

## A METHOD AND SYSTEM FOR MONITORING AND LOCATING AN INACTIVE INDIVIDUAL

### Field of the Invention

**[0001]** The present invention generally relates to monitoring systems. In particular, the invention relates to a method and system for detecting and locating individuals who have been inactive for a predetermined period of time.

### Background of the Invention

**[0002]** Present systems for monitoring individuals are well established in the state of the art. Existing monitoring systems make use of complex and expensive detection means and sensors to monitor the vital-signs of an individual. The object of monitoring these vital signs are dependent on the application of the monitoring systems.

**[0003]** Hospitals may use such monitoring systems to ensure that their patients are in stable conditions. When a particular patient exhibit unstable, erratic or diminishing vital signs, a central processing station is notified and alarms may be activated to bring medical staff to the attention of the particular patient.

**[0004]** Other types of monitoring systems may be used to monitor vital signs of individuals performing hazardous work in hard to access areas like the hulls of ships or underwater repair work. When their vital-signs become erratic and unstable, showing indications that the individuals might be facing difficulties or in distress, alarms are activated and locating means built into the monitoring systems also locate the positions of the individuals for rescuers to find them and come to their aid easily.

**[0005]** These present monitoring systems make use of sophisticated sensors and equipment to monitor the vital signs of the individuals. However, these sophisticated sensors and equipment tend to be expensive. Furthermore, the typical vital signs monitored are for example: heart beat rate, respiration rate, blood pressure, body temperature and brain activity.

**[0006]** All these variables have to be disadvantageously monitored before a better picture of the condition of the individual is ascertained. Having so many variables monitored may also disadvantageously complicate the implementation and set up of such monitoring systems. The different equipment required for monitoring such diverse variables are also a concern.

**[0007]** Alternatively, monitoring systems and devices can be implemented by way of accelerometers. A device is worn on the body of the individual being monitored comprising a few accelerometers for detecting motion and acceleration. These devices may be worn by the elderly and by individuals with life threatening conditions who are predominantly alone and not in usual company of others who can provide assistance in a medical emergency. These devices can also be worn by individuals who engage in outdoor activities alone like trekking, mountain climbing, hunting and kayaking.

**[0008]** If no motion or acceleration is detected for too long a period of time, an alarm may be activated which will initiate a possible location system incorporated into the device which will notify rescuers to the location of the individual.

**[0009]** It can thus be seen that there exists a need for a simple and robust way for monitoring of inactivity of an individual that can overcome the disadvantages of the existing prior art.

### Summary of the Invention

**[0010]** The present invention seeks to provide a method and system for monitoring and locating of an inactive individual

**[0011]** Accordingly, in one aspect, the present invention provides, a motion sensing device for detecting motion comprising: a sensing frame supported by a free pivoting stand at a center of the sensing frame; the sensing frame further comprising a plurality of weighted reflectors arranged equidistantly from the center of the sensing frame; a plurality of photo detectors for detecting a change of state of light reflecting off the plurality of weighted reflectors when the sensing frame moves; and a pulse generator for generating electronic pulses when the plurality of photo detectors detect the change of state of light reflecting off the weighted photo detectors.

**[0012]** In another aspect, the present invention provides, an apparatus for monitoring and locating an individual comprising: a motion sensing device comprising a sensing frame supported by a free pivoting stand at a center of the sensing frame; the sensing frame further comprising a plurality of weighted reflectors arranged equidistantly from the center of the sensing frame; a plurality of photo detectors for detecting a change of state of light reflecting off the plurality of weighted reflectors when the sensing frame moves; and a pulse generator for generating electronic pulses when the plurality of photo detectors detect the change of state of light reflecting off the weighted photo detectors; an alarm module for providing alarm functions; a communication module adapted for wireless communications in a wireless communication network; a location determining module for determining location of the apparatus; and a main processor adapted for receiving and processing electronic pulses from the motion sensing device and for

controlling the alarm module, the communication module and the location determining module.

**[0013]** In yet another aspect, the present invention provides, a system for monitoring and locating an individual comprising: a wireless communication network for providing wireless communication means; an inactivity monitoring device for monitoring the movement rate of the individual; a location determining server for determining location of the inactivity monitoring device; and an emergency server for contacting at least one designated party when instructed by the inactivity monitoring device; the inactivity monitoring device, the location determining server and the emergency server being adapted to communicate with each other via the wireless communication means.

**[0014]** In yet a further aspect, the present invention provides, a method for monitoring and locating an individual comprising the steps: providing an inactivity monitoring device to be worn or carried by the individual; monitoring time elapsed between electronic pulses generated by a motion sensing device of the inactivity monitoring device; activating a user alarm if time elapsed between electronic pulses exceed a predetermined period of time; activating a main alarm if user override is not activated; contacting an emergency server to notify of activation of main alarm; contacting a location determining server to determine location of the inactivity monitoring device; and sending the location of the inactivity monitoring device to the emergency server.

**[0015]** In yet an alternative aspect, the present invention provides, a method for monitoring and locating an individual comprising the steps: providing an inactivity monitoring device to be worn or carried by the individual; monitoring time elapsed between electronic pulses generated by a motion sensing device of the inactivity monitoring device; activating a user alarm if time elapsed between electronic pulses

exceed a predetermined period of time; activating a main alarm if user override is not activated; contacting at least one designated party to notify of activation of the main alarm; contacting a location determining server to determine location of the inactivity monitoring device; and sending the location of the inactivity monitoring device to said at least one designated party.

### Brief Description of the Drawings

**[0016]** A preferred embodiment of the present invention will now be more fully described, with reference to the drawings of which:

**[0017]** FIG.1 illustrates a system for monitoring and locating an inactive individual in accordance with the present invention;

**[0018]** FIG.2 illustrates a block diagram of an inactivity monitoring device from FIG.1;

**[0019]** FIG.3 illustrates a motion sensing device of FIG.2;

**[0020]** FIG. 4 illustrates the plan and side view of a sensing frame of FIG.3; and

**[0021]** FIG. 5 illustrates a flowchart for a method of monitoring and locating an individual of FIG. 1.

### Detailed description of the Drawings

**[0022]** A method and system for monitoring and locating an inactive individual with a preferred embodiment is described. In the following description, details are provided to describe the preferred and the alternate embodiment. It shall be

apparent to one skilled in the art, however that the invention may be practiced without such details. Some of the details may not be described at length so as not to obscure the invention.

**[0023]** Referring to FIG.1, the system 10 in accordance with the present invention comprises a wireless communication network 12, an emergency server 14, a location determining server 30 and an inactivity monitoring device 20. The inactivity monitoring device 20 is typically worn by an individual or a user 17 who wishes to be monitored in event that the individual 17 loses consciousness or faces situations of distress and requires assistance. The inactivity monitoring device 20 monitors the movement rate experienced by the user 17 and when this movement rate drops below a predetermined level, the inactivity monitoring device 20 will set off a main alarm and will perform a sequence of actions that will bring aid to the user 17.

**[0024]** The inactivity monitoring device 20, the emergency server 14 and the location determining server are adapted to communicate with each other via wireless communication means 15 provided by the wireless communication network 12. Non limiting examples of the wireless communication network 12 would be a mobile phone network or a Wireless Local Area Network (WLAN).

**[0025]** The emergency server 14 is further adapted to communicate via standard communication means 13 with at least one designated party 27 and rescuers 23. The location determining server 30 is also adapted to communicate via standard communication means 13 and may also communicate with the emergency server via standard communication means 13. The standard communication means 13 may comprise the wireless communication means 15 or may be conventional wired communications such as telephone lines, modems and other cable or line based data transmission means.

**[0026]** When the main alarm of the inactivity monitoring device 20 is activated, the inactivity monitoring device 20 communicates with the location determining server 30 to determine the location of the inactivity monitoring device 20. The location determining server 30 makes use of existing methods for determining location such as Global Positioning System (GPS) via satellite 35 tracking or by triangulation using the wireless communication network 12.

**[0027]** The inactivity monitoring device 20 also communicates with the emergency server 14 to notify that the main alarm has been activated, indicating that the user 17 may be unconscious or in distress and requires immediate assistance. The determined location of the user 17 is also sent to the emergency server 14.

**[0028]** The emergency server 14 contacts the at least one designated party 27 and the rescuers 23 and also notify them of the determined location of the user 17. The at least one designated party 27 may be a family member, a next of kin, insurance company or an attorney. The rescuers 23 may be law enforcement officers, medical professional or both. Both the at least one designated party 27 and the rescuers 23 may be predetermined according to the user's 17 needs and requirements.

**[0029]** Referring to FIG. 2, the inactivity monitoring device 20 comprises a main processor 40 and a motion sensing device 42. The inactivity monitoring device further comprises a communication module 50, a location determining module 52 and an alarm module 43.

**[0030]** Referring to FIG. 5 and FIG. 2, the method in accordance with the present invention starts with the main processor 40 determining whether an electronic pulse is received 510 from the motion sensing device 42 within a predetermined period of time.

**[0031]** The main processor 40 monitors the received electronic pulses generated by the motion sensing device 42 when the motion sensing device 42 detects motion by the user 17. The time period between each electronic pulse determines the movement rate of the user 17. When the movement rate of the user 17 drops below a predetermined level, i.e. the period of time between generated electronic pulses exceed a predetermined period of time, the alarm module 43 is activated.

**[0032]** The alarm module 43 comprises a user override 44, a user alarm 46 and a main alarm 48. Upon activation of the alarm module 43, the user alarm 46 is first activated 515. The user alarm 46 is for preventing false alarms in the event the user 17 may have fallen asleep without first removing or deactivating the inactivity monitoring device 20. The user alarm 46 may comprise of a 2-step alarm; a first silent vibration alarm to warn the user 17 without drawing undue attention to the user 17 or the inactivity monitoring device 20, followed by a second audible alarm if the first silent vibration fails to be noticed by the user 17. The user alarm 46 may be deactivated by activating 520 a user override 44 for either the first silent vibration alarm or the second audible alarm, which also indicates that the user 17 is aware of the long period of inactivity and prevents the main alarm 48 from being activated.

**[0033]** If the user override 44 is not activated 520 by the user 17 in time, the main alarm 48 is activated 525. At this point, the location determining module 52 contacts 535 the location determining server 30 to determine the location of the inactivity monitoring device 20 and the communication module 50 contacts 530 the emergency server 14 of the activation 525 of the main alarm indicating that the user 17 is either unconscious or in need of immediate assistance. Upon receiving the location from the location determining server 30, the communication module 50 then sends the location of the inactivity monitoring device 20 to the emergency server 14 to facilitate the rescuers 23 reaching the user 17.

**[0034]** The communication module 50 and the location determining module 52 may further continue to update the location of the inactivity monitoring device 20 periodically to the emergency server 14 to ensure that the user's 17 location is accurate.

**[0035]** Alternatively, the communication module 50 may contact the at least one designated party 27 and rescuers 23 directly via the wireless communication means 15 without going through the emergency server 14. The location determining module 52 will still contact 535 the location determining server 30 to determine the location of the inactivity monitoring device 20, but will send the location to directly to the at least one designated party 27 and the rescuers 23 without going through the emergency server 14.

**[0036]** The location determining server 30 in accordance with the present invention may yet further be a component of the location determining module 52 of the inactivity monitoring device 20. Upon the activation of the main alarm 48, the location determining module 52 will make use of the location determining server which is now part of the location determining module 52 to determine the location of the inactivity monitoring device 20.

**[0037]** Referring to FIG. 3 and FIG.4, the motion sensing device 42 in accordance with the present invention comprises a sensing frame 70 and a pulse generator 61 coupled to a plurality of photo detectors 62 and at least one lighting device 63.

**[0038]** The sensing frame 70 comprises a plurality of weighted reflectors 60 arranged substantially equidistant from a center 65 of the sensing frame 70. The weighted reflectors 60 are also arranged such that the angle subtended by each of the weighted reflectors are substantially equal. The weighted reflectors 60 are further

mounted in a substantially planar manner and in the present example is mounted on a plate 64. The weighted reflectors 60 may also be mounted on a wire frame with a center 65 instead of on a plate 64.

**[0039]** The weighted reflectors 60 are substantially similar in weight and together with the equidistant arrangement of the weighted reflectors 60 provides for a well balanced sensing frame 70.

**[0040]** The center 65 of the sensing frame 70 is supported and secured to a free-pivoting stand 67. The free pivoting stand 67 allows the sensing frame 70 to pivot freely about the free pivoting stand 67. This allows the sensing frame 70 to possess a relatively wide range of motions at the point of support of the sensing frame 70 which is also the center 65 of the sensing frame 70.

**[0041]** With any movement caused by or experienced by the user 17, the sensing frame 70 of the motion sensing device 42 would also move and likely right itself after the movement. The sensing frame 70 with its plurality of well balanced weighted reflectors 60 would counteract the movement of the sensing frame 70 and will always attempt to right itself after any movement to maintain the balance of the sensing frame 70.

**[0042]** The movement of the sensing frame 70 causes light from the at least one lighting device 63 to be reflected by the weighted reflectors 60 which are detected by the photo detectors 62. The photo detectors 62 which are coupled to the pulse generator 61 send signals to the pulse generator 61 whenever reflected light from the weighted reflectors 60 are detected by the photo detectors 62. The pulse generator 61 then generates electronic pulses whenever there is a change of state from the photo detectors 62.

**[0043]** The photo detectors 62 detect reflected light off the weighted reflectors 60 and send a signal to the pulse generator indicating that light is detected. When light is not detected, or when there is no reflected light detected by the photo detectors 62, a signal is also sent to the pulse generator to indicate the no light is detected. The change from detecting light to not detecting light constitutes a change of state and the pulse generator 61 will generate an electronic pulse to indicate movement by the user 17 or the inactivity monitoring device 20. Similarly, the change from not detecting light to detecting light also constitutes a change of state.

**[0044]** The electronic pulses generated by the pulse generator 61 are then used to determine the movement rate of the user 17 so as to infer if the user 17 is unconscious or in need of immediate assistance.

**[0045]** It will be appreciated that various modifications and improvements can be made by a person skilled in the art without departing from the scope of the present invention.

## Claims

1. A motion sensing device for detecting motion comprising:
  - a sensing frame supported by a free pivoting stand at a center of said sensing frame; said sensing frame further comprising a plurality of weighted reflectors arranged equidistantly from said center of said sensing frame;
  - a plurality of photo detectors for detecting a change of state of light reflecting off said plurality of weighted reflectors when said sensing frame moves;
  - and
  - a pulse generator for generating electronic pulses when said plurality of photo detectors detect said change of state of light reflecting off said weighted photo detectors.
2. The motion sensing device in accordance with claim 1, wherein said weighted reflectors are mounted in a substantially planar manner.
3. The motion sensing device in accordance with claim 1, wherein said weighted reflectors are mounted on a plate.
4. The motion sensing device in accordance with claim 1, wherein said weighted reflectors are mounted on a wire frame.
5. The motion sensing device in accordance with claim 1, wherein said plurality of weighted reflectors are substantially similar in weight.
6. The motion sensing device in accordance with claim 1, wherein said sensing frame pivots freely about said free pivoting stand and said sensing frame possesses a wide range of movement.

7. The motion sensing device in accordance with claim 1, wherein said light is provided by at least one lighting device.
8. A system for monitoring and locating an individual comprising:
  - a wireless communication network for providing wireless communication means;
  - an inactivity monitoring device for monitoring the movement rate of said individual;
  - a location determining server for determining location of said inactivity monitoring device;
  - an emergency server for contacting at least one designated party when instructed by said inactivity monitoring device; and
  - said inactivity monitoring device, said location determining server and said emergency server being adapted to communicate with each other via said wireless communication means.
9. The system in accordance with claim 8, wherein said inactivity monitoring device comprises: a motion sensing device comprising a sensing frame supported by a free pivoting stand at a center of said sensing frame; said sensing frame further comprising a plurality of weighted reflectors arranged equidistantly from said center of said sensing frame; a plurality of photo detectors for detecting a change of state of light reflecting off said plurality of weighted reflectors when said sensing frame moves; and a pulse generator for generating electronic pulses when said plurality of photo detectors detect said change of state of light reflecting off said weighted photo detectors.
10. The system in accordance with claim 8, wherein said wireless communication network comprises: a mobile phone network or a Wireless Local Area Network.

11. The system in accordance with claim 8, wherein said location determining server is adapted to determine location of said inactivity monitoring device via GPS tracking or triangulation using said wireless communication network.

12. The system in accordance with claim 8, wherein said inactivity monitoring device further comprises said location determining server.

13. A method for monitoring and locating an individual comprising the steps:

- a. providing an inactivity monitoring device to be worn or carried by said individual;
- b. monitoring time elapsed between electronic pulses generated by a motion sensing device of said inactivity monitoring device;
- c. activating a user alarm if time elapsed between electronic pulses exceed a predetermined period of time;
- d. activating a main alarm if user override is not activated;
- e. contacting an emergency server to notify of activation of main alarm;
- f. contacting a location determining server to determine location of said inactivity monitoring device; and
- g. sending said location of said inactivity monitoring device to said emergency server.

14. The method in accordance with claim 12, wherein said motion sensing device of step b. further comprises: a sensing frame supported by a free pivoting stand at a center of said sensing frame; said sensing frame further comprising a plurality of weighted reflectors arranged equidistantly from said center of said sensing frame; a plurality of photo detectors for detecting a change of state of light reflecting off said plurality of weighted reflectors when said sensing frame moves; and a pulse generator for generating electronic pulses when said plurality of photo detectors detect said change of state of light reflecting off said weighted photo detectors.

15. The method in accordance with claim 12, wherein said user alarm of step c. further comprises a first silent vibration alarm and a second audible alarm.

16. The method in accordance with claim 12, wherein said step e. further comprises said emergency server further contacting at least one designated party.

17. The method in accordance with claim 15, wherein said step g. further comprises said emergency server sending said location of said inactivity monitoring device to said at least one designated party.

18. A method for monitoring and locating an individual comprising the steps:

- a. providing an inactivity monitoring device to be worn or carried by said individual;
- b. monitoring time elapsed between electronic pulses generated by a motion sensing device of said inactivity monitoring device;
- c. activating a user alarm if time elapsed between electronic pulses exceed a predetermined period of time;
- d. activating a main alarm if user override is not activated;
- e. contacting at least one designated party to notify of activation of said main alarm;
- f. contacting a location determining server to determine location of said inactivity monitoring device; and
- g. sending said location of said inactivity monitoring device to said at least one designated party.

19. The method in accordance with claim 17, wherein said motion sensing device of step b. further comprises: a sensing frame supported by a free pivoting stand at a center of said sensing frame; said sensing frame further comprising a plurality of weighted reflectors

arranged equidistantly from said center of said sensing frame; a plurality of photo detectors for detecting a change of state of light reflecting off said plurality of weighted reflectors when said sensing frame moves; and a pulse generator for generating electronic pulses when said plurality of photo detectors detect said change of state of light reflecting off said weighted photo detectors.

20. The method in accordance with claim 17, wherein said user alarm of step c. further comprises a first silent vibration alarm and a second audible alarm.

21. An apparatus for monitoring and locating an individual comprising:

a motion sensing device comprising a sensing frame supported by a free pivoting stand at a center of said sensing frame; said sensing frame further comprising a plurality of weighted reflectors arranged equidistantly from said center of said sensing frame; a plurality of photo detectors for detecting a change of state of light reflecting off said plurality of weighted reflectors when said sensing frame moves; and a pulse generator for generating electronic pulses when said plurality of photo detectors detect said change of state of light reflecting off said weighted photo detectors;

an alarm module for providing alarm functions;

a communication module adapted for wireless communications in a wireless communication network;

a location determining module for determining location of said apparatus;

and

a main processor adapted for receiving and processing electronic pulses from said motion sensing device and for controlling said alarm module, said communication module and said location determining module.

22. The apparatus in accordance with claim 21, wherein said alarm module comprises: a user alarm, a user override and a main alarm.