

SHIP MONITORING SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the invention

This invention relates to a ship monitoring system, and more particularly, to a ship monitoring system for analyzing information and managing ships sailing on the sea by utilizing a radio frequency identification (RFID) receiving terminal adhered to the ship to reflect radio frequency signals transmitted from a base station and a monitoring centre to receive and analyze the radio frequency signals.

2. Description of Related Art

In addition to the applications of technology and resource, goods transportation capability is another one of the most important indications to evaluate the competitiveness of a country, especially in an era when boundaries between countries vanish.

Transportation by ship has a number of advantages, such as the ability to move large volumes with low unit transportation cost, and has become one of the most popular transportation methods adopted by manufacturers. However, ship transportation has some drawbacks. For instance, a ship sailing on the sea is at risk from pirates, especially when sailing in Malacca Strait, which is dangerous but where there is additional risk of heavy ship traffic.

An international maritime organization (IMO) assembles 43 countries, all of which usually transport goods via Malacca Strait, to hold a council for prevention from piracy.

Ship Tagging, Alarm System, Tracking System and Automatic Identification System are four of the most popular ship monitoring systems as prevention against piracy. Ship Tagging engraves visibility receiving terminals on ships owned by specific members, for ease of identifying users of the ship. Alarm System, such as "Seajack" and "Tigers Gate", alerts crew members on a ship of piracy by emitting or transmitting **an audible alarm**. Tracking System, such

as "Purplefinder" and "Shiploc", allows the ship owner or operator to track the positions of ships thereof via Internet.

As soon as the power supply of the ship is destroyed, Tracking System emits alarm signals immediately through the use of its own battery power. However, Tracking System alarm will not function if the battery is out of charge. Moreover, since Tracking System is too bulky to be easily concealed in a secret place on the ship, pirates can easily find and destroy Tracking System. Automatic Identification System allows ships provided with Automatic Identification System to identify each other. Therefore, when an unknown ship is approaching, the ships, which are provided with Automatic Identification System, are able to identify whether the ship is a registered ship or whether the ship is pirate owned.

Furthermore, Global Positioning System (GPS) is frequently used to monitor ships on the sea. Prior arts disclosure utilizes GPS to acquire positioning data of a mobile carrier, utilizing a wireless transceiver in a positioning device to transmit the positioning data to a monitoring centre. The wireless transceiver returns differentially reference positioning signals received by the monitoring center, utilizing the wireless transceiver to return differential amended values to the mobile carrier, and displaying the precise position of the mobile carrier on a geographic information system of a computer of the mobile carrier. Prior art further adds an identification code to the signals and accentuates a graph processing capability of computer software.

However, the prior arts, if applied to the management of ship locations, can encounter the following problems: -

- (1) the mobile carrier and the monitoring center, both of which receive and transmit wireless signals, are easily affected by climate and topography, and the mobile carrier is further restricted by its limited power and limited effective working area;
- (2) in case of emergency, the mobile carrier does not have any function to provide emergency calls;
- (3) the mobile carrier does not capture any shipwreck related information, such as the name and location of the wreck and the date when the shipwreck occurred.

- (4) the mobile carrier does not have an information printing functionality, and can not produce a printed record with location evidence; and
- (5) the prior arts can neither transmit nor record fishing harvest data.

SUMMARY OF THE INVENTION

In view of the above mentioned problems of the prior art, it is a primary objective of the present invention to provide a ship monitoring system having a network of base stations and antenna towers to be installed, covering an area between which a ship sails, and a monitoring center. The ship is connected to the base stations with wireless signals reflected from an RFID receiving terminal. The reflected wireless signals are sent to and analyzed by the monitoring center, so as to determine the precise location of the ship.

To achieve the above mentioned and other objectives, a ship monitoring system is disclosed according to the present invention. The ship monitoring system includes a wireless communications component, an antenna tower for receiving wireless signals, a base station for transferring radio frequency communications signals directed by predetermined frequencies based on the predetermined frequencies, and a monitoring center connected with the base station via wireless signals for managing communications mechanisms and communications contents of the base station, and analyzing received information.

The wireless communications component has a radio frequency identification (RFID) receiving terminal for receiving and transmitting radio frequency communications signals, a radio frequency antenna for receiving and transmitting wireless signals, a communications terminal for wirelessly transmitting terminal information to and acquiring distance information from a base station, the base station feeding results back to the communications terminal, and a ship (mobile) server.

According to the preferred embodiment, the RFID receiving terminal adopts an ISO / IEC JTC1 SC31 standard; the RFID

receiving terminal includes a film substrate and has a structure in the shape of a sheet; the base station transmits location, date, time and ship number information of a ship provided with the wireless communication component to the monitoring center; the monitoring center has a monitoring panel, a storage device, a geographic information system (GIS) database and a ship management server; the radio frequency antenna is a coiled antenna; the communications terminal utilizes a backup lithium battery having a chargeable condenser; the communications terminal transmits power information of the chargeable condenser to the base station; the ship (mobile) server transmits location information acquired by a global positioning system (GPS), and information related to name, destination, speed, location and size of a ship provided with the wireless communications component to the base station; the ship (mobile) server is provided with a stabilization power circuit for transferring power information including a main power and a battery power to the base station; the ship (mobile) server further emits chargeable wireless signals for charging a terminal; the ship (mobile) server is provided with a camera, and is capable of transmitting video information captured by the camera; the base station is provided with a telescope camera for transmitting video information from a certain region to the monitoring center; the wireless communications component further includes a power module having a power transformation unit for transforming the radio frequency communications signals received by the RFID receiving terminal to a transformation power, a power supply for providing power needed by the wireless communications component to operate, and a switch coupled to the power transformation unit and the power supply, the transformation power able to close the switch and the power provided by the power supply is provided to the wireless communications component via the closed switch; the power transformation unit is a charge pump; the power supply is a battery; the battery is a solar battery; the antenna tower is installed on the shoreline; antenna tower further transmits and receives laser, and the monitoring center judges the location of a ship sailing across a line between the corresponding antenna towers based on either shoreline.

BRIEF DESCRIPTION OF DRAWINGS

The invention can be more fully understood by reading the following detailed description of the preferred embodiments, with reference made to the accompanying drawings, wherein:

Fig. 1 is a schematic diagram of a ship monitoring system of the preferred embodiment according to the present invention; and

Fig. 2 is a functional block diagram of a power module of an RFID receiving terminal of the ship monitoring system shown in Fig.1.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

The following illustrative embodiments are provided to illustrate the disclosure of the present invention; these and other advantages and effects can be apparently understood by those in the art after reading the disclosure of this specification. The present invention can also be performed or applied by other different embodiments. The details of the specification may be on the basis of different points and applications, and numerous modifications and variations can be devised without departing from the spirit of the present invention.

Fig. 1 is a schematic diagram of a ship monitoring system 100 of the preferred embodiment according to the present invention. The ship monitoring system 100 comprises a wireless communications component 102, a base station 104, a plurality of antenna towers 103, 105, 106, 107 and a monitoring center 108. The wireless communications component 102 comprises a radio frequency antenna 112, a communications terminal 114 and a ship (mobile) server 116. The RFID receiving terminal 110 adopts ISO / IEC JTC1 SC31 standard. The RFID receiving terminal 110 comprises a film substrate and has a structure in the shape of a sheet. Therefore, the RFID receiving terminal 110 can be secreted in any area of a ship that are also difficult to access. For example, the RFID receiving terminal 110 can be adhered to a top region of the ship and covered by a water-proof sticker. Therefore, pirates will have difficulty to locate the RFID receiving terminal 110 due to reflecting light from the top region.

All of the antennal towers 103, 105, 106, 107 are used to receive radio frequency communications signals transmitted from the

RFID receiving terminal 110, which is installed on ship. The base station 104 is connected with the monitoring center 108 via wireless signals. In practice, the base station 104 transfers the radio frequency communications signals received by the RFID receiving terminal 110 and indicated by wireless frequencies, and varieties of information, such as name, date, time, number corresponding to the ship, to the monitoring center 108. For example, when the antenna towers 106, 107 have the highest voltage level, and the monitoring center 108 can therefore calculate distances between the ship and the antenna towers 106, 107, and also determine the location of the ship based on a distance L between the antenna towers 106, 107 and directions of the ship with relation to the antenna towers 106, 107.

Therefore, in case of emergency, such as the main power is cut off, or the ship can not contact with any ship (mobile object), or the communications terminal 114 can not provide a predefined power, the ship monitoring system 100 of the present invention is still able to take control of the location information of the ship, and prevent the piracy from happening.

The ship, which is provided with the wireless communication component 102, is allowed to take the use of the RFID receiving terminal 110 and the base station 104, which are installed on land or island, to transmit wireless signals and receive information reflected from the RFID receiving terminal 110, and transmit all of the information received by the base station 102 to the monitoring center 108. The monitor center 108, which can be installed in a government bureau or military base and able to direct police and the military at any time, comprises a monitoring panel, a storage device, a geographic information system (GIS) database and a ship management server. The monitoring center 108 manages the received information with a main server, and calculates the location of the ship with the base station 104.

The RFID receiving terminal 110 is battery powered. When staying in a standby state and receiving no wireless signals from the antenna tower 106, the RFID receiving terminal 110 is not actuated (the RFID receiving terminal 110 will not be actuated unless the ship enters the Straits of Malacca) and the battery does not have to provide any power to the RFID receiving terminal 110. Therefore the

battery can have a lifespan of one year between charges, and can be recharged together with maintenance of other devices. Because the RFID receiving terminal 110 is provided with the battery, even if the main power of the ship is cut off, the battery can still provide power to the RFID receiving terminal 110, and the RFID receiving terminal 110 can communicate with the base station 104 at any time. The RFID receiving terminal 110 can receive and transmit wireless signals and laser. The battery can be a solar powered battery.

The radio frequency antenna 112 is a coiled antenna, which is compact and is compatible to the RFID received terminal 110.

The communications terminal 114 receives and transmits signals wirelessly. The communications terminal 114 transmits terminal information to the base station 104 and acquires distance information from the base station 104, and the base station 104 feeds results back to the communications terminal 114. The communications terminal 114 is provided with a backup lithium battery having a chargeable condenser. The communications terminal 114 further transmits power information to the base station 104.

The ship (mobile) server 116 transmits location information acquired by a global positioning system (GPS), and information related to name, destination, speed, location, and size of a ship provided with the wireless communications component to the base station. The ship (mobile) server 116 is provided with a stabilization power circuit such as a rectifier for transferring power information including a main power and a battery power to the base station 104. The ship (mobile) server 116 further emits chargeable wireless signals for charging a terminal.

The ship (mobile) server 116 is further provided with a camera, and is capable of transmitting video information captured by the camera. Accordingly, the base station receives / transmits data from / to the monitoring center 108 with wireless signals and laser. The base station 104 is provided with a telescope camera for transmitting video information in a certain region to the monitoring center 108.

The monitoring center 108 manages communications method and contents of the base station 104, and analyzes the received information. The received information comprises a whole blueprint of the current state and an inner blueprint of the ship. The monitoring center 108 receives and transmits signals wirelessly. The monitoring center 108 comprises a modem, a GIS, a ship location information processing device and storage unit, and an excluded transmission line, which are all installed on a computer host and system operating software.

The monitoring system 100 comprises a variety of functions, such as an emergency rescue function, and a displaying function for displaying ship location, identification code and date and time, and is therefore capable of accurately monitoring any ship provided with the RFID receiving terminal 110. The ship monitoring system 100 of the present invention can further track the location of the ship. Therefore, if the ship is without power due to an accident, the ship monitoring system 100 can still determine the location of the ship accurately, and provide location and directions to any necessary rescue troops to recover the ship.

As mentioned previously, in addition to the wireless signals, the RFID receiving terminal 110 can be designed to receive and transmit laser. Accordingly, each of the antenna towers 103, 105, 106, 107 have to be designed to transmit and receive laser. In practice, when the ship sails to a region between the antenna towers 105 and 107, the laser transmitted between the antenna towers 105 and 107 is broken due to the mass of the ship. Therefore, the monitoring center 108 determines the ship is sailing in the region between the antenna towers 105 and 107 by determining that the laser is broken; on the other hand, when the ship sails to another region between the antenna towers 103 and 106, the laser transmitted between the towers 103 and 106 is broken due to the mass of the ship. Therefore, the monitoring center 108 determines the ship has left the region between the antenna towers 105 and 107 by determining that the laser is transmitted again between the antenna towers 105 and 107, and determines the ship is sailing in the another region by determining that the laser transmitted between the antenna towers 103 and 106 is broken. When the ship monitoring system 100 has more and more antenna towers, the antenna towers can form the

equivalent of an invisible laser network, and the monitoring center 108 is able to determine the location of the ship more accurately. The laser method can be used together with the previously mentioned wireless signals.

The laser, adopted by the laser method, can be transmitted between the antenna tower and the ship, in addition to being transmitted between the antenna towers. The distance between the ship and one of the antenna towers 103, 105, 106, 107 and the location of the ship can be determined by calculating time for the laser to travel from the antenna tower to the ship and from the ship back to the antenna tower. In practice, the ship can be provided with a corner cube reflector (CCR), which comprises a plurality of mirrors capable of reflecting the laser transmitted from the antenna tower and projected thereon. The longer the time is, the further the ship from the antenna tower becomes. Through acquiring three pieces of distance information from three antenna towers, the triangulation allows the location of the ship to be determined accurately. The antenna towers can emit the laser sequentially to a certain region of the base station 104.

In addition to the wireless signals and the laser method, the RFID receiving terminal 110 is allowed to adopt CDMA (CDMA 450 or CDMA 800) usually applied to a cellular phone, GSM, and wireless communications, so as to keep the transmitted data secret and make the best use of bandwidth.

The monitoring center 108 is able to monitor the ship by applying a mobile server communications method and the laser method sequentially.

In order that the antenna towers of the ship monitoring system 100 of the present invention can transmit and receive the wireless signals as clearly as possible, the antenna towers are installed in an open and wide region, such as a mountain and beach. Because both the CDMA and the laser method needs at least three distance information to determine the location of the ship, and the ship monitoring system 100 does not comprise the GPS system, the antenna towers have to be installed in the region described above.

Moreover, since the Malacca Strait is close to Malaysia, the construction of communications bases of the ship monitoring system 100 of the present invention relies on Telecom of Malaysia. Accordingly, Malaysia government and troops have to take the logistics responsibility, and are suggested to establish a "Malacca Strait Malata System Preparation Committee" as a bureau to manage the implementation of the ship monitoring system 100.

Although the ship monitoring system 100 is installed in Malacca Strait, the ship monitoring system 100 can be installed in any other straits, as long as these straits are provided with the same terminal facilities.

As described previously, once the wireless communications component 102 is out of power, the ship monitoring system 100 is unable to monitor the ship any more. To overcome the problem, the wireless communications component 102 further comprises a power module 20 (shown in Fig. 2). The power module 20 comprises a power transformation unit 24, a power 28 and a switch 30 coupled to the power transformation unit 24 and the power 28. The power 28 is used to supply power. The power transformation unit 24 is used to transform the radio frequency communications signals to a transformation power, which is used to close the switch 30.

Therefore, when the ship 102, which is provided with the wireless communications component 102, sails to a region close to Malacca Strait, the RFID receiving terminal 110 receives the radio frequency communications signals emitted by the antenna tower 106 installed on the shores of Malacca Strait, the power transformation unit 24 then transforms the radio frequency communications signals to the transformation power to close the switch 30, and the power supplied by the power 28 can be therefore transmitted via the closed switch 30 to the other components of the wireless communications component 102.

Conversely, when the ship has not yet entered or has left from Malacca Strait, because the radio frequency communications signals cover nowhere but Malacca Strait (the ship is safe now), the RFID receiving terminal 110 of the wireless communications component 102 will not receive any radio frequency communications signals, and

the power 28 will not supply any power to the components of the wireless communications component 102, because the switch 30 is open. Therefore, the power 28 will not consume any power, and the wireless communications component 102 is power – saving. According to the preferred embodiment, the power transformation unit 24 is a charge pump, and the power 28 is a solar battery.

The foregoing descriptions of the detailed embodiments are only illustrated to disclose the features and functions of the present invention and not restrictive to the scope of the present invention. It should be understood to those in the art that all modifications and variations according to the spirit and principle in the disclosure of the present invention should fall within the scope of the appended claims.

CLAIMS

What is claimed is:

1. A ship monitoring system comprising:

a wireless communications component comprising:

a radio frequency identification (RFID) receiving terminal for receiving and transmitting radio frequency communications signals;

a radio frequency antenna for receiving and transmitting wireless signals;

a communications terminal for wirelessly transmitting terminal information to and acquiring distance information from a base station, the base station feeding results back to the communications terminal; and

a ship (mobile) server

and antenna tower for receiving wireless signals;

the base station for transferring radio frequency communications signals directed by predetermined frequencies based on the predetermined frequencies; and a monitoring center connected with the base station via wireless signals for managing communications methods and communications contents of the base station, and analyzing received information.

2. The ship monitoring system of claim 1, wherein the RFID receiving terminal adopts an ISO / IEC JTC1 SC31 standard.

3. The ship monitoring system of claim 1, wherein the RFID receiving terminal comprises a film substrate and has a structure in the shape of a sheet.

4. The ship monitoring system of claim 1, wherein the base station transmits location, date, time and ship number information of a ship

provided with the wireless communications component to the monitoring center.

5.The ship monitoring system of claim 1, wherein the monitoring center comprises a monitoring panel, a storage device, a geographic information system (GIS) database and a ship management server.

6.The ship monitoring system of claim 1, wherein the radio frequency antenna is a coiled antenna.

7.The ship monitoring system of claim 1, wherein the communications terminal utilizes a backup lithium battery as a power supply.

8.The ship monitoring system of claim 7, wherein the backup lithium battery comprises a chargeable condenser.

9.The ship monitoring system of claim 8, wherein the communications terminal transmits power information of the chargeable condenser to the base station.

10.The ship monitoring system of claim 1, wherein the ship (mobile) server transmits location information acquired by a global positioning system (GPS) and laser network, and information related to name, destination, speed, location and size of a ship provided with the wireless communications component to the base station.

11.The ship monitoring system of claim 1, wherein the ship (mobile) server is provided with a stabilization power circuit for transferring power information including a main power and battery power to the base station.

12.The ship monitoring system of claim 1, wherein the ship (mobile) server further emits chargeable wireless signals for charging a terminal.

13.The ship monitoring system of claim 1, wherein the ship (mobile) server is provided with a camera, and is capable of transmitting video information captured by the camera.

14.The ship monitoring system of claim 1, wherein the ship (mobile) server is provided with a telescopic camera for transmitting video information in a certain region to the monitoring center.

15.The ship monitoring system of claim 1, wherein the wireless communications component further comprising a power module comprising:

- a power transformation unit for transforming the radio frequency communications signals received by the RFID receiving terminal to a transformation power;

- a power supply for providing power needed by the wireless communications component to operate; and

- a switch coupled to the power transformation unit and the power supply, the transformation power able to close the switch and the power provided by the power supply is provided to the wireless communications component via the closed switch.

16.The ship monitoring system of claim 15, wherein the power transformation unit is a charge pump.

17.The ship monitoring system of claim 15, wherein the power supply is a battery.

18.The ship monitoring system of claim 17, wherein the battery is a solar battery.

19.The ship monitoring system of claim 1, wherein the antenna tower is installed on a mountain

20.The ship monitoring system of claim 1, wherein the antenna tower is installed on a beach

21.The ship monitoring system of claim 1, wherein the antenna tower further transmits and receives laser, and the monitoring center judges the location of a ship provided with the wireless communications component based on laser received by the antenna tower.

22.The ship monitoring system of claim 21, wherein the wireless communications component further comprises a corner cube reflector (CCR) for reflecting the laser emitted by the antenna tower, and the monitoring center calculates the location of a ship provided with the wireless communications component based on the time of the laser reflected from the CCR to the antenna tower.

23.The ship monitoring system of claim 1, wherein the antenna tower is used to emit laser, the ship monitoring system further comprises another antenna tower for receiving the laser emitted by the antenna tower, and the monitoring center judges the location of a ship sailing across a line passing through the antenna towers based on whether another antenna tower is receiving the laser emitted by the antenna tower.