

Lamps and monitoring devices for flying-insect trapsField of the Invention

5 The present invention concerns lamps for flying-insect traps. More particularly, but not exclusively, the invention concerns lamps for flying-insect traps comprising monitoring devices, and monitoring devices for flying-insect traps, in which flying insects are attracted using ultraviolet light. The invention also concerns methods of servicing flying-insect traps.

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Background of the Invention

Flying-insect traps that attract flying insects using ultraviolet light are well known. Commonly, such traps comprise a glue board on which attracted insects
15 become trapped, though other means of trapping and/or killing the insects are known, for example attracted insects may be killed using an electrical charge. Such traps need periodic servicing, for example to replace a glue board when it has trapped a sufficient number of insects. In addition, the ultraviolet light source, which may for example be one or more ultraviolet-light-emitting diodes (UV LEDs), can
20 degrade over time and require replacing. It may also be desirable to monitor other operating conditions of a trap, for example to identify the types of insect that have been caught.

However, it can be onerous and expensive to replace existing traps with new traps that provides monitoring features.

25 US 2019/327951 A1 (Plunkett's Pest Control), published 31 October 2019, discloses a monitoring device comprising a camera for mounting on the grill of a flying-insect trap, to monitor a glue board of the trap. However, the position of the monitoring device on the trap is such that it blocks a large amount of the light emitted by the trap, reducing its effectiveness, and is generally not aesthetically
30 pleasing. Also, while it is not explicitly discussed, the monitoring device presumably

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requires a battery or the like as a power source, which will require periodic replacement.

The present invention seeks to mitigate the above-mentioned problems. Alternatively or additionally, the present invention seeks to provide improved lamps
5 for flying-insect traps comprising monitoring devices, monitoring devices for flying-insect traps, flying-insect traps, and methods of servicing flying-insect traps.

Summary of the Invention

10 In accordance with a first aspect of the invention there is provided a lamp for a flying-insect trap, comprising:

a light source arranged to emit ultraviolet light to attract insects; and
a monitoring device arranged to monitor operating conditions of the flying-insect trap;

15 wherein the lamp is arranged to be removably received in a lamp fitting of the flying-insect trap and to receive a supply of power from the flying-insect trap via the lamp fitting, and wherein the monitoring device is mounted on the light source.

By having a monitoring device that is mounted on the light source, the monitoring device can be used in existing flying-insect traps to provide them with
20 monitoring functionality, without the flying-insect trap needing to be replaced. In addition the monitoring device can be hidden within the interior of the flying-insect trap, so is not aesthetically unpleasing.

The monitoring device is arranged to be removably mounted on the light source. In this way, the monitoring device can be mounted on an existing light
25 sensor, such as a conventional flying-insect trap lamp. Further, the monitoring device can be mounted on a new light source, for example when the light source needs to be replaced, without the monitoring device also needing to be replaced.

The monitoring device may comprises: a cavity arranged to receive the light source for mounting of the monitoring device on the light source; and a locking
30 mechanism arranged to keep the light source within the cavity.

Alternatively, the monitoring device and the light source may share a housing. In this way, they can be manufactured and provided as a single integrated device.

The monitoring device may be arranged to receive a supply of power from the flying-insect trap via the lamp fitting. In this way, the monitoring device does not need separate supply of power. In this case, the monitoring device may be arranged to receive the supply of power from the flying-insect trap via the light source. The light source may comprise an electrical connection to supply power to the monitoring device, the monitoring device may comprise an electrical connection to receive power from the light source, and the electrical connection of the light source may be in contact with the electrical connection of the monitoring device when the monitoring device is mounted on the light source.

Alternatively, the monitoring device may comprise a battery that provides its supply of power, or may be arranged to receive a supply of power in another way, for example via by being connected to a dedicated electrical connection of the flying-insect trap provided for the monitoring device.

The light source may comprise a plurality of ultraviolet-light-emitting diodes.

The monitoring device may comprise a camera, and the monitoring device may be arranged to monitor using the camera insects caught by the flying-insect trap. The camera may be arranged to capture an image of a glue board of the flying insect trap.

The monitoring device may comprise a light sensor, and the monitoring device may be arranged to determine using the light sensor the level of ultraviolet light emitted by the light source of the flying-insect trap.

The monitoring device may comprise a glue board sensor, and the monitoring device may be arranged to determine using the glue board sensor the presence or absence of a glue board in the flying insect trap.

In accordance with a second aspect of the invention there is provided a monitoring device for a flying-insect trap comprising a light source arranged to emit ultraviolet light to attract insects, wherein the monitoring device is arranged to be

mounted on the flying-insect trap, wherein the monitoring device comprises a light sensor, and wherein the monitoring device is arranged to determine using the light sensor the level of ultraviolet light emitted by the light source of the flying-insect trap.

5 By measuring the level of ultraviolet light emitted, it can be determined that a lamp or lamps of the trap need replacement, so allowing them to be replaced only when necessary, rather than on a fixed time schedule as is often done, which can result in lamps being replaced before or after it is necessary to do, which in both cases is undesirable.

10 The monitoring device may comprise a glue board sensor, and the monitoring device may be arranged to determine using the glue board sensor the presence or absence of a glue board in the flying insect trap.

 In accordance with a third aspect of the invention there is provided a
15 monitoring device for a flying-insect trap comprising a light source arranged to emit ultraviolet light to attract insects and a glue board, wherein the monitoring device is arranged to be mounted on the flying-insect trap, wherein the monitoring device comprises a glue board sensor, and wherein the monitoring device is arranged to determine using the glue board sensor the presence or absence of a glue board in
20 the flying insect trap.

 In the lamp or monitoring device described above, the light sensor may be an ultraviolet-light sensor.

 In the lamp or monitoring device described above, the monitoring device may
25 be arranged to determine, using the light sensor, when the level of ultraviolet light emitted by the light source of the flying-insect trap has fallen below a threshold. The monitoring device may be arranged to determine the threshold by determining the ambient light level when the light source of the flying-insect trap is not emitting light. The ambient light level may be determined using the light sensor.

30 In the lamp or monitoring device described above, the glue board sensor may be a light sensor arranged to determine a level of light emitted from the direction of

the glue board of the flying-insect trap. The light sensor may determine a level of light of only a particular colour (i.e. light within a particular range of frequencies), for example blue light. The monitoring device may further comprise a light source arranged to emit light in the direction of the glue board of the flying-insect trap. The
5 light source is an ultraviolet-light-emitting diode.

The monitoring device may comprise a door sensor, and the monitoring device may be arranged to detect using the door sensor the opening of a door of the flying-insect trap.

The monitoring device may comprise a communication module for
10 communicating with a remote server, and the monitoring device may be arranged to send data to the remote server indicating operating conditions of the flying-insect trap using the communications module. The communication module may communicate wirelessly using WiFi, Bluetooth, Zigbee or any other communication protocol, or may communicate using a wired connection.

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In accordance with a fourth aspect of the invention there is provided a flying-insect trap comprising a lamp or a monitoring device as described above.

The flying-insect trap may further comprise a glue board. In this case, when the monitoring device comprises the glue board sensor and the glue board sensor is
20 a light sensor, the flying-insect trap may further comprise a luminescent and/or light-reflecting material mounted on an interior surface of the flying-insect trap on the opposite side of the glue board to the glue board sensor. The luminescent and/or light-reflecting material may be a fluorescent material. The material may paper, such as a sheet of paper or a paper sticker. The material, such as paper, may be white.
25 The material, such as paper, may be treated with a fluorescent additive. The luminescent and/or light-reflecting material will reflect and/or luminesce light falling upon it, but this light will only reach the glue board sensor when there is no glue board in place, so providing a higher difference in light levels when the glue board is present opposed to being absent for the glue board sensor to detect. This is
30 particularly the case when the material is fluorescent and the monitoring device

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comprises an ultraviolet-light-emitting diode, as the glue board will absorb the ultraviolet light and will not fluoresce.

In accordance with a fifth aspect of the invention there is provided a method
5 of servicing a flying-insect trap comprising a lamp or monitoring device comprising a communications module as described above, comprising the steps of:

receiving data from the monitoring device indicating operating conditions of the flying-insect trap;

determining from the received data that there is a servicing requirement of
10 the flying-insect trap; and

sending an alert to an operator indicating the determined servicing requirement of the flying-insect trap.

The servicing requirement may be replacing the lamp because the light emitted is below a threshold, replacing a full glue board, or any other servicing
15 requirement determined from the data from the monitoring device indicating operating conditions of the flying-insect trap.

It will of course be appreciated that features described in relation to one aspect of the present invention may be incorporated into other aspects of the
20 present invention. For example, the method of the invention may incorporate any of the features described with reference to the apparatus of the invention and *vice versa*.

Description of the Drawings

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Embodiments of the present invention will now be described by way of example only with reference to the accompanying schematic drawings of which:

Figure 1 shows a front view of a lamp for a flying-insect trap in accordance with
30 an embodiment of the invention;

Figure 2a shows a front view of a monitoring device of the lamp of Figure 1;

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Figure 2b shows a back view of a monitoring device of the lamp of Figure 1;

Figure 3 shows a front view of a flying-insect trap in which the lamp of Figure 1 is installed;

Figure 4 is a schematic diagram showing the functionality of the lamp of Figure 1;

5 Figure 5a shows a front view of a monitoring device in accordance with an embodiment of the invention;

Figure 5b shows a back view of the monitoring device of Figure 5a;

Figure 6a shows a front view of a flying-insect trap in which the monitoring device of Figure 5a is installed;

10 Figure 6b shows a cross-sectional side view of the flying-insect trap of Figure 6a;

Figure 7 is a schematic diagram showing the functionality of the monitoring device of Figure 5a;

Figure 8 shows an interior view of flying-insect trap in which a monitoring device in accordance with an embodiment of the invention is installed;

15 Figure 9 is a flowchart showing the operation of the light sensor module of the monitoring device of Figure 5a;

Figures 10a to 10c are graphs showing the duty cycle of the lamps of the flying-insect trap of Figure 6a in different brightness modes;

Figure 11 is a graph showing the luminance levels against wavelength parts of the flying-insect trap of Figure 8; and

20 Figure 12 is a flowchart showing a method of servicing a flying-insect trap in accordance with an embodiment of the invention.

Detailed Description

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A lamp for a flying-insect trap in accordance with an embodiment of the invention is now described with reference to Figures 1 to 4.

The lamp 1 comprises a light source 2, which has an elongate body 2 in which are mounted six UV LEDs 6. The light source 2 has end connectors 4 and 5 so that the
30 lamp can be mounted the lamp 1 into a conventional trap lamp fitting, as described

in more detail below. The fitting 4 in particular has electrical connectors to allow the lamp 1 to receive a supply of power from a trap in which it is installed.

The lamp 1 further comprises a monitoring device 10, which is attached to the midpoint of the light source 2. The monitoring device 10 has a body 11 and, on
5 its bottom surface, a camera 15.

The monitoring device 10 is shown in more detail in Figures 2a and 2b, without the light source 2. As can be seen, the monitoring device 10 has on the front of its body 11 a cover 12, which is attached to the body 11 by hinges 13. Between the cover 12 and the body 13 is a cavity 14, in which the light source 2 can fit. In this
10 way, the monitoring device 10 can be mounted on the light source 2, by placing the light source in the cavity and closing the cover 12, securing the monitoring device 10 to the light source 2, to give the lamp 1 showing in Figure 1.

In the present embodiment, the light source 2 has at its midpoint electrical connectors (not shown in the figures), which contact corresponding electrical
15 connectors in the cavity 14 of the monitoring device 10 (again not shown in the figures), so allowing the monitoring device 10 to receive a supply of power from the light source 2.

However, in other embodiments, the light source may be a conventional lamp for a trap. In this case, the monitoring device will not be able to receive a
20 supply of power from the light source, so will require another supply of power, for example an internal battery, or a wired connection to electrical connectors in the trap. In other embodiments, the monitoring device and light source may be integrated, i.e. manufactured and provided as a single device within a shared housing, so allowing the monitoring device to receive a supply of power from the
25 light source, or directly from the trap via the electrical connectors of the lamp fitting.

The lamp 1 is shown in Figure 3 installed in a flying insect trap 50. The trap 50 has a body 50, with a door 52 with a grill. The door 52 is shown open in Figure 3, and Figure 6a shows a similar type of trap with door closed. Inside the trap 50 at the bottom is a bottom glue board 53, and at the back inside the trap 50 is a back glue
30 board 54. Each of the bottom glue board 53 and the back glue board 54 have glue on their surfaces, on which any flying insects attracted by the trap become stuck.

The sides of the bottom glue board 53 are fitted between protrusions on the interior sides of the trap 50, so allowing the glue board 53 to be removed from the trap 50 by sliding it towards the open front of the trap 50, so that it can be replaced. Similarly, the back glue board 54 can be replaced when required.

5 The trap 50 has top, middle and bottom lamp fittings on its interior sides, each comprising on the left side a fitting with electrical connections (not shown) to supply power to an installed lamp, and on the right side a corresponding second fitting to hold the installed lamp in place. In the top and middle lamp fittings there are installed two conventional lamps 52. Each conventional lamp 52 comprises six
10 UV LEDs directed towards the front of the trap 50. In the bottom lamp fitting the lamp 1 of the present embodiment is installed, so that six UV LEDs 6 are again directed towards the front of the trap 50, and also so that the camera 15 of the monitoring device 10 is directed towards the bottom glue board 53.

 A schematic diagram showing the functionality of the lamp 1 is shown in
15 Figure 4. As can be seen, the lamp 1 comprises the light source 2 and monitoring device 10, and also a controller 20. The controller 20 receives a supply of power from the trap 50, and in turn provides a supply of power to the light source 2 and the monitoring device 10.

 As discussed above, the light source 2 comprises the UV LEDs 6. The
20 monitoring device 10 comprises a camera module 21, which comprises the camera 5. The monitoring device 10 also comprises a communications module 22, which is in communication with a remote server 80. In the present embodiment the communications module 22 is arranged to communicate using Wi-Fi with a local gateway to the Internet, with the remote server 80 also being in communication
25 with the Internet, but it will be appreciated that in other embodiments other methods of communicating can be used.

 In use, the lamp 1 receives a supply of power from the trap 50 via the electrical contacts 4 of the light source 2 which are connected to the bottom lamp fitting of the trap 50. (The trap 50 itself receives power from a mains power supply.)
30 The controller 20 of the lamp 1 uses the supply of power from the trap 50 to supply power to the light source 2 and so power the six UV LEDs 6, and also to supply power

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to the monitoring device 10. In this way, the monitoring device 10 is able to receive a supply of power from the trap 50, even though the trap 50 is a conventional trap 50 and has not been modified in order to provide power to the monitoring device 10. Thus, the lamp 1 can be installed in an existing conventional flying-insect trap,
5 without any modification being required, in order to provide such an existing trap with monitoring functionality.

Flying insects are attracted by the UV LEDs of the conventional lamps 52 and the lamp 1, and will become trapped on the bottom glue board 53 and back glue board 54. The camera 15 of the monitoring device 10 periodically captures images of
10 the glue board 53 of the trap 50, which are sent via the communications module 22 to the remote server 80. The remote server 80 can then process the images and determine, for example, if the bottom glue board 53 needs to be replaced, and send a suitable alert to an operative for that to be actioned. (As flying insects will tend to be trapped on the bottom glue board 53 and the back glue board 54 in a consistent
15 manner, it can be determined from monitoring only the bottom glue board 53 whether the back glue board 54 also needs to be replaced.)

It will be appreciated that in other embodiments, the monitoring device can provided various other types of desirable functionality, again allowing this to be provided in an existing trap without any modification of the trap being required,
20 including but not limited to the functionality of the monitoring device now described.

As discussed above, in other embodiments the monitoring device may comprise a battery, or obtain a supply of power other than via the light source. In such embodiments, as the monitoring device can be mounted on a conventional
25 lamp, as it does not need to be mounted on a lamp with electrical contacts from which it can receive a supply of power. In this way, the monitoring device when mounted on a conventional lamp can be used to provide such an existing trap with monitoring functionality, without any modification of the trap of the lamps used being required.

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A monitoring device for a flying-insect trap in accordance with another embodiment of the invention is now described with reference to Figures 5a to 11.

The monitoring device 100 has a body 101, and on a first end of the body 101 a display portion 102 with status LEDs 103. At the other end of the body 101 is a
5 sensor portion 105, which comprises a door sensor module 110, a light sensor module 120 and a glue board sensor module 130, each of which is described in detail below.

At the top part of the sensor portion 105 is a clip 104, with which the monitoring device 100 can be mounted on a flying-insect trap 150, of a similar type
10 to the trap 50 of the embodiment described above, as shown particularly in Figures 6a and 6b. The trap 150 has a body 151 and door 152 with a grill, and can be opened as shown for the similar type of trap 50 in Figure 3. A bar 155 extends horizontally across the top of the interior of the trap 100, and the clip 104 clips onto an end of the bar 155, so that the sensor portion 105 is positioned within the interior of the
15 trap 150, and the display portion 102 is positioned on the outside of the trap 150 with the status LEDs 103 directed away from the trap 150 so they can be seen by an operator.

A schematic diagram showing the functionality of the monitoring device 100 is shown in Figure 7. The monitoring device 100 comprises a controller 150, which
20 receives a supply of power from a battery 140. The controller 150 is in communication with, as well as providing a source of power to, each of the door sensor module 110, light sensor module 120 and glue board sensor module 130, as well as a communications module 160. The communications module 160 is in turn in communication with the remote server 80, which as in other embodiments might be
25 via a Wi-Fi connection or any other suitable communication means.

The door sensor module 110 of the monitoring device 100 is now described. The door sensor module 110 comprises a button 111, which is positioned towards the bottom of the sensor portion 105. As can be seen in particular in Figure 6b, the button 111 is position and orientated so that when the monitoring device 50 is
30 mounted on the trap 100, the button extends from the interior of the trap toward

the front, and particularly so it extends into space in which the door 152 is positioned when it is closed.

Figure 8 shows a monitoring device 200 of another embodiment of the invention, which is similar to the monitoring device 100, but does not have a light
5 sensor 120. Further, the monitoring device 200 is mounted on a flying-insect trap that is similar to the trap 150, but which is a smaller version that only has a single lamp 252, and does not have a bottom glue board. In Figure 8, the monitoring device 200 is shown with the end part of the housing of the sensor portion 205 removed, and only the PCBs for the door sensor module 110 and glue board sensor module
10 130 included (and not their respective components, or any other components of the monitoring device 200). In particular, the button 111 of the door sensor module 110 is not shown in Figure 8, but the hole 111a in the housing of the sensor portion 205 through which the button 111 extends is shown.

By having the button 111 of the door sensor module 110 so positioned and
15 oriented, the button 111 is depressed when the door 152 is closed, and released when the door 152 is opened, thus enabling the door sensor module 110 to determine when the door 152 is opened and closed.

The light sensor module 120 of the monitoring device 100 is now described. The light sensor module 120 comprises a UV light sensor 121, which is also
20 positioned towards the bottom of the sensor portion 105, but oriented towards the opposite interior wall of the trap 150, so towards the lamps of the trap 150, so that it can receive light emitted by the lamps.

The operation of the light sensor module 120 is now described with reference to the flowchart 300 of Figure 9. In a first step, the door 152 of the trap 150 is
25 opened (step 301), in order to service the trap 152. This causes the trap 150 to switch off the lamps (step 302). The trap 150 is then serviced by an operator (step 303), for example to replace one or more lamps of the trap 150, to replace a glue board, to view the number of insects caught by the trap, or any other desired servicing or monitoring operation. The door 152 is then closed (step 304).

30 For an initial period after the door 152 has been closed, for example for 5 seconds, the lamps of the trap 150 remain switched off. During this period, the light

sensor module 120 uses the UV light sensor 121 to determine an ambient light level (step 305), i.e. to measure the level of UV light present when the lamps of the trap are not switched on. When the initial period has finished, the lamps are switched on (step 306).

5 The light sensor module 120 then determines the brightness mode of the trap 150 (step 307), i.e. brightness level at which the lamps of the trap 150 have been set to operate. This is done by using the UV light sensor 121 to determine the duty cycle of the lamps, i.e. how long they are switched on compared to being switched off, as their brightness is controlled by adjusting of their duty cycle. Figures
10 10a to 10c are graphs showing duty cycles for different brightness modes for the lamps. Figure 10a shows a low brightness level, in which it can be seen that the lamp is switched on for approximately 60% of the time. Figure 10b shows a medium brightness level, in which it can be seen that the lamp is switched for approximately 80% of the time. Finally, Figure 10c shows a high brightness level, in which it can be
15 seen that the lamp is switched for approximately 90% of the time. As the lamps are turned on and off many times a second (say having cycles of 50Hz, so 50 times a second), the lamps will not appear to flash on and off to a human, but will appear to be at different continuous brightness levels. However, the light sensor module 120 is nevertheless able to identify using the UV light sensor 121 the duty cycle of the
20 lamps, and so can determine the brightness modes at which the lamps of the trap 150 have been set.

 The light sensor module 120 then uses the determined ambient light level and the determined brightness mode to determine a light level threshold for the trap 150, i.e. a light level that if the trap 150 falls below, it indicates one or more of the
25 lamps of the trap requires replacement. The light sensor module 120 then determines the light level output by the lamps (step 308), by measuring the level of UV light output by the lamps using the UV light sensor 121. The determination of the light level output may be repeated as often as is desired, for example every minute, hour, day, or any other desired period. If the light level is determined to have fallen
30 below the determined threshold, an alert is sent using the communications module

160 (step 309), to indicate that one or more lamps of the trap 150 needs to be replaced by an operator.

The glue board sensor module 110 of the monitoring device 100 is now described. The glue board sensor module 110 comprises a blue light sensor 131 and a UV LED 132, which are position on the back of the sensor portion 105 facing the back interior wall of the trap 150, on which is fixed a sheet of paper 160, behind the back glue board 154. As can be seen particularly in Figure 8, in the trap therein the blue light sensor 131 and UV LED 132 will face in the direction A, toward the sheet of paper 160 fixed to the back interior wall of the trap. The back glue board is not shown, but it will be appreciated that when installed in the trap it will be positioned in front of the sheet of paper 160, so between the blue light sensor 131 and UV LED 132, and the sheet of paper 160. The sheet of paper 160 is standard white paper, with a fluorescent additive.

Figure 11 is a graph showing luminance levels for different wavelengths of light (in nanometres), for the blue light sensor 131, the UV LED 132, and the sheet of paper 160 when fluorescing. The UV LED 132 outputs UV light at a wavelength of around 367nm towards the back interior wall of the trap 150. When the back glue board 154 is installed in the trap 150, the UV light from the UV LED 132 will hit the glue of the back glue board 154 and be absorbed. Consequently, when the back glue board 154 is installed, little to no light will be emitted from the back glue board 154 due to the UV LED 132. However, if the back glue board 154 is not installed, the UV light from the UV LED 132 will hit the sheet of paper 160. Particularly as the sheet of paper 160 has a fluorescent additive, it fluorescence in response, emitting light at a wavelength of around 435nm, i.e. blue light. Thus, by determining the level of blue light received by the blue light sensor 131, it can be determined whether the back glue board 154 is present or absent. In particular, if a high level of blue light is detected, this indicates that the back glue board 154 is not installed and so the UV light emitted by the UV LED 132 is causing the sheet of paper 160 to fluoresce. If a low level of blue light is detected, this indicates that the back glue board 154 is installed, and is absorbing the UV light emitted by the UV LED 132.

A method of servicing a flying-insect trap comprising a lamp or monitoring device in accordance with an embodiment of the invention is now described, with reference to the flowchart 400 of Figure 12. The flying-insect trap may for example by the trap 50 or the trap 150 described above, and the lamp or monitoring device
5 may be the lamp 1 or monitoring device 100 described above, or any other suitable flying-insect trap, lamp or monitoring device in accordance with the invention.

In a first step, data indicating operating conditions of the trap is received at the remote server 80 (step 401). This data may for example comprise images of the bottom glue board 53 of the trap 50 captured by the camera 5 of the lamp 1; or
10 door, light level or glue board status determinations for the trap 150 determined by the monitoring device 100. A servicing requirement is then determined from the received data by the remote server (step 402). It may for example be determined that the glue boards of the trap need replacing or are missing, that one or more lamps need replacing, that the door of the trap has been left open, or any other
15 operating condition of the trap that means the trap requires servicing by an operator. A servicing alert is then sent to an operator (step 403), so that the trap can be serviced to satisfy the servicing requirement.

While the present invention has been described and illustrated with
20 reference to particular embodiments, it will be appreciated by those of ordinary skill in the art that the invention lends itself to many different variations not specifically illustrated herein. For example, while in the embodiments above a flying-insect trap with bar-shaped lamps has been described, in other embodiments a flying-insect trap with bulb-shaped lamps could be used, with in some embodiments the
25 monitoring device being mounted or incorporated into the bulb-shaped lamps. It will also be appreciated that sensor modules to determine other operating conditions of a lamp could additionally or alternatively be incorporated into a monitoring device of an embodiment, and the sensor modules described above could operate in other ways. To give just some examples, a door sensor using a light sensor rather than a
30 button could be used. Where ultraviolet light sensors or blue light sensors have been used, sensors that additionally or alternatively sense other frequencies of light could

be used. In the glue board sensor, a source of light other than ultraviolet light could be used.

Where in the foregoing description, integers or elements are mentioned which have known, obvious or foreseeable equivalents, then such equivalents are
5 herein incorporated as if individually set forth. Reference should be made to the claims for determining the true scope of the present invention, which should be construed so as to encompass any such equivalents. It will also be appreciated by the reader that integers or features of the invention that are described as preferable, advantageous, convenient or the like are optional and do not limit the scope of the
10 independent claims. Moreover, it is to be understood that such optional integers or features, whilst of possible benefit in some embodiments of the invention, may not be desirable, and may therefore be absent, in other embodiments.

Claims

1. A lamp for a flying-insect trap, comprising:
 - a light source arranged to emit ultraviolet light to attract insects; and
 - 5 a monitoring device arranged to monitor operating conditions of the flying-insect trap;wherein the lamp is arranged to be removably received in a lamp fitting of the flying-insect trap and to receive a supply of power from the flying-insect trap via the lamp fitting, and wherein the monitoring device is mounted on the light source.
- 10 2. A lamp as claimed in claim 1, wherein the monitoring device is arranged to be removably mounted on the light source.
3. A lamp as claimed in claim 1 or 2, wherein the monitoring device comprises:
 - 15 a cavity arranged to receive the light source for mounting of the monitoring device on the light source; and
 - a locking mechanism arranged to keep the light source within the cavity.
4. A lamp as claimed in claim 1, wherein the monitoring device and the light source
- 20 share a housing.
5. A lamp as claimed in any preceding claim, wherein the monitoring device is arranged to receive a supply of power from the flying-insect trap via the lamp fitting.
- 25 6. A lamp as claimed in claim 5, wherein the monitoring device is arranged to receive the supply of power from the flying-insect trap via the light source.
7. A lamp as claimed in claim 6, wherein the light source comprises an electrical connection to supply power to the monitoring device, wherein the monitoring device
- 30 comprises an electrical connection to receive power from the light source, and wherein the electrical connection of the light source is in contact with the electrical

connection of the monitoring device when the monitoring device is mounted on the light source.

8. A lamp as claimed in any preceding claim, wherein the light source comprises a plurality of ultraviolet-light-emitting diodes.

9. A lamp as claimed in any preceding claim, wherein the monitoring device comprises a camera, and wherein the monitoring device is arranged to monitor using the camera insects caught by the flying-insect trap.

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10. A lamp as claimed in claim 9, wherein the camera is arranged to capture an image of a glue board of the flying insect trap.

11. A lamp as claimed in any preceding claim, wherein the monitoring device comprises a light sensor, and wherein the monitoring device is arranged to determine using the light sensor the level of ultraviolet light emitted by the light source of the flying-insect trap.

12. A lamp as claimed in any preceding claim, wherein the monitoring device comprises a glue board sensor, and wherein the monitoring device is arranged to determine using the glue board sensor the presence or absence of a glue board in the flying insect trap.

13. A monitoring device for a flying-insect trap comprising a light source arranged to emit ultraviolet light to attract insects, wherein the monitoring device is arranged to be mounted on the flying-insect trap, wherein the monitoring device comprises a light sensor, and wherein the monitoring device is arranged to determine using the light sensor the level of ultraviolet light emitted by the light source of the flying-insect trap.

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14. A monitoring device as claimed in claim 13, wherein the monitoring device comprises a glue board sensor, and wherein the monitoring device is arranged to determine using the glue board sensor the presence or absence of a glue board in the flying insect trap.

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15. A monitoring device for a flying-insect trap comprising a light source arranged to emit ultraviolet light to attract insects and a glue board, wherein the monitoring device is arranged to be mounted on the flying-insect trap, wherein the monitoring device comprises a glue board sensor, and wherein the monitoring device is

10 arranged to determine using the glue board sensor the presence or absence of a glue board in the flying insect trap.

16. A lamp or monitoring device as claimed in claim 11, 13 or 14, wherein the light sensor is an ultraviolet-light sensor.

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17. A lamp or monitoring device as claimed in claim 11, 13, 14 or 16, wherein the monitoring device is arranged to determine, using the light sensor, when the level of ultraviolet light emitted by the light source of the flying-insect trap has fallen below a threshold.

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18. A lamp or monitoring device as claimed in claim 17, wherein the monitoring device is arranged to determine the threshold by determining the ambient light level when the light source of the flying-insect trap is not emitting light.

25 19. A lamp or monitoring device as claimed in claim 18, wherein the ambient light level is determined using the light sensor.

20. A lamp or monitoring device as claimed in claim 12, 14 or 15, wherein the glue board sensor is a light sensor arranged to determine a level of light emitted from the direction of the glue board of the flying-insect trap.

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21. A lamp or monitoring device as claimed in claim 20, wherein the monitoring device further comprises a light source arranged to emit light in the direction of the glue board of the flying-insect trap.
- 5 22. A lamp or monitoring device as claimed in claim 21, wherein the light source is an ultraviolet-light-emitting diode.
23. A lamp or monitoring device as claimed in any preceding claim, wherein the monitoring device comprises a door sensor, and wherein the monitoring device is
10 arranged to detect using the door sensor the opening of a door of the flying-insect trap.
24. A lamp or monitoring device as claimed in any preceding claim, wherein the monitoring device comprises a communication module for communicating with a
15 remote server, and wherein the monitoring device is arranged to send data to the remote server indicating operating conditions of the flying-insect trap using the communications module.
25. A flying-insect trap comprising a lamp or a monitoring device as claimed in any
20 preceding claim.
26. A flying-insect trap as claimed in claim 25, further comprising a glue board.
27. A flying-insect trap as claimed in claim 26, wherein the monitoring device
25 comprises the glue board sensor, and wherein the flying-insect trap further comprises a luminescent and/or light-reflecting material mounted on an interior surface of the flying-insect trap on the opposite side of the glue board to the glue board sensor.
- 30 28. A flying-insect trap as claimed in claim 27, wherein the luminescent and/or light-reflecting material is a fluorescent material.

29. A method of servicing a flying-insect trap comprising a lamp or monitoring device as claimed claim 24, comprising the steps of:

- receiving data from the monitoring device indicating operating conditions of
- 5 the flying-insect trap;
- determining from the received data that there is a servicing requirement of the flying-insect trap; and
- sending an alert to an operator indicating the determined servicing requirement of the flying-insect trap.