayed e.g. on the equipment or visible in the serviceable location. The code may contain an Internet address (e.g. Uniform Resource Locator (URL)) of the website of the service provider, where the service requester can fill out a service request form.

5 This approach may require slightly less effort from the requester, but it requires the requester to have a smart terminal or phone.

SUMMARY OF THE INVENTION

An object of the present invention is to provide maintenance service system
10 with low effort on the requesting side.

This object is achieved by an apparatus as claimed in claim 1, a system as claimed in claim 12, a method as claimed in claim 14, and a computer program product as claimed in claim 15.

Accordingly, maintenance service can be requested independent of equipment
15 types and with very minimum effort, e.g., a press of button. The proposed solution is thus advantageous for service companies that need to serve various types of equipments. It is easy to deploy e.g. by sticking or attaching a trigger device with a simple user interface to the related equipment or an adjacent surface; it does not have to be built into the equipment in the factory nor on the site. The service request may even not be related to a particular equipment
20 piece, but to a location, e.g. table in a restaurant, fitting room in a shop, etc. Moreover, an effortless maintenance request system can be built utilizing an existing building network, e.g. a lighting network, so that installation effort can be minimized as well.

According to a first aspect, the apparatus may comprise a message generator for automatically generating the service request and adding service-related information
25 retrieved from a memory to the service request. Thereby, the service request can be initiated with a simple trigger process and without any input of additional information by the user.

According to a second aspect which may be combined with the above first aspect, the service-related information may comprise at least one of an identifier of the apparatus, data indicative of a type of equipment or location to which the apparatus is attached,
30 data indicative of the position of the equipment or location, a serial number of the equipment or location, data indicative of a type of failure, data indicative of a type of the service requested, and an urgency of the request. This ensures that relevant information is provided to the service provider, so that the maintenance service can be readily initiated.

According to a third aspect which can be combined with any one of the first and second aspects, the at least one communication interface may comprise a radio communication interface or any other wire-free communication interface, including infrared, ultrasound, coded light, via which the service request can be sent out wirelessly. This provides the advantage that installation costs can be minimized, since no new wires have to be added. The communication interface does allow the service requests to be forwarded on the network. The network can be a standalone network dedicated to servicing, but preferably, existing networks - wireless with mesh, bus or star topology; or hybrid networks including wireless bridges/gateways/access points, e.g. lighting control networks or information technology (IT) networks - can be used for forwarding the service request to the service provider. The service provider may be located on local network, or on public network (e.g. Internet), e.g. accessible via gateway.

According to a fourth aspect which can be combined with any one of the first to third aspects, the user interface may include at least one of a button, a toggle switch, a rotary actuator (knob), a slider, a touch screen, a deformable element (e.g. of a piezo-electric material), etc. The service request may thus be initiated or triggered by simply pressing the button or turning or flipping or toggling the switch or activating any other one of the above actuators types.

According to a fifth aspect which can be combined with any one of the first to fourth aspects, the apparatus may be adapted to be attachable to the equipment or location to which the service request is related. This leads to a further decrease of installation effort since the trigger apparatus with the user interface may simply be attached or fixed to the equipment or location.

According to a sixth aspect which can be combined with any one of the first to fifth aspects, the apparatus may comprise an installer for automatically retrieving service-related information. For example, the installer may retrieve the service-related information from the equipment when the apparatus is attached to the equipment. Alternatively, the installer may retrieve the service-related information from the network or from a backend server of the service provider when the apparatus is connected to the network. The installer facilitates information retrieval, so that the user does not need to initially program or configure the apparatus.

According to a seventh aspect which can be combined with any one of the first to sixth aspects, the apparatus may be adapted to perform a procedure for joining the

communication network which may comprise e.g. a lighting control network. This may include steps like channel finding, parent/network finding, security bootstrap, address assignment, parameter configuration, device discovery, service discovery, and application binding. Again, user effort for manual configuration of the apparatus can be reduced.

5 According to an eighth aspect which can be combined with any one of the first to seventh aspects, the apparatus may be powered by an energy harvesting mechanism. Thereby, power consumption can be reduced substantially since the energy harvesting mechanism generates the required power for operation of the apparatus without requiring any additional power source.

10 It is noted that the apparatus may be implemented as a discrete hardware circuitry with discrete hardware components, as an integrated chip, as an arrangement of chip modules, or as a signal processing device or chip controlled by a software routine or program stored in a memory, written on a computer readable medium, or downloaded from a network, such as the Internet.

15 Further advantageous embodiments are defined below.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described, by way of example, based on embodiments with reference to the accompanying drawings, wherein:

20 Fig. 1 shows a schematic block diagram of a system architecture according to a first embodiment; and

Fig. 2 shows a block diagram of a user interface device according to a second embodiment.

25 DETAILED DESCRIPTION OF EMBODIMENTS

Embodiments of the present invention will now be described based on a maintenance request system which uses an available wireless mesh network (e.g. an intelligent lighting network) for conveying service requests to the service provider.

30 Fig. 1 shows a schematic block diagram of a system architecture according to a first embodiment. The proposed maintenance request system according to the first embodiment comprises one or more user interface (UI) devices 10, e.g. a button or a toggle switch conveniently attached to a serviceable object, equipment or facility 20. The UI device 10 may be battery-less devices which require no external power sources. This can be achieved

by providing an internal energy harvesting mechanism or the like, which may be initiated by a user trigger action when the service request is activated. The UI device 10 may further comprise at least one radio communication interface via which service request messages can be sent out wirelessly via a communication network 30, e.g., a building facility network to a destination address which may be a fixed address or an address that may be changed or that may change during the routing process.

Optionally, the communication network 30 may comprise at least a router/gateway 40 for providing a connection to a public network 50, e.g., the Internet. The communication network 30 can be a standalone dedicated network or an existing network that is formed by mains-powered luminaires with radio interfaces in a mesh fashion, e.g., a ZigBee Light Link (ZLL) network for intelligent lighting solutions. The radio interfaces of luminaires may receive messages sent from the UI device 10 and help forward these messages towards the public network 40. Alternatively, the communication network 30 could be powered by Power-over-Ethernet (PoE) or EMerge direct current (DC) power system or could be self-powered or battery-powered, and could utilize any other network technology, such as an Internet Protocol (IP) based network, a power line communication (PLC) network, a Wi-Fi network, a ZigBee network, a Z-Wave network, a Bluetooth-based network etc.

Service request messages from the UI device 10 may then be routed to a service/maintenance backend server 60. These servers receive the service request messages originated from the UI device 10, process the messages against their databases of building facility equipments, and present the service provider with the right service-related information, e.g. the reason the report or the message is generated, the serial code of the UI devices and hence the ID of the building facility equipment whose malfunction is being reported, the type of the facility equipment, and the location of the equipment. More specifically, the backend server 60 looks up the relevant information based on a unique identifier included in the service request message. The identifier could be a user-readable string like "Dell Latitude D620", whereas in a particular implementation of the embodiments a code such as "0b00" may be used to mean the same. The identifier may thus also be obtained by binary/enumeration encoding. The backend server 60 may inform service personnel with all the information it gets so far. The backend server 60 may inform the service personnel in a variety of ways that may include email, SMS, web page etc.

It is noted that there can be multiple UI devices 10 with buttons or other trigger elements provided on one equipment 20, with labels that indicate different reasons for

malfunctions/service request. For example, one button may indicate the coffee machine it attaches to is broken; and another button may indicate coffee bean powder needs to be refilled.

Fig. 2 shows a block diagram of a user interface device according to a second embodiment.

5 Before the system can be fully operational, the UI devices 10 have to be registered. It is assumed there is a unique identifier that is linked to a particular UI device 10. When the UI device 10 is attached to a piece of facility equipment 20, relevant information may be recorded down by an installer 130 (e.g. a software routine or hardware circuit provided in the UI device 10) and/or is inserted to or stored at the UI device 10, and/or the
10 network (30) and/or the backend server 60 later. The installer 130 may retrieve the service-related information from the equipment 20 when the UI device 10 is attached to the equipment 20. Alternatively, the installer 130 may retrieve the service-related information from the communication network 30 or from a backend server when the apparatus is connected to the communication network 30. The relevant or service-related information
15 might contain at least one of the identifier of the UI device 10 (e.g. Medium Access Control (MAC) address), the type of the equipment 20 that the UI device 10 is attached to, the location of the equipment 20, the serial number of the equipment 20, the type of service request it is meant to trigger, etc. In addition, the installer 130 may perform any needed procedure in order for the UI device 10 to join the communication network 30. This may
20 include steps like channel finding, parent/network finding, security bootstrap, address assignment, parameter configuration, device discovery, service discovery, and application binding. After these steps the system may be put in operation mode. The installer 130 could be realized e.g. based on a connectable external device (e.g. a Universal Serial Bus (USB) stick or dongle). Or, based on a determination of the location of the UI device 10 by e.g.
25 triangulation.

 During operation, a user actuates the user interface 110 of the UI device 10 when he or she likes to report malfunction of a particular piece of facility equipment. The UI device 10 comprises a message generating function or unit 120 which generates one or multiple service request messages, which contain at least the unique identifier that is
30 associated to the UI device 10. When the relevant information mentioned above is available at the UI device 10, e.g. provided by a memory or by the installer 130, the message generating unit 120 of the UI device 10 may include that information also in the message. Moreover, an error code that corresponds to the type of malfunction may also be included.

The service request message is forwarded to a communication interface 140 of the UI device, which transmits the message so that it travels along the communication network 30 (e.g. mesh-type lighting network) and - if required via the router/gateway 40 to the public network 50 (e.g. Internet) - to reach the backend server 60. The communication interface 140 may be or may comprise a radio communication interface or any other wireless communication interface, including infrared, ultrasound or coded light/visual light communication, via which the service request can be sent out wirelessly.

In summary, the present invention relates to an apparatus, system and method for requesting maintenance service via a communication network, wherein a service request is triggered by activating a user interface at an equipment to which the service request is related, and a service request message with service-related information of the equipment is automatically generated and transmitted to a predetermined destination address via the communication network in response to the triggering. An effortless maintenance request system can thereby be built on using an existing building network, e.g. a lighting control network.

While the invention has been illustrated and described in detail in the drawings and the foregoing description, such illustration and description are to be considered illustrative or exemplary and not restrictive. The invention is not limited to the disclosed embodiments and can be used for various buildings (office, school, health care, hospitality facilities) and facility management systems, where lighting networks serve an indispensable role of providing shared infrastructure for transporting messages related to other facility systems. As already mentioned, the UI device does not have to be built into the equipment in the factory nor on the site. The service request may even not be related to a particular equipment piece, but to a location, e.g. table in a restaurant, fitting room in a shop, etc. Of course, other types of wired or non-wired communication networks can be used for conveying the proposed service request message to the public network.

From reading the present disclosure, other modifications will be apparent to persons skilled in the art. Such modifications may involve other features which are already known in the art and which may be used instead of or in addition to features already described herein.

Variations to the disclosed embodiments can be understood and effected by those skilled in the art, from a study of the drawings, the disclosure and the appended claims. In the claims, the word "comprising" does not exclude other elements or steps, and the

indefinite article "a" or "an" does not exclude a plurality of elements or steps. As already mentioned above, the maintenance requesting functions described in connection with the above embodiments of Figs. 1 and 2, may at least partially be implemented as software routines or computer programs which may be stored/distributed on a suitable medium such as an optical storage medium or a solid-state medium supplied together with or as a part of other hardware, but may also be distributed in other forms, such as via the Internet or other wired or wireless telecommunication systems. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage. Any reference signs in the claims should not be construed as limiting the scope thereof.

CLAIMS:

1. An apparatus for requesting maintenance service via a communication network (30), said apparatus (10) comprising:

5 a) a user interface (110) for allowing a user to trigger a service request; and

b) at least one communication interface (140) for transmitting said service request to a destination address of a service provider via said communication network (30) in response to a trigger event at said user interface.

10 2. The apparatus according to claim 1, wherein said apparatus (10) comprises a message generator (120) for automatically generating said service request and adding service-related information retrieved from a memory to said service request.

15 3. The apparatus according to claim 2, wherein said service-related information comprises at least one of an identifier of said apparatus, data indicative of a type of equipment or location (20) to which said apparatus is attached, data indicative of the position of said equipment or location (20), a serial number of said equipment or location (20), data indicative of a type of failure, data indicative of a type of service requested, and an urgency of said service request.

20 4. The apparatus according to claim 1, wherein said at least one communication interface (140) comprises a wireless communication interface via which said service request can be sent out wirelessly.

25 5. The apparatus according to claim 1, wherein said user interface (110) may comprise at least one of a button, a toggle switch, a rotary actuator, a slider, a touch screen and a deformable element for triggering said service request.

30 6. The apparatus according to claim 1, wherein said apparatus (10) is adapted to be attachable to an equipment or location (20) to which said service request is related.

7. The apparatus according to claim 1, wherein said apparatus (10) comprises an installer (130) for automatically retrieving service-related information.

5 8. The apparatus according to claim 7, wherein the installer (130) may retrieve said service-related information from an equipment or location (20) when the apparatus is attached to said equipment or location (20) or from said communication network (30) or a backend server of a service provider.

10 9. The apparatus according to claim 7, wherein said installer (130) is adapted to perform a procedure for joining said communication network (30).

10. The apparatus according to claim 1 wherein said communication network (30) comprises a lighting control network.

15

11. The apparatus according to claim 1, wherein said apparatus is powered by an energy-harvesting mechanism.

12. A system comprising at least one apparatus according to claim 1, and said
20 communication network (30).

13. The system according to claim 12, wherein said system further comprises a service or maintenance backend server (60) for providing a service provider with service-related information included in said service request.

25

14. A method of requesting maintenance service via a communication network (30), said method comprising:

a) triggering a service request by activating a user interface at an equipment or location (20) to which said service request is related;

30 b) automatically generating a service request message with service-related information of said equipment or location (20); and

c) transmitting said service request message to a destination address of a service provider via said communication network (30) in response to said triggering.

15. A computer program product comprising code means adapted to produce
5 the steps of method claim 14 when run on a computing device.

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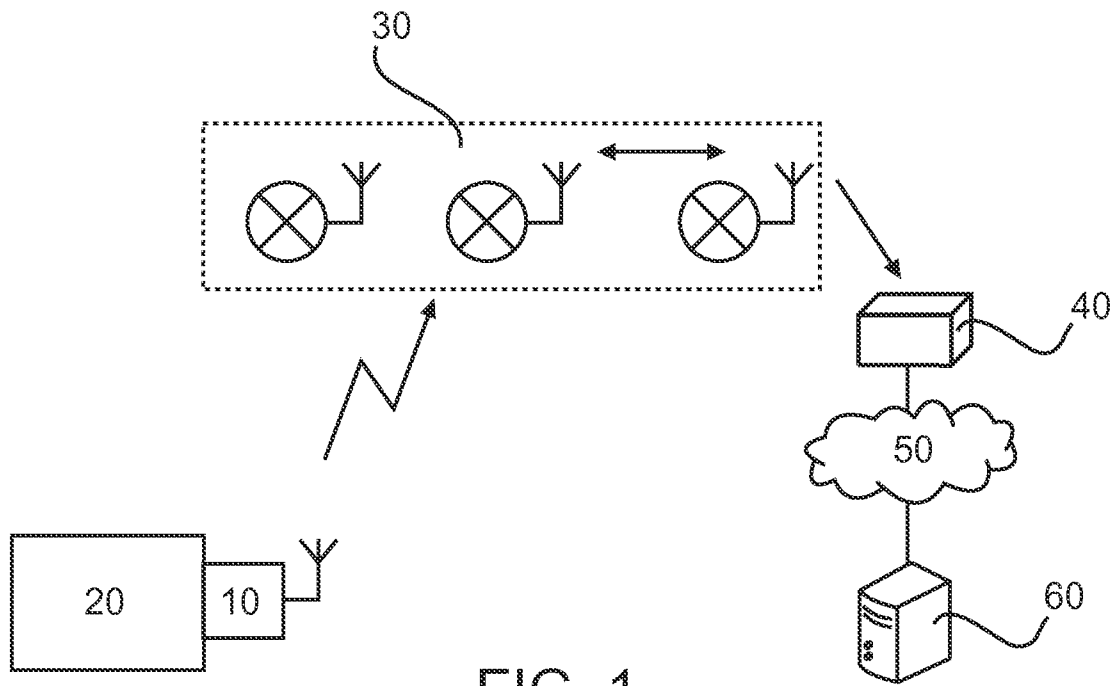


FIG. 1

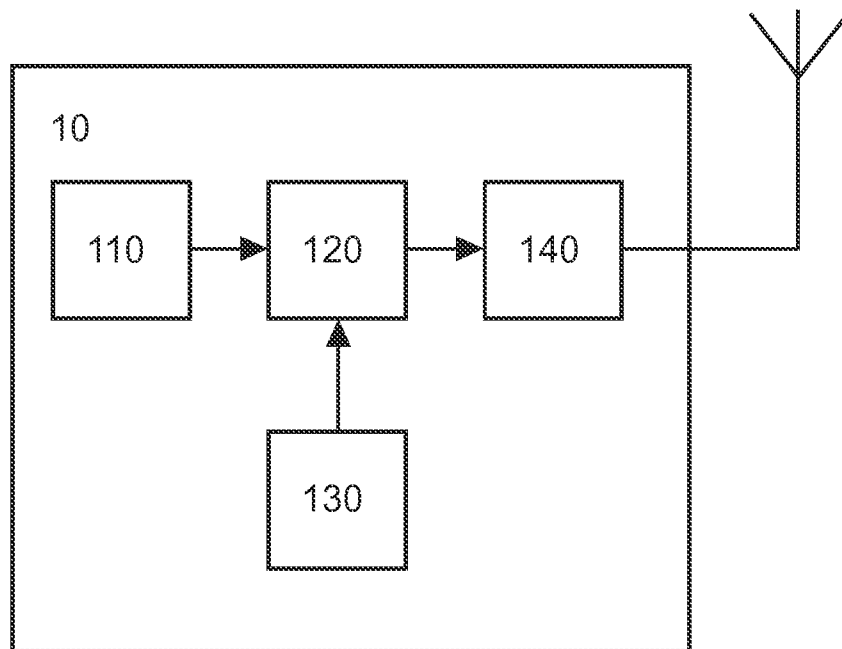


FIG. 2

INTERNATIONAL SEARCH REPORT

International application No

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A. CLASSIFICATION OF SUBJECT MATTER

INV. H04M11/00 H04L29/08
 ADD. H04M11/04

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)

H04L H04M G08B G08C

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 7 894 795 B1 (DUNNE KEVIN FRANCIS [US] ET AL) 22 February 2011 (2011-02-22) column 2, lines 16-24 column 4, line 46 - column 5, line 46 column 8, lines 25-54 column 13, lines 20-45 column 15, lines 12-22 figure 1	1-15
X	US 2007/035402 A1 (DAWSON N R [US] DAWSON N RICK [US]) 15 February 2007 (2007-02-15) paragraph [0002] paragraph [0043] - paragraph [0044] paragraph [0047] - paragraph [0049] paragraph [0047] - paragraph [0048] ----- -/-	1-15



Further documents are listed in the continuation of Box C.



See patent family annex.

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INTERNATIONAL SEARCH REPORT

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2007/105092 A2 (KONINKL PHILIPS ELECTRONICS NV [NL]; PHILIPS CORP [US]) 20 September 2007 (2007-09-20) page 2, lines 7-18 page 9, lines 10-28 page 11, lines 3-22 page 14, line 11 - page 15, line 15 -----	1-15
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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