

A FLUID QUALITY-MONITORING DEVICE

FIELD OF THE INVENTION

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The present invention relates to a fluid quality-monitoring device to provide continuous monitoring of a fluid of interest.

10 BACKGROUND OF THE INVENTION

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Fluid quality monitoring, for example, water quality monitoring, is essential in determining the level of contamination in the water. This monitoring provides an indication as to whether the level of contamination is within acceptable levels, or whether certain measures have to be put in place. As water is an important source of survival, monitoring the quality of drinking water from reservoirs also safeguards the lives of many.

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Presently, water quality is measured using handheld devices to do point measurements, or water samples are collected for subsequent water quality checks in a laboratory.

There is presently no reliable continuous monitoring of water quality parameters in water bodies.

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This is very essential for many communities worldwide. However, the water quality measuring probes/sensors placed in these water bodies are easily fouled up by bio-growth resulting in (a) maintenance problems and (b) inaccuracies in data collection over time.

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Operators, engineers, managers and practitioners have been conducting regular water quality-monitoring over the years. However, continuous water quality-monitoring has not been very successful as there is no commercial solution to the bio-fouling problem.

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Presently, the universities are still working on new probes/sensors that can hopefully prevent bio-growth on them.

Various probes/sensors manufacturers/researchers are working on new probes/sensors that can prevent bio-growth on them. Some are working on material usage. Others are working on changing the sensing protocols. Materials that require the coating of the probes/sensors with toxic substances will defeat the objective of water quality monitoring. On the other hand, changing the sensing protocols will face many initial objections from international water quality standard boards, and will probably not be well received.

Moreover, there are so many different water quality-monitoring probes/sensors and each one needs to be replaced, thus incurring many objections and a very high cost for continuous water quality-monitoring to be achieved. This is not very desirable.

It is an object of the invention to ameliorate one or all of the above problems.

SUMMARY OF THE INVENTION

According to an embodiment of the invention, there is provided a fluid quality-monitoring device, for providing continuous monitoring of at least one parameter of a fluid of interest, said device including a detector for measuring a parameter value of the fluid, a transmission means in communication with the detector, for transmitting values measured by the detector, a data storage means to receive and store said transmitted data, wherein the device further includes a movement inducing means, to impart a movement to the detector, so as to retard or prevent a build up of biological material on a surface of the detector. Advantageously, this movement retards or prevents any attachment of biological material, and inhibits any growth or build up by shearing off any biological material that may momentarily attach itself onto the surface.

Preferably, the movement inducing means is a motor, to impart a movement to the device.

In a preferred embodiment, the movement inducing means imparts a movement to only the detector, and not the whole device.

Preferably, the device further includes a housing, to contain the data storage means and the transmission means, to prevent fluid damage.

- 5 Still preferably, the housing further includes a rotatable platform therein, to receive a detector therethrough, where the detector is extended therethrough for immersion into the fluid of interest, so that it can monitor the fluid of interest, while the data storage means and the transmission means are kept dry on the housing.
- 10 Still preferably, the movement inducing means moves the rotatable platform, having the detector extending therethrough, so that only the rotatable platform and the detector is in movement, and the housing containing the data storage means and the data transmission means stays stationary.
- 15 Preferably, the movement inducing means is a first motor, driving the rotatable platform.

Still preferably, the first motor is reversible, so that the movement of the platform may be reversed.

- 20 In an embodiment, the movement inducing means further includes a magnet of a polarity on an edge of the platform, and a proximity switch on an adjacent surface of the housing, and wherein the proximity switch is in communication with the first motor.

Preferably, the proximity switch is activated when in a magnetic field.

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Still preferably, the proximity switch reverses the first motor when it is activated.

- Preferably, the first motor moves the rotatable platform and the magnet in a first direction, until the magnetic field is sensed by the proximity switch and the motor
- 30 reverses to move the platform in a second direction.

In another embodiment, the movement inducing means is a magnet of a polarity on an edge of the rotatable platform, and a magnet of like polarity on an adjacent surface of the housing, so that a repulsive force is generated when a magnet on the rotatable platform meets the magnet of the housing, thereby causing a rotation of the rotatable platform in the opposite direction.

In this embodiment, preferably the magnet is powered by a second motor.

Still preferably, the first and second motor are driven by a motor driver circuit, controlled by a controller.

Still preferably, the control is programmable through a programmable logic controller.

Preferably, the motor is driven by a motor driver circuit, controlled by a controller.

Still preferably, the control is determined by a programmable logic controller.

Preferably, the device further includes a float on the housing, to maintain a buoyancy of the housing, or otherwise, the housing is made of a buoyant material.

Still preferably, the device further includes a power generating means to power the data storage means and the detector.

In a preferred embodiment, the power generating means uses a renewable energy source, so that there will not be a need to replenish the resources.

In an embodiment, power-generating means is a solar panel and a converter.

Preferably, the transmission means is a data transmission wire.

In another preferred embodiment, the transmission means is a wireless transmitter, so that there is no need for wires, and the data may be transmitted to locations a distance away.

In a preferred embodiment, the device has a plurality of detectors.

In this embodiment, each detector is deployed on a pod, provided separate from the housing.

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Preferably, each pod has a housing with a rotatable platform therein, to receive a detector therethrough, where the detector is extended therethrough for immersion into the fluid of interest.

10 Preferably, a movement inducing means moves each rotatable platform of each pod.

In a preferred embodiment, each rotatable platform is moved by a movement inducing means having a magnet of a polarity on an edge of the platform, and a proximity switch on an adjacent surface of the housing, and wherein the proximity switch is in
15 communication with the first motor, the proximity switch activated when in a magnetic field, and reverses the first motor when it is activated.

Preferably, the first motor moves the rotatable platform and the magnet in a first direction, until the magnetic field is sensed by the proximity switch and the first motor
20 reverses to move the platform in a second direction.

Preferably, each rotatable platform is moved by a movement inducing means having a magnet of a polarity on an edge of the rotatable platform, and a magnet of like polarity on an adjacent surface of the housing, so that a repulsive force is generated when a
25 magnet of rotatable platform meets the magnet of the housing, thereby causing a rotation of the rotatable platform.

DESCRIPTION OF FIGURES

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In order that the invention might be more fully understood, embodiments of the invention will be described by way of example only, with reference to the accompanying drawings, in which:

Figure 1 shows a first embodiment of the fluid quality-monitoring device;

Figure 2 shows a cut-through side elevation of a second embodiment of the fluid quality-monitoring device;

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Figure 3 shows an embodiment of the movement inducing means;

Figure 4 shows a cut-through side elevation of a third embodiment of the fluid quality-monitoring device;

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Figure 5 shows a cut-through side elevation of a fourth embodiment of the fluid quality-monitoring device; and

Figure 6 shows a top view of a fifth embodiment of the fluid quality-monitoring device.

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The attached drawings are not necessarily drawn to scale.

DETAILED DESCRIPTION OF THE INVENTION

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Reference will now be made in detail to the preferred embodiments of the invention, examples of which are illustrated in the accompanying drawings. The preferred embodiments of the invention are not intended to limit the invention in its broadest aspect to these embodiments. On the contrary, the invention is intended to cover alternatives, modifications and equivalents, which may be included within the spirit and scope of the invention as defined by the appended claims. Furthermore, in the following detailed description of the embodiments, numerous specific details are set forth in order to provide an understanding of the present embodiments.

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30 The present invention relates to a fluid quality-monitoring device 100, seen in Figure 1, and includes a detector 10 for providing continuous detection of at least a parameter of a fluid, a transmission means 20, seen in Figure 1 as a data carrying wire 21, to transmit the detected parameter value to a data storage means 30, seen in Figure 1 as

a pH probe meter 31. The device 100 further includes a movement inducing means 40, to transmit a motion to the detector 10.

In Figure 1, only one detector 10 is illustrated. However, the invention is not limited to the use of one detector, or a particular detector, and may have an array of detectors, to suit the needs of a user. Examples of relevant detectors include a DO (dissolved oxygen) detector, a temperature detector, a chloride detector, a conductivity detector, and a turbidity detector, just to name a few. Correspondingly, the data storage means are complementary. For example, a pH meter is used with a pH detector, etc.

When in use, the detector 10 is immersed in the fluid of interest 70, where a parameter or parameters are to be detected and therefore monitored. When stagnant objects are immersed in fluids after long periods of time, there will inadvertently be a build up of biological material on a stagnant surface. This build up of material, critically on a surface of the detector, will desensitize or impair the reading ability of the detector. In extreme situations, the detector will be rendered useless and will have to be replaced. This is time consuming and costly.

The movement inducing means 40 imparts a motion to the detector 10, so that a build-up of biological material will not occur on the surface of the detector 10. This is because the motion retards or prevents any attachment of biological material, and inhibits any growth or build up by shearing off any biological material that may momentarily attach itself onto the surface.

In the embodiment of Figure 2, shown in a cross-sectional view, the device 100 includes a housing 50, to contain the transmission means 20 or wire 21, and the data storage means 30. The housing 50 is made of a naturally buoyant material and floats on top of the fluid, so that the contents of the housing are kept dry, and not in direct contact with the fluid 70. The detector 10 is housed in a probe 11, the probe 11 having a probe tip 12 where detection occurs, and having the wire 21, extending from a distal end of the probe tip, to the data storage means 30. The probe may be fully or partially immersed in the fluid of interest, just as long as the probe tip or detection point is exposed to and immersed in the fluid of interest.

Specifically, as seen in Figure 2, there are two detectors or probes. A pH probe 15 and a DO probe 16, both these probes mentioned only for the purposes of illustration. The probe tip of both probes extends beyond the housing 50, so that they are immersed in the fluid of interest 70. Wires 21 connected at the distal end of the probes are
 5 connected to its corresponding data storage means – pH probe meter 31 and DO probe meter 32. The depth of extension of the probe beyond the housing is dependent on the depth of monitoring desired by the user. The device 100 is preferably anchored so that it will not drift off.

10 The probes are inserted through a rotatable platform 60 of the housing 50, which may freely rotate about an axle 61. The probes are engaged to the rotatable platform 60, so that any movement of the platform is translated to the probe. As seen in Figure 3, at two opposed ends of the housing 50 adjacent to the rotatable platform 60 are two proximity switches 54, which are activated when a magnet is near them. On a central extension of
 15 the rotatable platform 60 is a magnet 62. A first motor 63 drives the platform 60 in a first direction, until the magnet 62 communicates with a first proximity switch 54. The motor 63 then rotates in an opposite direction, until the magnet 62 communicates with a second proximity switch, on an opposed side end of the housing. Therefore, the motor 63 moves in a half clockwise, half anti-clockwise direction, and this movement is
 20 translated to the probe or detector.

In another embodiment of the movement inducing means, at two opposed ends of the housing 50, adjacent to the rotatable platform are two magnets 53 of like polarity. On two opposed ends of the rotatable platform 60 are two magnets 62 of identical polarity.
 25 Therefore, when the magnets on the rotatable platform 62 moves close to the magnets 53 of the housing, it repels and causes the rotatable platform 60 to move in an opposite direction, and when the magnets next meet, it is again repelled, and moves in an opposite direction. Therefore, the magnetic force generates a half clockwise, half anti-clockwise kind of rotation to the rotatable platform 60. This causes the probes to rotate
 30 in that kind of motion as well. The magnetic arrangement forms a second embodiment of the movement inducing means 40. When readings are to be obtained, the motion is stopped.

As can be appreciated, the use of a single magnet each on the housing and the rotatable platform is also possible.

5 The magnets are powered by a second motor 64 (not shown in the figures), so that when the magnetism is generated by the motor, the motor is programmed to stop after a predetermined time period, so that the magnetic field is deactivated. This stops the repulsive force on the rotating platform and the platform will be caused to stop rotation, for readings to be taken from the probe or probes.

10 The first motor 63 and/ or the second motor 64 are driven by a motor driver circuit, controlled by a controller (not shown in the figure). The control is programmable through a programmable logic controller, or PLC, to control the start and stop of the motor. In this way, the start and stop of the movement of the detector or probes may also be controlled by the controller.

15 In other embodiments of the movement inducing means 40, a first motor drives the axle 61 to cause the rotation of the rotatable platform, and also the probes. When the motor stops running, the rotation of the probes will be interrupted, and readings from the probe can then be taken. This interruption and the length of the interruption may be controlled
20 by a timer or microprocessor. For example, the timer or microprocessor may be programmed to run the motor for 28 minutes, and then stopped for a period of 2 minutes. This translates to a movement of the probe for 28 minutes, to retard or prevent growth of biological material on the surface, and then stopping for 2 minutes during which time, the readings from the detector or probe will be taken.

25 In a further embodiment as seen in Figure 4, the housing 50 further includes a float 52. The float causes the housing to be above the fluid, so that the data storage means 30 and the transmission means 20 will not be in contact with the fluid. This prevents any electrical damage.

30 In another embodiment, the housing is made of a naturally buoyant material or construction, such that a float 52 is not separately required.

In a further embodiment, the device 100 further includes a power generating means 80, powered by a renewable energy source. For example, a solar panel or a wind turbine. Advantageously, this allows the device 100 to be deployed in remote locations without the need to build complicated power supplies. In the embodiment of Figure 5, the power
5 generating means 80, is a solar panel 81.

In previous embodiments, the detectors are integral to the housing 50. In a variation of the arrangement of the fluid quality-monitoring device as seen in Figure 6, the detector or probes may be provided, detached from the housing 50. As seen in a top view, the
10 detectors 10 are provided in four discrete pods or platforms 90. Each pod 90 may be provided with different detectors, or it may be provided with the same kind of detectors, depending on the choice of a user. Where the same detectors are used, for example, a pH probe 15, an average value of the pH value obtained from the multiple pH probes may be obtained, for a better representative value of the pH of the area.

15 The invention is now described using pod A as an example, as all pods are the same, except for the choice of detector.

In pod A, a pH probe 15, is provided through a rotatable platform 60, which is freely
20 rotatable about an axis 61. The pod 90 has an outer ring 91, where magnets 93 are positioned at opposed ends. At the edge of the rotatable platform 60 are placed two magnets 62 at opposed ends of the platform 60. The outer ring 91 is fixed so that only the rotatable platform 60 rotates. The arrangement forms the movement inducing means 40 of the device 100. The readings obtained from each probe are transmitted to
25 the data storage means 30 via transmission wires 21.

In a variation, the transmission means 20 is a wireless transmitter, so that the use of wires is not required. Readings obtained from the detectors are wirelessly transmitted to a remote data storage means 30. In this variation, the fluid quality-monitoring device
30 100 may be submerged.

In a variation of the movement inducing means, the movement is induced by motors or by a series of programmable logic controllers. As may be easily appreciated by a

person skilled in the art, any one of these variations may be easily integrated into the present invention without departing from the spirit of the invention.

5 In other variations of the movement inducing means, the movement is induced upon other shaped platforms, and not necessarily a circular disc. For example, a rectangular, or square platform.

10 Further, the movement discussed thus far is rotational. However, the movement may also be translational or vibratory or any other movement, or a combination of these movements, and it is preferred that the movement induced changes, or the direction of movement is varied, for example, in a rotation movement, clockwise, and then anti-clockwise.

15 The embodiments have been advanced by way of example only, and modifications are possible within the scope of the invention as defined by the appended claims.

CLAIMS

1. A fluid quality-monitoring device, for providing continuous monitoring of at least one parameter of a fluid of interest, said device including
5 a detector for measuring a parameter value of the fluid;
a transmission means in communication with the detector, for transmitting values measured by the detector;
a data storage means to receive and store said transmitted data;
wherein the device further includes a movement inducing means, to impart a
10 movement to the detector, so as to retard or prevent a build up of biological material on a surface of the detector.
2. A fluid quality-monitoring device according to claim 1, wherein the movement inducing means is a motor, to impart a movement to the device.
- 15 3. A fluid quality-monitoring device according to any one of claims 1 or 2, wherein the movement inducing means imparts a movement to the detector.
4. A fluid quality-monitoring device according to claim 1, wherein the device further
20 includes a housing, to contain the data storage means and the transmission means, to prevent fluid damage.
5. A fluid quality-monitoring device according to any one of claims 1 or 4, wherein the housing further includes a rotatable platform therein, to receive a detector
25 therethrough, where the detector is extended therethrough for immersion into the fluid of interest.
6. A fluid quality-monitoring device according to any one of claims 1, 4 or 5, wherein the movement inducing means moves the rotatable platform.
- 30 7. A fluid quality-monitoring device according to any one of claims 1, 4, 5 or 6, wherein the movement inducing means is a first motor, driving the rotatable platform.

8. A fluid quality-monitoring device according to any one of claims 1, 4, 5, 6 or 7, wherein the first motor is reversible, so that the movement of the platform may be reversed.

5 9. A fluid quality-monitoring device according to any one of claims 1, 4, 5, 6, 7 or 8, wherein the movement inducing means further includes a magnet of a polarity on an edge of the platform, and a proximity switch on an adjacent surface of the housing, and wherein the proximity switch is in communication with the first motor.

10 10. A fluid quality-monitoring device according to any one of claims 1, 4, 5, 6, 7, 8 or 9, wherein the proximity switch is activated when in a magnetic field.

11. A fluid quality-monitoring device according to any one of claims 1, 4 to 10, wherein the proximity switch reverses the first motor when it is activated.

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12. A fluid quality-monitoring device according to any one of claims 1, 4 to 11, wherein the first motor moves the rotatable platform and the magnet in a first direction, until the magnetic field is sensed by the proximity switch and the motor reverses to move the platform in a second direction.

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13. A fluid quality-monitoring device according to any one of claims 1, 4, 5, or 6, wherein the movement inducing means is a magnet of a polarity on an edge of the rotatable platform, and a magnet of like polarity on an adjacent surface of the housing, so that a repulsive force is generated when a magnet on the rotatable platform meets
25 the magnet of the housing, thereby causing a rotation of the rotatable platform.

14. A fluid quality-monitoring device according to claim 13, wherein the magnet is powered by a second motor.

30 15. A fluid quality-monitoring device according to any one of claims 7 to 14, wherein the first and second motor are driven by a motor driver circuit, controlled by a controller.

16. A fluid quality-monitoring device according to claim 15, wherein the control is programmable through a programmable logic controller.

17. A fluid quality-monitoring device according to any one of the preceding claims, wherein the device further includes a float on the housing, to maintain a buoyancy of the housing.

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18. A fluid quality-monitoring device according to claim 17, wherein the housing is made of a buoyant material.

19. A fluid quality-monitoring device according to any one of the preceding claims, wherein the device further includes a power generating means to power the data storage means and the detector.

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20. A fluid quality-monitoring device according to any one of the preceding claims, wherein the power generating means uses a renewable energy source.

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21. A fluid quality-monitoring device according to any one of claims 19 or 20, wherein the power generating means is a solar panel and a converter.

22. A fluid quality-monitoring device according to any one of the preceding claims, wherein the transmission means is a data transmission wire.

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23. A fluid quality-monitoring device according to any one of claims 1 to 21, wherein the transmission means is a wireless transmitter.

24. A fluid quality-monitoring device according to any one of the preceding claims, wherein the device has a plurality of detectors.

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25. A fluid quality-monitoring device according to claim 24, wherein each detector is deployed on a pod, provided separate from the housing.

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26. A fluid quality-monitoring device according to claim 25, wherein each pod has a housing according to claims 4 or 5.

27. A fluid quality-monitoring device according to claim 26, wherein a movement inducing means moves each rotatable platform of each pod.

28. A fluid quality-monitoring device according to claim 27, wherein each rotatable
5 platform is moved according to the movement inducing means of any one of claims 6 to 12, 15 or 16.

29. A fluid quality-monitoring device according to claim 27, wherein each rotatable
platform is moved according to the movement inducing means of any one of claims 6,
10 13 to 16