

Claims

1. A sensor arrangement (101) for observing the presence, location, movement and/or attitude of a person in monitored area, the sensor arrangement
5 comprising an infrared based sensor, such as a PIR-sensor, and a radar-based sensor,

the sensor arrangement (101) further comprises means for processing the measurement signals of the sensors, such as measuring electronics,

characterized in that,

10 the infrared based sensor is configured to measure the monitored area and detect movement of the person (206) in the monitored area,

the radar-based sensor is configured to measure the monitored area and detect movement of the person (206) in the monitored area,

15 wherein the sensor arrangement (101) is configured to use the infrared based sensor for observing movement in the monitored area and to enable the radar-based sensor to measure when the infrared based sensor is not able to observe movement in the monitored area and/or the observed movement by the infrared based sensor in the monitored area is below a predefined threshold level,

20 wherein the sensor arrangement (101) is configured to detect falling of the person (206) by a determined elevation of the person such that when the determined elevation of the person (206) is under certain threshold elevation value, the person (206) is determined to be fallen, wherein the sensor arrangement (101) is configured determine the elevation of the person with the radar-based sensor, and

25 wherein the sensor arrangement is configured to disable the radar-based sensor when the radar-based sensor has not detected any movement.

2. A sensor arrangement according to claim 1, wherein the sensor arrangement (101) is configured to disable the radar-based sensor when the
30 infrared based sensor is able to observe movement in the monitored area and/or the observed movement by the infrared based sensor in the monitored area is above the predefined threshold level.

3. A sensor arrangement according to claim 1 or 2, wherein the measurement area of infrared based sensor is arranged and/or limited so that the infrared based sensor cannot observe movement below certain height, e.g. on the floor level.

4. A sensor arrangement according to claim 1 or 2, wherein the sensor arrangement (101) comprises a battery configured to provide energy for the sensor arrangement.

5. A sensor arrangement according to any preceding claim, wherein the sensor arrangement structure comprises an attachment structure in which the sensor arrangement (101) can be placed, wherein the attachment structure is fixable to a wall or ceiling.

6. A sensor arrangement according to any preceding claim, wherein the radar-based sensor is configured to determine objects and their azimuth, elevation and/or distance from the sensor based on the measurement signal.

7. A sensor arrangement according to any preceding claim, wherein the sensor arrangement (101) is configured to analyze the measurement signal by at least filtering the measurement signal such a way that the phase of the measurement signal is determined in order to observe movement of the object, such as heartbeat and/or breathing.

8. A sensor arrangement according to any preceding claim, wherein the radar-based sensor is a radar sensor configured to observe the elevation, azimuth, movement and/or distance of objects, e.g. with continuous-wave radar technique, such as a frequency-modulated continuous-wave (FMCW).

9. A sensor arrangement according to any preceding claim, wherein the sensor arrangement comprises means to detect the attitude of the sensor

arrangement (101), such as an acceleration sensor, and the sensor is configured to take attitude of the sensor into account when determining azimuth, elevation and/or distance from the sensor of the person (206).

- 5 10. A method for observing the presence, location, movement and/or attitude of a person in monitored area with a sensor arrangement (101), the sensor arrangement comprising an infrared based sensor, such as a PIR-sensor, and a radar-based sensor, and means for processing the measurement signals of the sensors, such as measuring electronics, **characterized** in that,
- 10 the infrared based sensor measures the monitored area and detects movement of the person (206) in the monitored area,
- the radar-based sensor measures the monitored area and detects movement of the person (206) in the monitored area,
- wherein the sensor arrangement (101) uses the infrared based sensor for
- 15 observing movement in the monitored area and enables the radar-based sensor to measure when the infrared based sensor is not able to observe movement in the monitored area and/or the observed movement by the infrared based sensor in the monitored area is below a predefined threshold level,
- wherein the sensor arrangement (101) detects falling the person (206) by
- 20 a determined elevation of the person such that when the elevation of the person (206) is under certain threshold elevation value, the person (206) is determined to be fallen, wherein the sensor arrangement (101) determines the elevation of the person with the radar-based sensor and
- wherein the sensor arrangement disables the radar-based sensor when
- 25 the radar-based sensor has not detected any movement.

11. A method according to claim 10, wherein the sensor arrangement (101) disables the radar-based sensor when the infrared based sensor is able to observe movement in the monitored area and/or the observed movement by the
- 30 infrared based sensor in the monitored area is above a predefined threshold level.

12. A method according to claim 10 or 11, wherein the measurement area of infrared based sensor is arranged and/or limited so that the infrared based sensor cannot observe movement below certain height, e.g. on the floor level.

5 13. A method according to any claim 10 – 12, wherein the sensor arrangement (101) comprises a battery provide energy for the sensor arrangement.

10 14. A method according to any claim 10 – 13, wherein the sensor arrangement structure comprises an attachment structure in which the sensor arrangement (101) can be placed, wherein the attachment structure is fixable to a wall or ceiling.

15 15. A method according to any claim 10 – 14, wherein the radar-based sensor determines objects and their azimuth, elevation and/or distance from the sensor based on the measurement signal.

20 16. A method according to any claim 10 – 15, wherein the sensor arrangement (101) analyzes the measurement signal by at least filtering the measurement signal such a way that the phase of the measurement signal is determined in order to observe movement of the object, such as heartbeat and/or breathing.

25 17. A method according to any claim 10 – 16, wherein the radar-based sensor is a radar sensor configured to observe the elevation, azimuth, movement and/or distance of objects, e.g. with continuous-wave radar technique, such as a frequency-modulated continuous-wave (FMCW).

30 18. A method according to any claim 10 – 17, wherein the sensor arrangement (101) comprises means to detect the attitude of the sensor, such as an acceleration sensor, and the sensor takes attitude of the sensor into account

when determining azimuth, elevation and/or distance from the sensor of the person.

19. A system for observing the presence, location, movement and/or
5 attitude of one or more objects to be monitored in the area to be monitored,

characterized in that the system comprises at least one sensor
arrangement (101) according to claim 1 – 9,

wherein the sensor arrangement (101) or sensor arrangements are fitted
in the monitored area, e.g. on a floor, wall and/or ceiling.

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20. System according to claim 19, wherein the system comprises at least
two said sensor arrangements (101) according to claim 1 – 10, the system is
configured to detect and measure the persons (206) in the monitored area based
on the measurement signal of at least two sensor arrangement, which sensor
15 arrangements can monitor the same area and/or different area.

21. System according to any of claims 19 – 20, wherein the system is
further adapted to send a notification of a fall if a person (206) is interpreted as
having fallen and/or if the vital functions of the monitored person (206), such as
20 tracked heartbeat and/or breathing of monitored the person, is not within the
predefined limits.

22. System according to any of claims 19 – 21, the notification and/or fall
notification is the sending of an alarm or message to person and/or an
25 organization monitoring the health of the object, e.g. as a message to a phone
(202), as an alarm and/or e.g. to a nurse (203), to relatives or to an emergency
center.

23. System according to any whatsoever of claims 19 – 22, wherein in that
30 the system is adapted to send information derived from the object (206) onwards
using a wireline or wireless communications means.