A LOCATOR DEVICE

TECHNICAL FIELD

This invention relates generally to a locator device.

Background

Personal locator systems are typically used for enabling a person to be tracked or located. Typical personal locator systems may be suitable for the particular purpose to which they address but are usually limited in range and locations where they can be applied, for example, like being able to function in remote locations. Even when directed for use based on their intended purpose, these personal locator systems focus on location tracking but lack functionality to perform locating, tracking, and messaging between users. Even when looking at adapting smart devices, which uses cellular transmissions to transmit or receive signals for communications and location tracking, there is still a need for pre-existing infrastructure to be present which requires functioning within specific parameters in limited locations. Further, existing tracking devices on the market are not directed at distress situations, for example in the event of a fall in forested area wherein broadcast of distress signal has to be executed with the least action and thought possible and with convenience. This has led to the absence of a true locator that is not bounded by network infrastructure requirements and which can effectively function in distress situations where such personal locator systems are most needed. Therefore, there exists a need for a method for addressing the foregoing problems.

Summary

In accordance with a first aspect of the invention, there is disclosed a locator device comprising a controller for operating between a Standard Mode and a Distress Mode, a transceiver module being adapted to be controlled by the controller to broadcast a homing signal, the homing signal identifying the locator device by an identification code that is associated with the locator device, and a position calculator module being adapted to be controlled by the controller for determining position of the locator device. The position

calculator module one of being deactivated and having reduced frequency of determining position of the locator device when in the Standard Mode and one of being activated and having increased frequency of determining position of the locator device when in the Distress Mode. The locator device further comprises a data logger module for logging the position determined by the position calculator module in a position log and a first communications module for enabling managing of communication over a radio frequency (RF) channel with a remote device for the transmission and reception of at least one of voice and data signals. Wherein a distress code is incorporated into the homing signal when in the Distress Mode.

In accordance with a second aspect of the invention, there is disclosed a locator device comprising a controller, a transceiver module being adapted to be controlled by the controller to broadcast a homing signal, the homing signal identifying the locator device by an identification code that is associated with the locator device, a position calculator module being adapted to be controlled by the controller for determining position of the locator device, a data logger module for logging the position determined by the position calculator in a position log and a first communications module for enabling managing of communication over a radio frequency (RF) channel with a remote device for the transmission and reception of at least one of voice and data signals.

Brief Description of the Drawings

FIG. 1 shows a system diagram of use of a locator device according to an aspect of the invention; and

FIG. 2 shows a system diagram of the locator device of FIG. 1.

Detailed Description

An exemplary embodiment of the present invention, a locator device 20, is described hereinafter with reference to FIG. 1 and FIG. 2. The locator device 20 preferably comprises a controller 22, a transceiver module 24, a position calculator module 26, a data logger module 28 and a first communications module 30. The controller 22 is for operating between a Standard Mode and a Distress Mode. The transceiver module 24 is adapted to be controlled by the controller 22 to broadcast a homing signal 32 for identifying the locator device 20 by an identification code that is associated with the locator device 20. The position calculator module 26 is adapted to be controlled by the controller 22 for determining position of the locator device 20 while the data logger module 28 is for logging the position determined by the position calculator module 26 in a position log. The first communications module 30 is for enabling managing of communication over a radio frequency (RF) channel 38 with a remote device 40 for the transmission and reception of at least one of voice and data signals.

Preferably, the position calculator module 26 comprise a GNSS module, for example a GPS module and a GLONASS module, for determining the position, for example geo-position or geo-location, of the locator device 20. The position determined by the position calculator module 26 and being logged by the data logger module 28 is at least one of time intervals and distance interval. The controller 22 may control the position calculator module 26 to reduce the frequency of determining the location of the locator device 20 when in use and to switch to an increased frequency only during an SOS, emergency or occurrence of a pre-defined event. For example, the position can be determined and logged at the elapsed of a predefined duration, at every pre-defined distance interval or a combination of both. The homing signal 32 can further comprise at least a portion of the position log. In an implementation, the homing signal 32 may comprise the last two or three positions being logged in the position log. The number of last logged positions may be increased upon determining that the homing signal 32 has been received by a recipient device 42 or upon request by the recipient device 42, for example from the two last logged positions to the

twenty last logged positions. For clarity, the recipient device 42 and the remote device 40 may be two separate devices or the same device.

The locator device 20 further comprises a second communications module 44 for establishing signals communication via a pre-established network, for example GSM and LTE networks, and/or low power device-based and/or mission specific networks such as LPWan, for example LoRa, LTE-M and NB-IoT. It is preferred that controller 22 is able to utilize both the first communications module 30 and the second communications module 44 in tandem. Additionally or alternatively, the controller 22 may switch between the first communications module 30 and the second communications module 44 based on availability, signal strength and/or preference prioritization. Even in utilizing the second communications module 44, the controller 22 is further able to switch between GSM, LTE and LPWan based on availability and/or prioritization preference.

Further, one or more of the position calculator module 26, the first communication module 40 and the second communication module 44 is deactivated or the position calculator module 26 has a reduced frequency of determining position of the locator device 20 when in the Standard Mode. Further, one or more of the position calculator module 26, the first communication module 40 and the second communication module 44 is activated or the position calculator module 26 has an increased frequency of determining position of the locator device 20 when in the Distress Mode. Hence, broadcast of the homing signal 32 can further be via one or both of the first communication module 40 and the second communication module 44 when in the Distress Mode, in addition to being via the transceiver module 24.

In one preferred implementation of the locator device 20, signal communication via each of the second communications module 44 and the first communications module 30 and the broadcast of the homing signal 32 via the transceiver module 24 can be performed over a common or single RF signal or signal carrier. In such an implementation, the first communication module 30 and the second communications module 44, or part of each

thereof, may constitute physical components of the transceiver module 24. For the avoidance of doubt, any pair or trio of the transceiver module 24, the first communications module 30 and the second communications module 44 may have overlapping or shared physical components and/or functional components.

It is preferred that a distress code is incorporated into the homing signal 32 when in the Distress Mode. The distress code can be in a form of a typically recognizable message in common language, a message in a form recognizable by an authorized group of operators, for example search and rescue personnel and services, or through a recognizable modulation of the homing signal 32 being sent, when in the Distress Mode.

Preferably, the locator device 20 comprises a user interface (UI) module 46 in signal communication with the controller 22 for use by a user for interacting therewith. The UI module 46 can comprise at least one of input switches, touch sensor, pressure sensor, a scroll wheel, a display, a touch sensing display, a microphone and a speaker. The homing signal 32 further comprises at least one of a pre-generated message and a message generated by user interaction with the UI module 46.

Preferably, the UI module 46 comprising a distress button being activatable for one of initiating sending of the homing signal 32 and increasing frequency of broadcast of the homing signal 32 via the transceiver module 24. The homing signal 32 can be at least one of coded and encrypted. When the distress button is activated, the locator device 20 activates the Distress Mode. In the Distress Mode, an option of the locator device 20 is to have the homing signal 32 transmitted without encryption, and in some cases, without encoding depending on the setting preference of the user of the locator device 20. When the homing signal 32 is sent with encryption, intended recipients of the homing signal, for example authorized rescuers, may be with the digital key and the remote device 40/recipient device 42 for decrypting the message/info contained in the homing signal 32 and/oe for decoding the homing signal 32.

Further, the locator device 20 preferably further comprises a short range communicator module 50 for establishing signal communication with a mobile computing device. The mobile computing device is one of a smart device, a smart phone, a mobile phone, a transponder and a wireless input device. Preferably, the short range communicator module 50 utilises at least one of WiFi, Bluetooth and BLE to establish communication with the mobile computing device. Hence, the mobile computing device can function as an external user interface (UI) when in signal communication with the short range communicator module 50 for use by a user for interacting with the locator device 20. Therefore, sending of the homing signal 32 by the locator device 20 can be initiated using the mobile computing device. At least one or both of the mobile computing device and the UI module 46 may be used for generating a message or selecting one or more pre-defined message for incorporating into the homing signal 32 to be broadcasted by the transceiver module 24.

The locator device 20 can comprise one of an activity sensing module 54 comprising one or more of a motion sensor, an accelerometer, an orientation sensor and a directional sensor for generating activity data. The data logger module 28 is further for logging the activity data in an activity log.

Additionally or alternatively, the homing signal 32 is being sent via the transceiver module 24 in response to occurrence of an event. The event can be pre-defined and can be, for example, one or a combination of inactivity for a pre-defined duration, registered acceleration beyond a pre-defined limit and activation through a UI by a user.

In an implementation of the locator device 20, the locator device 20 is preferably shaped and dimensioned as a portable device with a small foot-print that can be easily and unobtrusively carried in a person's pocket or be attached to a person's clothes or equipment. This may necessitate that the locator device 20 comprise a body that can be adapted for use with attachments or accessories for attachment to equipment, for example sporting gears, parts of a person's body, for example to the wrist or ankle, and to clothes or gears being worn by a

person. These attachments may be akin to the attachment and accessories used in action camera set-ups for attachment of action cameras to a person or equipment.

The body can be adapted to contain the controller 22, the transceiver module 24, the position calculator module 26, the data logger module 28, the first communications module 30 and power source 62, for example a rechargeable battery. Additionally, the body of the locator device 20 may also contain the second communications module 44, the user interface (UI) module 46, the short range communicator module 50 and the activity sensing module 54. The body is preferably waterproof or at least water-resistant with at least a portion of the UI module 46 being formed integral with the body and being presented with an external surface of the body.

When in use, the locator device 20 can operate in various modes. In the Standard Mode, the controller 22 will broadcast of the homing signal 32 at a predetermined signal frequency or a range of frequencies. The broadcast of the homing signal 32 is also performed once after every time interval, distance interval or at the elapse of any of the time interval or distance interval. The homing signal 32 can contain the identification code that will enable the remote device 40 to identify the identity of the signal source. This is important differentiating between devices in situations where multiple homing signals 32 are being broadcasted from multiple locator devices 20. The controller may be programmed, through default instructions or by a user using the UI module 46 to indicate a power conservation schedule to ensure that the power source still has a determined amount of power left when the locator device 20 switches from the Standard Mode to the Distress Mode. The power conservation schedule can include the deactivation of the position calculator module 26 and other constituent modules of the locator device 20 when in the Standard Mode and the reactivation of the position calculator module 26 and other respective constituent modules of the locator device 20 when in the Distress Mode. When in the Distress Mode, the position calculator module 26 and other relevant constituent modules of the locator device 20 may also be programmed to be activated only by a remote device, for example the remotely by the remote device 40 the recipient device 42, or the like device used by a search and rescue

personnel, crew or facility. The power conservation schedule can further include stopping the broadcast of the homing signal 32 when remaining power of the power source 62 goes below a certain level, or to increase the time interval or distance interval for broadcast of the homing signal 32 progressively at various levels of remaining power of the power source 62 which can include terminating broadcast of the homing signal 32 when a final remaining power level is reached.

In the event that a person carrying the locator device needs to be located, various approaches can be employed. In a built-up area or an pre-defined geographical zone, one or more of the remote device 40 can exist in the form of tracking antenna systems on the side or at the top of buildings or the like structures or as antenna towers, for example telco towers, LTE towers or hybrid towers, permanent or otherwise, to form a blanket net over the geographical zone to be tracked. Alternatively, the remote device 40 can be a portable device or scanner that is carried on an unmanned aerial vehicle (UAV), for example a drone, or a manned aircraft that traverses over various regions for picking up the homing signal 32. Once the homing signal 32 is detected, the location or proximity of the locator device 20 can be determined using approaches such as time of arrival and angle of arrival based on the received homing signal 32. Further, the locator module 20 may further be programmed to keep the position calculator module 26 deactivated, even when in the Distress Mode, until an activation signal has been received from the remote device 40 on the UAV. As such, the activation signal may be sent only when reasonable proximity of the locator device 20 from the remote device 20 has been estimated to reduce unnecessary or premature power usage by relatively power intensive modules like the position calculator module 26.

As the homing signal may be broadcasted with position data of the locator device 20, the position calculator module 26 will calculate the position of the locator device 20 when in the Standard Mode. Similar to the broadcast of the homing signal 32, the position of the locator device 20, which may involve the downloading of GPS data, GLONASS data or the like geo-position/GNSS data in alternative formats and standards, will occur at the elapsed of every time interval, distance interval or any of the time interval and distance interval. The

location data transmitted with the homing signal 32 can include the last determined location or last few determined locations of the locator device 20 when in the Standard mode. However, the calculating and logging of the positions of the locator device 20 may increase in frequency when in the Distress Mode.

The controller 22 may adapt to increase the number of last determined positions of the locator device 20 after switching from the Standard Mode to the Distress Mode. Alternatively, the increase in the number of last determined positions of the locator device 20 will only be perform when the locator device 20 receives confirmation or indication from the remote device 40 that the homing signal 32 has been received or a request by the remote device 40 to increase the number of last determined locations of the locator device 20 to be sent with the homing signal 32. When switching from the Standard Mode to the Distress Mode, the homing signal 32 may further comprise a distress indicator in the form of a message or signal modulation to indicate that the user of the locator device 20 is in distress.

Besides being objectively for broadcasting of the homing signal 32, the locator device 20 further enables direct and indirect point-to-point communication between the locator device 20 and one or more of the remote device 40. The first communication module 30 of the locator device 20 may be adapted to enable push-to-talk (PTT) style of communication directly with one or more of the remote device 40 or indirectly through a rebroadcast device, station or facility.

The first communication module 30 can further manage communication between the locator device 20 and multiple groups of remote devices 40 with each group having specific one or more frequencies over which communication within the respective group is contained. The first communication module 30 can further be adapted to enable channel-hopping type communications over one or across multiple RF channels 38.

The transceiver module 24 can work in conjunction with the first communication module 30 to manage broadcast of the homing signal 32 over the one or across multiple of the RF channels 38.

The second communication module 44 provides an alternative pathway for communication to occur between the locator device 20 and the remote device 40 or the recipient device 42. Through pre-established network infrastructure, whether permanent network which non-dedicated for which the locator device 20 piggy-backs to dedicated permanent network infrastructures in remote locations or only users of the locator device 20 and temporary network infrastructures that are established for an occasion or activity, for example a trekking expedition, a cross-country race or a multi-sport event like a triathlon event or in situations of crisis or natural disaster for use by victims and rescuers. Beyond using the second communication module 44, the transceiver module 24 can also work in conjunction with the second communication module 44, in addition or alternative to functioning with the first communication module 30, to manage broadcast of the homing signal 32 over the network infrastructure.

Beyond activating the Distress Mode through the use of the UI module 46, distress button or the mobile computing device in signal communication with the locator device 20, the controller 22 may further be programmed to activate the Distress Mode in response activity sensing module detecting an anomaly in the form of a sensed impact, a sudden change in elevation, unusual orientation or unusual and sudden change in orientation or sudden prolonged inactivity of the locator device. The UI module 46 may provide one or more of an audible, visual and vibratory alert before or upon activation of the Distress Mode so that the Standard Mode may be reactivated in the event of a false alarm. The activity data in the activity log, or part thereof, may be incorporated for sending with the homing signal 32 when the Distress Mode is activated to potentially enable deduction of the state of the user of the locator device 20 therefrom.

To this date, current dedicated commercial tracking devices mostly rely on GPS signals and Telco connections (mostly GSM), their limitations are either huge and bulky in size and those smaller units, the battery life last for a mere couple of days. They are also limited to a simple tracking functions only. However, the current invention disrupts that idea by providing a smart positioning unit with long range wireless connection and a built-in GPS module with a low power short and long-range transmitter, It also contains various smart sensors such as an acceleraometers. It can also be equipped with an optional screen which comes with a user interface for control and messaging purposes. Based on a built-in datalogger and smart sensors in the device, it can relay the owner's positioning history, motion/movement activity, time and date. It can automatically relay all this information to their intended destination or transmit it on demand. With the usage of a smartphone with the application installed, the device can establish a connection to other devices and serve as a platform for communication such as messaging, which ranges easily over 10km in an open space.

The device is very small and portable and is capable of lasting for up to a year, due to the usage of smart energy management technology the device utilises, it also does not need to rely on dedicated GSM or LTE connections, making it useful if such connections are unavailable. If GPS signal is unavailable, the device will act as a positioning beacon which can also transmit data that can be picked up by other similar devices. A separate, dedicated portable reader that has higher sensitivity and more features, can be carried by for example, Search and Rescue Teams, which will be able to pick up the signal. This device is not only used for people who may get lost outdoors and require rescue, but can also be used for tracking pets, children and even old people with dementia who may be unable to find their ways back home. It can also be mounted on vehicles such as vessels or UAVs in case of carrying out searches in large areas.

Aspects of particular embodiments of the present disclosure address at least one aspect, problem, limitation, and/or disadvantage associated with existing locator devices. While features, aspects, and/or advantages associated with certain embodiments have been

described in the disclosure, other embodiments may also exhibit such features, aspects, and/or advantages, and not all embodiments need necessarily exhibit such features, aspects, and/or advantages to fall within the scope of the disclosure. It will be appreciated by a person of ordinary skill in the art that several of the above-disclosed structures, components, or alternatives thereof, can be desirably combined into alternative structures, components, and/or applications. In addition, various modifications, alterations, and/or improvements may be made to various embodiments that are disclosed by a person of ordinary skill in the art within the scope of the present disclosure, which is limited only by the following claims.

Claims

1. A locator device comprising:

a controller for operating between a Standard Mode and a Distress Mode;

a transceiver module being adapted to be controlled by the controller to broadcast a homing signal, the homing signal identifying the locator device by an identification code that is associated with the locator device;

a position calculator module being adapted to be controlled by the controller for determining position of the locator device, the position calculator module one of being deactivated and having reduced frequency of determining position of the locator device when in the Standard Mode and one of being activated and having increased frequency of determining position of the locator device when in the Distress Mode;

a data logger module for logging the position determined by the position calculator module in a position log; and

a first communications module for enabling managing of communication over a radio frequency (RF) channel with a remote device for the transmission and reception of at least one of voice and data signals,

wherein a distress code is incorporated into the homing signal when in the Distress Mode.

2. The locator device as in claim 1, the position calculator module comprising at least a GNSS module.

3. The locator device as in claim 1, the homing signal further comprising at least a portion of the position log.

4. The locator device as in claim 1, the position determined by the position calculator module being logged by the data logger module at least one of time intervals and distance intervals.

5. The locator device as in claim 1, further comprising one of a motion sensor and an accelerometer for generating activity data, the data logger module further for logging the activity data in an activity log.

6. The locator device as in claim 1, the homing signal being sent via the transceiver module in response to occurrence of an event, the event being one of inactivity for a pre-defined duration, registered acceleration beyond a pre-defined limit and activation through a UI by a user.

7. The locator device as in claim 1, further comprising a second communications module for signal communication via one of a pre-established network, low power device-based network and mission specific network.

8. The locator device as in claim 7, the pre-established network comprising one of GSM and LTE networks and the power device-based and mission specific networks comprising LPWAN such LTE-M and NB-IoT.

9. The locator device as in claim 1, further comprising a short range communicator module for establishing signal communication with a mobile computing device.

10. The locator device as in claim 9, the short range communicator module utilising at least one of wifi, Bluetooth and BLE to establish communication with the mobile computing device.

11. The locator device as in claim 9, the mobile computing device functioning as an external user interface (UI) when in signal communication with the short range communicator module for use by a user for interacting with the locator device.

12. The locator device as in claim 1, further comprising a user interface (UI) module in signal communication with the controller for use by a user for interacting therewith.

13. The locator device as in claim 12, the UI module comprising at least one of input switches, touch sensor, pressure sensor, a scroll wheel, a display, a touch sensing display, a microphone and a speaker.

14. The locator device as in claim 12, the homing signal further comprising at least one of a pre-generated message and a message generated by user interaction with the UI module.

15. The locator device as in claim 12, the UI module comprising a distress button being activatable for one of initiating sending of the homing signal and increasing frequency of broadcast of the homing signal via the transceiver module.

16. The locator device as in claim 1, the homing signal being at least one of coded and encrypted.

17. A locator device comprising:

a controller;

a transceiver module being adapted to be controlled by the controller to broadcast a homing signal, the homing signal identifying the locator device by an identification code that is associated with the locator device;

a position calculator module being adapted to be controlled by the controller for determining position of the locator device;

a data logger module for logging the position determined by the position calculator module in a position log; and

a first communications module for enabling managing of communication over a radio frequency (RF) channel with a remote device for the transmission and reception of at least one of voice and data signals.

18. The locator device as in claim 17, the position calculator module comprising at least a GNSS module.

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