(54) Title of the Invention: Life-saving equipment monitoring system
Abstract Title: Monitoring the presence of lifesaving equipment in an enclosure

(57) A lifesaving equipment monitoring device is provided for remotely monitoring the presence or absence of the equipment, for example floatation ring 8, within an enclosure, housing, or similar storage unit 7. The device comprises a distance / range detecting unit arranged to detect a distance to an object, wherein, if said object is detected at a predetermined distance, the lifesaving equipment is deemed to be present. The device can be directly mounted to an enclosure or housing 7, or alternatively mounted on a pole (9,fig.2) at an elevation beside or in close proximity to the enclosure or housing 7. One or more solar panels 3 may provide charge to a battery unit 6 which supplies power to the control unit electronics 4. A self-calibrating sensor 5 may be used to detect the presence or absence of the Life-saving equipment. The device communicates with a remote server on a predefined or user configurable time period via a wireless connection.
Life-Saving Equipment Monitoring System

This invention relates to a device for monitoring the presence or absence of Life-savinng equipment normally found in an enclosure, housing or storage unit.

Life-saving equipment consisting of a floatation ring, buoyancy aid or similar rescue device can be found in suitable enclosures, housings and storage units around many beaches, harbours, lakes and river walkways. Because of the vital function they perform, it is paramount that they are present at all times and therefore require regular inspection to ensure that they do not fall foul of misuse, unauthorized removal, theft or vandalism. Subsequently, if these regular checks are not performed then the absence of any Life-saving equipment may jeopardise the assistance of a critical life-saving rescue. Regular inspection of sites may have adverse financial and manpower cost impact due to a range of factors including geo-graphical distances and logistics.

Reference is made to GB1288635 and GB2382201A. GB1288635 describes an invention ‘Lifebelt Alarm’ where the removal of a Lifebelt activates an alarm. The alarm is operated when the Lifebelt is removed where it is mounted on a hook for supporting a Lifebelt. This system presents several disadvantages which will be overcome by the Life-saving equipment monitoring system. These include a method of detecting the removal of life-saving equipment without use of a mechanical fixture that may include a hook or pivoting mechanism where its performance may degrade due to corrosion if exposed to moisture, water ingress or sea spray commonly found in the environments where the equipment is likely to be installed. It may be the case that regular inspection is required to ensure that the mechanical parts are free to operate properly and are not impeded or seized. Secondly, although the alarm system described may serve to deter unauthorised person/s from removing the Lifebelt, in the case where it is removed permanently there is no mechanism to inform the person/s responsible for maintaining the equipment that this has occurred and the
risk this presents if an emergency rescue prevails. The only solution would be for someone
to be physically present at each site which wouldn’t be practical.

GB2382201A describes an invention 'The Safetycom' that Life-Saving equipment such
as a torpedo float is located on hooks coupled to a pivot system. Removal of the equipment
from the housing sends an SMS or text message on a GSM mobile telephone. The
disadvantages of this system are the use of a mechanical mechanism to activate the alarm.
As with GB1288635 'Lifebelt Alarm', operation in outside environment will lead to exposure
to moisture, water or sea spray that may degrade the performance of the system. Secondly,
the system intends to inform person/s responsible for maintaining the equipment by SMS or
text messaging. Text messaging may not be considered the best approach of informing
authorised person/s of the removal of the equipment as the message could be left unread or
may not reach the intended recipient reliably.

The Life-saving equipment monitoring system overcomes shortcomings of GB1288635
and GB2382201A by using a non-mechanical, non-contact sensing unit hereby described as
a 'Self-Calibrating Sensor Unit'. This provides a zero maintenance reliable method for
detection of the removal of Life-saving equipment from an enclosure, housing or storage
box. The system also provides a solution for informing person/s responsible for the
maintenance of the equipment at each site by use of data transferred over a mobile network
connection (e.g. 3G or better). The system will exchange data in a safe method with a
Server computer and will acknowledge the receipt of data back to the monitoring system.

According to one embodiment, the present invention provides a device for monitoring
a presence of lifesaving equipment in an enclosure. The device comprises a distance
detecting means configured to detect a distance to an object, wherein if the object is
detected at a predetermined presence distance the lifesaving equipment is deemed to be
present.

Preferably, the distance detecting means comprises a sensor, and the distance is a
distance between the sensor and the object.
Preferably, the device also comprises calibrating means for establishing a predetermined presence distance when the lifesaving equipment is present in the enclosure. The predetermined presence distance is a distance between the sensor the said lifesaving equipment.

Preferably, if the object is detected at a predetermined absence distance the lifesaving equipment is deemed to be not present. Preferably, the device also comprises calibrating means for establishing the predetermined absence distance when the lifesaving equipment is not present in the enclosure.

Preferably, the device also comprises communication means for providing alerts when the lifesaving equipment is not present. Preferably, the communication means comprises wireless communication.

Preferably, the device also comprises one or more solar panels for providing power to said device.

According to another embodiment, the present invention provides a method for calibrating a device as specified above, the method comprising the following steps: actuating the calibrating means; positioning the lifesaving equipment in the enclosure during a first period; detecting the presence distance; removing the lifesaving equipment from the enclosure during a second period; and detecting the absence distance. This means that calibrating for any lifesaving device in any enclosure can be achieved achieved.

Thus the present invention provides a cost effective monitoring system which can be fitted to a new or existing Life-saving equipment enclosure, housing or storage box installation. The device is solar powered by one or more solar panels and may be directly mounted to the Life-saving equipment enclosure or housing, alternatively the device may be installed in the near vicinity of the Life-saving equipment enclosure or housing at an elevated height by means of a metal or plastic pole.
A self calibrating sensor unit provides detection of the presence or absence of the Life-saving equipment within the enclosure or housing. The sensor unit is fitted to the Life-saving equipment enclosure or housing and also provides a control and visual interface for installation, calibration and configuration of the system.

The device communicates with a remote server on a predefined or user configurable time period using a wireless mobile device (e.g. 3G or better modem or similar) utilising mobile phone network infrastructure to relay information on the status (presence or absence) of the Life-saving equipment. The data is collected and processed by the user through an easily accessible database, and can be viewed on a PC, tablet or similar handheld mobile device.

The device will also send data to the end user which will include GPS co-ordinates to assist in quick identification of the problem site. This will enable qualified personnel responsible for maintaining the equipment to attend the site promptly and efficiently to resolve any issues.

For a more complete explanation of the present invention and technical advantages thereof, reference is now made to the following description and the accompanying drawing in which:

Figure 1 shows an embodiment of the Life-saving equipment monitoring system fitted directly to a typical Life-saving equipment housing with a detailed view of internal components;

Figure 2 shows an embodiment of the Life-saving equipment monitoring system mounted on a pole;

Figure 3 shows a detailed view of the separate components of the pole mounted Life-saving equipment monitoring system;

Figure 4 shows details of the sensor unit;
Figure 5 shows rear view details of the sensor unit mounted to a typical Life-saving equipment housing;

Figure 6 shows details of the operation of the self calibrating sensor unit; and

Figure 7 shows an overview schematic block diagram of the entire system.

Figure 1 shows a direct mounted embodiment of the a device for monitoring a presence of lifesaving equipment in an enclosure showing the various components of the Life-saving equipment monitoring system. A chassis 1 is used to mount the internal parts to the Life-saving equipment enclosure or housing 7 using fasteners. The chassis supports the control unit electronics 4 and the battery unit 6. The device has a distance detecting means comprising a sensor unit 5 fitted in the centre of the chassis and can be adjusted using several fitting points on the chassis to enable alignment of the sensor unit to for example a Lifebuoy floatation ring 8 within the enclosure or housing. The internal components are protected with a cover 2 that is secured with fasteners to the Life-saving equipment enclosure or housing. The cover also supports the solar panels 3 used to charge the batteries within the battery unit. Typically the chassis is made from a metal or alloy, and the cover is made from plastic.

Figure 2 shows an embodiment of the Life-saving equipment monitoring system that is mounted at an elevation above a typical Life-saving equipment enclosure or housing 7 using a length of metal or plastic pole 9. The pole may be of square or round section and variable length. The position of the mounting pole will be beside or within the near vicinity of the Life-saving equipment enclosure or housing.

Figure 3 shows the various components of the pole mounted embodiment of the Life-saving equipment monitoring system. A hinged chassis 10 is used to mount the parts of the Life-saving equipment Monitoring system. The chassis is fastened to a pole 9 and is adjustable by a hinged bracket 11 to allow for alignment of the solar panels 3. The chassis
supports the control unit electronics 4 and the battery unit 6. Typically the chassis is made from a metal or alloy, and the cover is made from metal or plastic.

Figure 4 shows the sensor unit 5. The sensor unit is mounted using lugs 15 and connected by a multi-core electrical cable to the control unit electronics. A self-calibrating sensor device 12 is used to determine the position of the Life-saving equipment within the enclosure. The sensor unit also provides a control interface 13 and Light Emitting Diodes (LEDs) 14 to allow the Life-saving equipment monitoring system to be installed by the user.

Figure 5 shows the rear view details of the sensor unit 5 mounted to a typical Life-saving equipment housing or enclosure 7. The sensor unit may be located at any point on the Life-saving equipment enclosure or housing. The sensor unit is self-calibrating and will automatically detect the presence of the Life-saving equipment for example a floatation ring or similar buoyancy aid during the installation process.

Figure 6 shows how the installer would use a magnet 16 to activate a reed switch 13 within the sensor unit 5 to place it in self-calibration mode for detection of Life-saving equipment in this case a Lifebuoy floatation ring 8. LEDs 14 provide visual indication to the installer at each stage of the process. Each stage is accomplished over a time period. With the Life-saving equipment presence within the enclosure 7 an optical device 12 scans and calculates the distance 17 between the sensor unit and the floatation ring. The computed value is stored in a memory device within the control unit electronics 4. The installer removes the floatation ring when notified by the LED interface and the optical device then calculates a value which corresponds to when the floatation ring is absent and this is also stored in memory. These values are used during normal operation to determine when the floatation ring is present or have been removed. The computed presence or absence values will depend on the type of Life-saving equipment that is to be monitored as this may vary in geometric shape and size. The absence value may correspond, for example, to a distance between the sensor and a door or cover of the enclosure when the enclosure is empty.
Figure 7 shows a block diagram overview of the circuit of the Life-saving equipment monitoring system. The control unit electronics 4 is powered from the battery unit 6 which contains, for example, 2 sealed lead acid batteries. Solar panels 3 provide charge current to a solar charger within the control unit that regulates the proper voltage and current levels to maintain the batteries. During normal operation the Master processor and 3G modem dongle 17 are in an off state as the Step-up converter is disabled. An Ultra-low power Slave processor is monitoring the Sensor Unit 5 over an I2C bus. It communicates with the optical sensor which in turn is monitoring the presence of the Life-saving equipment. As has previously been described, during the configuration stage the installer will have calibrated the sensor and the Ultra-low power Slave processor will have stored those values that correspond to the presence and absence of the life-saving equipment within the enclosure or housing. In the event that the sensor detects that the measured value are outside these parameters then the Slave processor will enable the Step-up converter and power up the main processor and 3G Modem. It will initialise the USB communications bus to the 3G Modem and send the data to the remote Server. The Server will acknowledge the data and inform the Master processor that the delivery of data was successful. After the data has been exchanged, the Slave processor will shutdown the Master processor and the 3G Modem by disabling the Step-up converter in order to preserve power and will continue to monitor the Life-saving equipment. Also during normal operation the Control unit will send periodic data to the Server at a rate defined by the installer of the current status of the Life-saving equipment. This will ensure that the end user can check that the Life-saving equipment is presence at all times or check when an existing alarm condition has been cleared. The Life-saving equipment monitoring device will also deliver the GPS co-ordinates of the problematic site to the Server. These co-ordinates are entered manually by the installer during the configuration stage and stored in the internal memory of the Slave processor. This will assist in the identification of the site so that service or maintenance person/s can attend to rectify any issues.
Claims

1. A device for monitoring a presence of lifesaving equipment in an enclosure, said device comprising distance detecting means configured to detect a distance to an object, wherein if said object is detected at a predetermined presence distance said lifesaving equipment is deemed to be present.

2. A device according to claim 1, wherein said distance detecting means comprises a sensor, and wherein said distance is a distance between the sensor and the object.

3. A device according to claim 2, said device comprising calibrating means for establishing said predetermined presence distance when said lifesaving equipment is present in said enclosure, wherein said predetermined presence distance is a distance between said sensor and said lifesaving equipment.

4. A device according to claim 1, wherein if said object is detected at a predetermined absence distance said lifesaving equipment is deemed to be not present.

5. A device according to claim 4, said device comprising calibrating means for establishing said predetermined absence distance when said lifesaving equipment is not present in said enclosure.

6. A device according to any preceding claim, additionally comprising communication means for providing alerts when said lifesaving equipment is not present.

7. A device according to claim 6, wherein said communication means comprises wireless communication.
7. A device according to any preceding claim, additionally comprising one or more solar panels for providing power to said device.

8. A device for monitoring a presence of lifesaving equipment in an enclosure substantially as described herein with reference to the drawings.

9. A method for calibrating a device according to any of claims 2 to 7, said method comprising the steps of:
   actuating said calibrating means;
   positioning said lifesaving equipment in said enclosure during a first period;
   detecting said presence distance;
   removing said lifesaving equipment from said enclosure during a second period; and
   detecting said absence distance;
   wherein calibrating for any lifesaving device in any enclosure is achieved.

10. A method for calibrating a device for monitoring a presence of lifesaving equipment in an enclosure, the method substantially as described herein with reference to the drawings.
Claims

1. A device for monitoring a presence of lifesaving equipment in an enclosure, said
device comprising distance calculating means configured to measure a distance to an
object, wherein if said object is measured at a predetermined presence distance said
lifesaving equipment is deemed to be present.

2. A device according to claim 1, wherein said distance calculating means comprises an
optical sensor, and wherein said distance is a distance between the sensor and the
object.

3. A device according to claim 2, said device comprising calibrating means for calculating
said predetermined presence distance when said lifesaving equipment is present in
said enclosure, wherein said predetermined presence distance is a distance between
said sensor and said lifesaving equipment.

4. A device according to claim 1, wherein if said object is measured at a predetermined
absence distance said lifesaving equipment is deemed to be not present.

5. A device according to claim 4, said device comprising calibrating means for calculating
said predetermined absence distance when said lifesaving equipment is not present in
said enclosure.

6. A device according to any preceding claim, additionally comprising communication
means for providing alerts when said lifesaving equipment is not present.

7. A device according to claim 6, wherein said communication means comprises wireless
communication.
8. A device according to any preceding claim, additionally comprising one or more solar panels for providing power to said device.

9. An enclosure for lifesaving equipment comprising the device of any of claims 1 to 8.

10. A device for monitoring a presence of lifesaving equipment in an enclosure substantially as described herein with reference to the drawings.

11. A method for calibrating a device according to any of claims 2 to 8, said method comprising the steps of:

   actuating said calibrating means;

   positioning said lifesaving equipment in said enclosure during a first period;

   calculating said presence distance;

   removing said lifesaving equipment from said enclosure during a second period; and

   calculating said absence distance;

   wherein calibrating for any lifesaving device in any enclosure is achieved.

12. A method for calibrating a device for monitoring a presence of lifesaving equipment in an enclosure, the method substantially as described herein with reference to the drawings.
**Patents Act 1977: Search Report under Section 17**

**Documents considered to be relevant:**

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<th>Category</th>
<th>Relevant to claims</th>
<th>Identity of document and passage or figure of particular relevance</th>
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<tr>
<td>X</td>
<td>1-3,6 &amp; 7</td>
<td>US2004/0019258 A1 (KAVOUNAS et al.) See whole document, especially paragraphs 6-8,12-13,44-48 &amp; figure 5</td>
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<tr>
<td>X</td>
<td>1,2,6 &amp; 7</td>
<td>JP09167291 A (TATENO) See EPO abstract</td>
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**Categories:**

| X | Document indicating lack of novelty or inventive step & Member of the same patent family |
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| A | Document indicating technological background and/or state of the art. |
| P | Document published on or after the declared priority date but before the filing date of this invention. |
| E | Patent document published on or after, but with priority date earlier than, the filing date of this application. |

**Field of Search:**

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC: B63B; G01S; G08B

The following online and other databases have been used in the preparation of this search report:

EPODOC, WPI, TXTE

**International Classification:**

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