

A POSITIONING AND RECORDING INFORMATION SYSTEM FOR RESCUE AT SEA IMPLEMENTED WITH A MULTI-HOPPING TECHNIQUE AND WITHOUT USING GLOBAL POSITIONING SYSTEM

FIELD OF THE INVENTION

The present invention relates to a positioning and recording information system for rescue at sea, and more particularly to not only a positioning and recording information system without rescuing global positioning system, but also a positioning and recording information system for rescue at sea implemented with a multi-hopping technique that utilizes at least two mobile stations for transmitting, receiving and storing data packets of the stations.

BACKGROUND OF THE INVENTION

About 71% of the surface of the earth is water that is predominantly oceans. Accordingly, no matter how human culture and technology develop, mankind is extremely dependent on the ocean in transportation and economy. Many governments' current ocean policies emphasize issues of ocean traffic safety, rescue at sea, fishery resources management, ocean environment protection and so on.

A ship's log traditionally provides a full nautical record of a ship's voyage including location and speed of the ship, observations from the ship and events occurring on the ship. However, most ship's logs are not useful immediately in effecting a rescue when a ship accident occurs because the ships' logs are aboard ship rather than in the hands of the rescuers.

At present, three systems are used for rescue on the ocean, including the Global Maritime Distress and Safety System (GMDSS), the Ship Security Alert System (SSAS) and the Automatic Identification System (AIS). When a ship meets with misfortune, the three systems send out emergency distress signals through the Global

Positioning System (GPS), and the rescue is executed in the area where the emergency distress signals are transmitted.

Because the GPS is extremely expensive to use to report a ship's position, most shipping companies cannot afford to transmit signals frequently via GPS.

5 Consequently, the updated position information received at the receiving end is not the same as the real position of the ship at the time of an accident, so there are often great mistakes in rescue on the ocean, such as delayed rescue, incorrect rescue areas, etc. Research related to AIS conducted by Lloyd's Register Research Unit indicates that AIS often has insufficient or incorrect messages about the destination, speed,
10 direction and so on of a specific ship at a specific time to adequately determine the ship's position. Insufficient messages are often the key factor leading to inefficient rescues on the sea.

U.S. Patent No. 6,778,809 B2 published on Aug. 17, 2004 titled "Mobile Network for Remote Service Areas Using Mobile Stations" disclosed a system and
15 method for transmitting and receiving data in a mobile communication network. The system includes one or more mobile stations for transmitting data in a mobile digital network. The mobile stations are configured to act as buffer/repeaters by storing and forwarding data signals until they are received by a specific destination station. A relay means is utilized in the system to form the mobile network. However, the
20 distance from one station to an adjacent station in an international shipping route is usually too far for the ships to effectively communicate. Furthermore, the relay means has the following problems:

1. The data origin is too far away from the destination resulting in an excessive hop count, and the communication efficiency decreases when the relay count increases.

2. All the stations in the shipping route are not connected to other ships all the time so communication is often intermittent.

Based on the foregoing problems, once the data signals received from a ship meeting with misfortune are not sufficient to identify a ship's accident position. Finding a way to obtain a correct position for a ship's accident is urgently required to affect timely rescues. A need therefore exists to provide a positioning and recording information system implemented with a multi-hopping technique rather than that rescuing global positioning system.

SUMMARY OF THE INVENTION

The problems set forth above may at least in part be solved by a system that does not use the GPS and is capable of utilizing a multi-hopping technique to provide sufficient messages about shipwrecks for positioning and rescue at sea.

According to an aspect of the present invention, there is provided a positioning and recording information system for rescue at sea, wherein: the positioning and recording information system is implemented with a multi-hopping technique and without using global positioning system; and at least two stations are required where each said station transmits, receives and stores data packets of the stations through digital communication and Internet access for mobile vessels, the information about each station being processed into data packets being position data, the data packets temporarily being stored in temporary repositories of the stations, the system comprising at least one fixed station, representing a destination station, comprising hopping software and a communication device, and configured to process received data packets into applicable information for positioning; multiple mobile stations, each comprising a respective communication device and the hopping software, and configured to transmit and store data packets in a signal-reception area; the system comprising means of transmitting and storing data packets from a first mobile station to second and third mobile stations by using the hopping software; receiving and storing the data packets in the second and third mobile stations through the communication devices; transmitting and storing feedback data packets from the second and third mobile stations to the first mobile station by using the hopping software; transmitting and storing a data packet from the second mobile

station to the third mobile station by using the hopping software; receiving and storing the data packet in the third mobile station through the communication devices; transmitting and storing feedback data packets from the third mobile station to the second mobile station by using the hopping software; and receiving and storing the data packets in the destination station.

The fixed and mobile stations may have an identification code individually.

The fixed station may be at a port or a buoy station.

The mobile station may be mounted on a ship.

The destination station may not only receive and store the data packets but also process the data packets into applicable information.

The data packets may include the identification codes of the mobile stations, and the time and the location when the data packets are transmitted and received.

The digital communication may be affected using the IEEE 802.11 standard, radio transmission, infrared transmission or Worldwide Interoperability for Microwave Access.

The temporary repository may be a disk or a network disk.

The identification code may be an IP address.

The position may be shown using longitude and latitude.

The data packets may be composed of multiple bits.

The data packets may be binary, octal or the hexadecimal.

The data packets may comprise navigation information when the mobile stations are on ships.

The navigation information may comprise course, speed, serial number of the current waypoint, the distance from the waypoint, the estimated time of arrival at the next waypoint, the distance off the route.

The present disclosure also relates to a positioning and recording information method for rescue at sea characterized in that the positioning and recording information system for rescue at sea does not use the GPS and is implemented with multi-hopping techniques to transmit, receive and store data packets between at least one fixed station and multiple mobile stations. The mobile stations transmit data packets to each other and store the data packets if they are in a signal-transmitted area. The data packets are transmitted between the fixed and mobile stations through digital communication and Internet access for mobile vessels. The data packets are used to record positions. The system comprising

- a first mobile station, transmits data packets to a second and a third mobile stations, stores the data packets and receives and stores feedback data packets;

- the second mobile station, transmits data packets to the first and third mobile stations, stores the data packets and receives and stores feedback data packets;

- the third mobile station, transmits data packets to the first and second mobile stations, stores the data packets and receives and stores feedback data packets;

- a fixed station, receives and stores data packets transmitted from the mobile stations.

The system according to embodiments of the present invention may transmit data packets using a multi-hopping technique that is based on the IEEE 802.11 standard instead of the Global

Positioning System. Without the huge expense of using the Global Positioning System, ship companies may be able to afford to transmit and update signals frequently. The system may improve the communication efficiency of the network implemented with the multi-hopping technique. Therefore, whenever and wherever a ship accident occurs, the information needed for the rescue may be identified by the latest data packet that is transmitted and received. The identified location may be closer to the disaster position so rescue can be affected more efficiently.

BRIEF DESCRIPTION OF THE DRAWINGS

Attendant advantages and features of this invention in the following detailed description will become more apparent when taken in conjunction with the following drawings.

Fig.1 is a diagram of multiple ships transmitting and recording positioning information with a first embodiment of a system for rescue at sea with multi-hopping technique in accordance with the present invention.

Fig.2 is a diagram of a first embodiment of a data packet used in the positioning and recording information system in Fig. 1.

Fig.3 is a functional block diagram of the positioning and recording information system in Fig. 1 in a connected network.

Fig.4 is a functional block diagram of one station in the positioning and recording information system in Fig.1.

Fig.5 is an operational diagram of a mobile station moving and transmitting to form a moving track for positioning.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to Figs.1 and 5, a positioning and recording information system for rescue at sea does not use the GPS and is implemented with a multi-hopping

technique in accordance with the present invention. The system comprises at least one fixed station and multiple mobile stations. Each station 10, 20, 30, 40 transmits, receives and stores data packets using digital communications and Internet access for mobile vessels. The data packets are temporarily stored in temporary repositories of the stations. The mobile stations transmit data packets to other mobile stations and store the data packets if they are in a signal-transmitted area. The system comprises at least one fixed station that is a destination station and multiple mobile stations. The system comprises operating steps of

a first mobile station 10 transmits and stores the data packet 11 to a second mobile station 20 if the second mobile station 20 is in the signal-transmitted area of the first mobile station 10; the first mobile station 10 transmits and stores the data packet 12 to a third mobile station 30 if the third mobile station 30 is in the signal-transmitted area of the first mobile station 10; the second mobile station 20 and third mobile station 30 transmit feedback data packets 13 and 14 to the first mobile station 10 when the second mobile station 20 and third mobile station 30 confirm receptions of the data packets 11 and 12 respectively.

Subsequently, the second mobile station 20 transmits and stores the data packet 21 to the third mobile station 30 in a signal-transmitted area of the second station 20; the second mobile station 20 also transmits and stores the data packet 22 to a specific mobile station 40 if the specific mobile station 40 is in the signal-transmitted area of the second mobile station 20; the third mobile station 30 and the specific mobile station 40 receive and store the data packets 21, 22; the third mobile station 30 and the specific mobile station 40 transmit and store feedback data packets 23, 24 to the second mobile station 20 when they confirm receptions of the data packet 21, 22.

In the same way, the third mobile station 30 transmits and stores the data packet 31 to the specific mobile station 40 if the specific mobile station 40 is in the signal-transmitted area of the third mobile station 30; the specific mobile station 40 then receives and stores the data packet 31; the specific mobile station 40 transmits and stores feedback data packet 32 when it confirms a reception of the data packet 31.

The data packets 11, 12, 13, 14, 21, 22, 23, 24, 31, 32 are transmitted between multiple stations 10, 20, 30, 40, 50 to form a network topology. Eventually, the fixed station 50, which is a destination station can receive and store the data packets 11, 12, 13, 14, 21, 22, 23, 24, 31, 32 after the data packets 11, 12, 13, 14, 21, 22, 23, 24, 31, 32 are continuously transmitted. The mobile stations 10, 20, 30, 40 have temporary repositories respectively. If one of the stations 10, 20, 30, 40 meets with misfortune, the location where the accident occurred is identified in the network topology by the latest data packet 11, 12, 13, 14, 21, 22, 23, 24, 31, 32 received by any of the other stations 10, 20, 30, 40, 50 to facilitate rescue at sea.

With reference to Fig.1 and 2, the data packets 11, 12, 13, 14, 21, 22, 23, 24, 31, 32 are composed of multiple bits and could be binary, octal or hexadecimal systems. A data packet could be a 24-bit code if it includes an identification code of a station sending the original position, time when the data packet 11, 12, 13, 14, 21, 22, 23, 24, 31, 32 is transmitted and received and the position where the data packet 11, 12, 13, 14, 21, 22, 23, 24, 31, 32 is transmitted and received. The position is shown as longitude and latitude. For example, a data packet 11 transmitted at 10:35PM on December 30, 2005 at E130°, N30 °, from a mobile station 10 coded as 197.13.24.05 using a hexadecimal system would be 7D5C1E1623C50D1805821E01. The first three bits represent the year. The fourth bit represents the month. The fifth and sixth bits represent the day of the month. The seventh and eighth bits represent the hour on a 24

hour clock. The ninth and tenth bits represent the minute. The eleventh to eighteenth bits represent the identification code that is the IP address, in this case 197.13.24.05. The nineteenth to twenty-second bits represent the east longitude and north latitude. The last two bits are a confirmation code for the data packet 11, 12, 13, 14, 21, 22, 23, 24, 31, 32. The confirmation code reflects the transmission state of the data packet 11, 12, 13, 14, 21, 22, 23, 24, 31, 32. "00" indicates unsuccessful transmission, "01" indicates successful transmission, and "02" indicates a retransmission is being performed. Furthermore, each digit of the data packet 11, 12, 13, 14, 21, 22, 23, 24, 31, 32 may be encoded with encoding techniques such as error detection and correction codes. The encoding techniques are not restricted to the format and content of the bits and information mentioned above.

With further reference to Fig. 3, a way utilized to transmit and store the data packets 11, 12, 13, 14, 21, 22, 23, 24, 31, 32 is described as follow

the first mobile station 10 translates information into a transmittable data packet 11 by an application program 1 in the first mobile station 10, stores the data packet 11 in a temporary repository 2 and transmits the data packet 11 from the first mobile station 10 to the second mobile station 20 by a hopping software 3 and a communication device 4;

the second mobile station 20 stores the data packet 11 in the temporary repository 2 after receiving by the communication device 4, translates the received information and the information about the second mobile station 20 into a data packet 21 through the hopping software 3 and transmits the data packet 21 to the third mobile station 30 through the communication device 4;

the third mobile station 30 stores the data packet 21 in the temporary repository 2 after receiving by the communication device 4, translates the received information

and the information about the third mobile station 30 into a data packet 31, which includes the information of the mobile stations 10, 20, 30 through the hopping software 3 and transmits the data packet 31 to the next specific mobile station 40 through the communication device 4;

5 a fixed station 50 that represents a destination station eventually receives the data packets 11, 21, 31 after the data packets 11, 21, 31 are continuously transmitted, stores the data packets 11, 21, 31 in a repository 5 after receiving by the communication device 4 and translates the data packets 11, 21, 31 into applicable information by an application program 6.

10 The fixed station of the present invention could be mounted on a buoy or at a port. The mobile station of the present invention could be mounted on a ship. If the mobile station is mounted on a ship, the data packets further comprise navigation information such as the course, the speed, the serial number of current waypoint, the distance from the waypoint, the estimated time of arrival at the next waypoint, the
15 distance off the route, etc.

With further reference to Fig.1 and 4, the first mobile station 10 comprises a server 8, a communication device 4, an antenna 7 and a power supply 16. The server 8 comprises an operating system 15, hopping software 3 and a temporary repository 2. The operating system 15 of the server 8 transmits the information about the first
20 mobile station 10 to the hopping software 3 through a transmission medium 9 to form a data packet 11, transmits the data packet 11 to the temporary repository 2 and stores the data packet 11 in the temporary repository 2. Simultaneously, the operating system 15 transmits the data packet 11 to the communication device 4 and antenna 7, and further forwarding the data packet 11 to other stations by the communication
25 device 4 and the antenna 7. Besides, the communication device 4 and antenna 7 of the

first mobile station 10 receive data packets from other stations. The received data packets are stored in the temporary repository 2 and are transmitted to other stations.

With reference to Fig.5, the data packets from the first mobile station 10 are continuously transmitted to other stations by the multi-hopping technique in the signal-transmitted area and eventually received by the fixed station 50 that is the destination station. Since the first mobile station 10 keeps moving and transmitting the data packets, the position of the first mobile station 10 and its track can be identified by the fixed station 50. The fixed station 50 processes the received data packets into applicable information for positioning. Therefore, when a ship accident occurs, the position where the ship signal disappears can be identified so a rescue can be started without delay.

The present invention utilizes the multi-hopping technique instead of the Global Positioning System to transmit data packets. Accordingly, ship companies can afford to transmit signals frequently. The present invention also improves the communication efficiency of the network by solving the problem of excessive hop count and no connection among ships all the time. When a ship accident occurs, the latest information received in the destination station is closer to the real situation compared to that of the prior art, and the rescue can be started without delay.

While the present invention has been described in connection with a preferred embodiment thereof, changes and modifications may be made without departing from the true spirit and scope of the present invention. Accordingly, the appended claims intend to cover all such changes and modifications within the spirit and scope of the invention.

What is claimed is:

1. A positioning and recording information system for rescue at sea, wherein:

the positioning and recording information system is implemented with a multi-hopping technique and without using global positioning system; and

at least two stations are required where each said station transmits, receives and stores data packets of the stations through digital communication and Internet access for mobile vessels, the information about each station being processed into data packets being position data, the data packets temporarily being stored in temporary repositories of the stations, the system comprising

at least one fixed station, representing a destination station, comprising hopping software and a communication device, and configured to process received data packets into applicable information for positioning;

multiple mobile stations, each comprising a respective communication device and the hopping software, and configured to transmit and store data packets in a signal-reception area;

the system comprising means of

transmitting and storing data packets from a first mobile station to second and third mobile stations by using the hopping software;

receiving and storing the data packets in the second and third mobile stations through the communication devices;

transmitting and storing feedback data packets from the second and third mobile stations to the first mobile station by using the hopping software;

transmitting and storing a data packet from the second mobile station to the third mobile station by using the hopping software;

receiving and storing the data packet in the third mobile station through the communication devices;

transmitting and storing feedback data packets from the third mobile station to the second mobile station by using the hopping software; and

receiving and storing the data packets in the destination station.

2. The system as claimed in claim 1, wherein each station comprises an identification code.
3. The system as claimed in claim 1, wherein the fixed station is set at a port.
4. The system as claimed in claim 1, wherein the mobile station is set on a ship.
5. The system as claimed in claim 1, wherein the destination station processes the received data packets.
6. The system as claimed in claim 1, wherein the data packets include information as the identification codes of stations, time when the data packets are transmitted and received and the position where the data packets are transmitted and received.
7. The system as claimed in claim 1, wherein the stations transmit data packets using the IEEE 802.11 standard, radio techniques, infrared techniques or Worldwide Interoperability for Microwave Access.
8. The system as claimed in claim 1, wherein the temporary repository is a disc or a network disc.
9. The system as claimed in claim 2, wherein the identification code is an IP address.
10. The system as claimed in claim 6, wherein the position is shown using longitude and latitude.
11. The system as claimed in claim 6, wherein the data packets are composed of multiple bits.
12. The system as claimed in claim 6, wherein the data packets are binary, octal or hexadecimal.
13. The system as claimed in claim 6, the data packets further include navigation information when the mobile station is set on a ship.

14. The system as claimed in claim 13, wherein the navigation information includes the course, speed, serial number of a waypoint, the distance from the waypoint, the estimated time of arrival at the next waypoint and the distance off the route.
15. The system as claimed in claim 1, wherein the fixed station is set on a buoy.

ABSTRACT

A positioning and recording information system for rescue at sea implemented with a multi-hopping technique but not the Global Positioning System (GPS). At least two stations transmit navigation information to one another in the form of data packets. The data packets are received and temporarily stored in the stations. The steps of transmitting, receiving and storing are repeated to form a network topology that records a track of a station mounted on a ship. When the ship meets with misfortune at sea, the latest data packet transmitted by the ship provides a position near the location of the ship accident. Consequently, the rescue can be started immediately, and efficiency of a rescue operation is improved when compared to traditional ways of estimating a ship's position.