

DESCRIPTION

Search and Rescue Terminal Device Based on Beidou, AIS and Underwater Acoustic Technology

[0001] Technical Field

[0002] The present invention relates to the technical field of electronic devices, and in particular, to a search and rescue terminal device based on Beidou, AIS and underwater acoustic technology.

[0003] Background Art

[0004] After an occurrence of plane crashes, shipwrecks, travel accidents and other disasters, for the rescue work, it is crucial to quickly find victims and persons in distress and carry out an emergency rescue on the surviving victims and persons in distress.

[0005] In the rescue process, instrument and devices are usually used to find the victims; and if the victims or articles like affected vessel are equipped with a device search and rescue terminal device, it is very beneficial to the rescue work.

[0006] In the process of realizing the present invention, the inventor finds that: in the aftermath of the disaster, due to factors such as the weather, environment, and limited rescue device of the scene, the situation in the scene can be more complicated, so that the rescue work is facing many unexpected difficulties; in view of the above, the distress performance of the existing search and rescue terminal device should be constantly upgraded, so that a rescue worker can, as far as possible, learn the specific location where the search and rescue terminal device is located through a variety of channels as soon as possible, thereby carrying out the rescue work timely and accurately. From the abovementioned description, it can be known that the existing search and rescue terminal device needs to be constantly improved to continuously increase the rescue efficiency and rescue success rate.

[0007] In view of the demands for the existing search and rescue terminal device to be continuously improved, based on many years of rich practical experiences in designing and manufacturing such products and professional knowledge, and with the use of science and management, the inventor actively researches and innovates so as to expect to create a novel structure of the search and rescue terminal device based on the Beidou, AIS and underwater acoustic technology, which can further improve the existing search and rescue terminal device, and make it more practical. Through continuous research and design, and after repeated test

DESCRIPTION

samples and improvements, the present invention of practical use is finally created.

[0008] Summary of the invention

[0009] An aim of the present invention is to provide a search and rescue terminal device of a new structure based on Beidou, AIS and underwater acoustic technology for the requirements that the existing search and rescue terminal devices need to be continuously improved; and the technical problem to be solved includes: further improving the existing search and rescue terminal devices to increase the rescue efficiency and rescue success rate.

[0010] The aim and the solution of the technical problem of the invention can be realized by the following technical solution.

[0011] According to the present invention, a search and rescue terminal device based on Beidou, AIS and underwater acoustic technology is provided, including: a satellite positioning communication module based on a Beidou satellite positioning system used for carrying out signal conversion processing on a radio frequency signal transmitted from a Beidou satellite, providing the processed signal to a microprocessor, converting a distress message transmitted from the microprocessor into a radio frequency signal, and transmitting the radio frequency signal to the Beidou satellite; a marine automatic identification system AIS module used for transmitting an AIS signal under the control of the microprocessor; an underwater acoustic transduction module used for generating an acoustic signal under the control of the microprocessor; a pressure sensor used for collecting a pressure signal, and providing the collected pressure signal for the microprocessor; a microprocessor used for forming the distress message according to the received signal, and transmitting the distress message to the satellite positioning communication module based on the Beidou satellite positioning system, and further used for, when it is judged that the current water depth of the search and rescue terminal device reaches a predetermined water depth according to a collection signal transmitted from the pressure sensor, controlling the satellite positioning communication module and the AIS module to be in a non-working state, and controlling the underwater acoustic transduction module to generate the acoustic signal, or otherwise, controlling the underwater acoustic transduction module to be in the non-working state, and controlling the satellite positioning communication module or the AIS module to be in a working state; and a power module used for providing power resources for various electric appliances in the terminal device.

[0012] The aim and the solution of the technical problem of the invention can also be further

DESCRIPTION

realized by adopting the following technical measures.

[0013] Preferably, according to the foregoing search and rescue terminal device based on the Beidou, AIS and underwater acoustic technology, wherein the satellite positioning communication module based on the Beidou satellite positioning system comprises: a satellite positioning antenna, used for receiving the radio frequency signal transmitted from the Beidou satellite or transmitting the radio frequency signal to the Beidou satellite; a low noise amplifier, used for carrying out amplification processing on the radio frequency signal transmitted from the Beidou satellite through the satellite positioning antenna and transmitting the radio frequency signal to a radio frequency unit; a radio frequency unit, used for carrying out frequency conversion processing on the radio frequency signal transmitted from the low noise amplifier, transmitting an analog signal after the frequency conversion processing to an analog-digital converter, modulating the analog signal transmitted from the analog-digital converter into a radio frequency signal and transmitting the modulated radio frequency signal to a pre-amplifier; an analog-digital converter, used for converting the analog signal transmitted from the radio frequency unit into a digital signal, transmitting the digital signal to a baseband signal processing unit, converting the digital signal transmitted from the baseband signal processing unit into the analog signal and transmitting the converted analog signal to the radio frequency unit; a baseband signal processing unit, used for carrying out baseband signal processing on the digital signal transmitted from the analog-digital converter, transmitting the digital signal to the microprocessor, carrying out the baseband signal processing on the signal transmitted from the microprocessor and transmitting the signal to the analog-digital converter; and a pre-amplifier, used for transmitting the radio frequency signal transmitted from the radio frequency unit to the Beidou satellite through the satellite positioning antenna.

[0014] Preferably, according to the foregoing search and rescue terminal device based on the Beidou, AIS and underwater acoustic technology, wherein the satellite positioning communication module based on the Beidou satellite positioning system is a single-mode chip or a multi-mode chip.

[0015] Preferably, according to the foregoing search and rescue terminal device based on the Beidou, AIS and underwater acoustic technology, wherein besides the satellite positioning communication module based on the Beidou satellite positioning system, the multi-mode chip further comprises: at least one of a satellite positioning module based on an American global positioning system, a satellite positioning module based on a Russian GLOSNAS satellite positioning system and a satellite positioning module based on an European Galileo satellite positioning system.

DESCRIPTION

[0016] Preferably, according to the foregoing search and rescue terminal device based on the Beidou, AIS and underwater acoustic technology, wherein the microprocessor is further used for forming the distress message according to the signals transmitted from the satellite positioning module based on the American global positioning system, the satellite positioning module based on the Russian GLOSNAS satellite positioning system or the satellite positioning module based on the European Galileo satellite positioning system, and transmitting the distress message to the satellite positioning communication module based on the Beidou satellite positioning system.

[0017] Preferably, according to the foregoing search and rescue terminal device based on the Beidou, AIS and underwater acoustic technology, wherein the controlling the satellite positioning communication module or the AIS module to be in the working state comprises: controlling the satellite positioning communication module and the AIS module to alternatively be in the working state according to a predetermined time interval.

[0018] Preferably, according to the foregoing search and rescue terminal device based on the Beidou, AIS and underwater acoustic technology, wherein the AIS module comprises: an AIS signal transmitting unit and an AIS antenna, and the AIS signal transmitting unit is respectively connected with the microprocessor and the AIS antenna.

[0019] Preferably, according to the foregoing search and rescue terminal device based on the Beidou, AIS and underwater acoustic technology, wherein the AIS module further comprises: an AIS signal receiving unit, and the AIS signal receiving unit is respectively connected with the microprocessor and the AIS antenna.

[0020] Preferably, according to the foregoing search and rescue terminal device based on the Beidou, AIS and underwater acoustic technology, wherein the control of the microprocessor on the AIS module comprises: the microprocessor controls the AIS module to be in an AIS signal monitoring state, and when determining the presence of a rescue facility according to an AIS signal received by the AIS module, controls the AIS module to be in an AIS signal transmitting state to enable the AIS module to transmit the AIS signal; and/or the microprocessor controls the AIS module to periodically be in the AIS signal transmitting state according to a predetermined transmission interval.

[0021] Preferably, according to the foregoing search and rescue terminal device based on the Beidou, AIS and underwater acoustic technology, wherein the AIS module comprises a Si4463 model chip, and the AIS antenna is an antenna with a very high frequency.

[0022] With the abovementioned technical solution, the search and rescue terminal device based

DESCRIPTION

on the Beidou, AIS and underwater acoustic technology of the present invention at least has the following advantages and beneficial effects: the present invention provides a satellite positioning communication module based on a Beidou satellite positioning system, an AIS module, an underwater acoustic transduction module and a pressure sensor in the search and rescue terminal device based on the Beidou, AIS and underwater acoustic technology, such that the search and rescue terminal device based on the Beidou, AIS and underwater acoustic technology can not only transmit information such as the location of the search and rescue terminal device to a back-end platform (such as the command center or control center, etc.) with the satellite positioning communication module based on a Beidou satellite positioning system under the control of a microprocessor, and in the case of the presence of a rescue device such as a ship around the search and rescue terminal device,, can make the AIS module transmit an AIS signal to request for a targeted rescue under the control of the microprocessor; in addition, in the case that the microprocessor judges that the search and rescue terminal device is located at a certain depth underwater based on the pressure collection signals output by the pressure sensor, it may also transmit an acoustic distress signal through the underwater acoustic transduction module; by rational control over the satellite positioning communication module based on a Beidou satellite positioning system, the AIS module, the underwater acoustic transduction module and the pressure sensor, the microprocessor in the present invention can make the search and rescue terminal device achieve effective distress request in the condition of better endurance performance; thus it can be known that, according to the search and rescue terminal device based on the Beidou, AIS and underwater acoustic technology of the present invention, a rescue worker can know the specific location where the search and rescue terminal device is located as soon as possible via multiple channels, and the search and rescue terminal device is further improved, thereby increasing the rescue efficiency and the rescue success rate.

[0023] The above description is only an overview for the technical solutions of the present invention; in order to more clearly understand the technical measures of the present invention, the present invention can be implemented in accordance with the content of the description, and in order to make the aforementioned and other aims, features and advantages of the present invention be more apparent and understandable, preferred embodiments are listed and described in details with the accompanying drawings in the following.

[0024] Brief Description of the Drawings

[0025] Fig. 1 is a schematic diagram for the structure of the search and rescue terminal device

DESCRIPTION

based on the Beidou, AIS and underwater acoustic technology of the present invention.

[0026] Detailed Description of the Invention

[0027] To further illustrate the technical measures taken and efficacy for the present invention to achieve the intended purpose of the invention, the embodiments, structure, characteristics and effect of the search and rescue terminal device based on the Beidou, AIS and underwater acoustic technology provided in the present invention are described in detail below in combination with the accompanying drawings and the preferred embodiments.

[0028] The major structure of the search and rescue terminal device based on the Beidou, AIS and underwater acoustic technology of the present embodiment is shown in Fig. 1.

[0029] In Fig. 1, the search and rescue terminal device based on the Beidou, AIS and underwater acoustic technology of the present embodiment mainly comprises a satellite positioning communication module 100 (such as a satellite positioning communication module 100 based on a Beidou satellite positioning system), an AIS (Marine automatic identification system) module 110, an underwater acoustic transduction module 120, a pressure sensor 130, a microprocessor 140 and a power module 150.

[0030] The various parts of the search and rescue terminal device based on the Beidou, AIS and underwater acoustic technology will be illustrated below in detail respectively.

[0031] The satellite positioning communication module 100 based on the Beidou satellite positioning system is connected with the microprocessor 140. The satellite positioning communication module 100 based on the Beidou satellite positioning system is mainly used for obtaining the location information where the search and rescue terminal device is located to achieve active positioning, and the satellite positioning communication module 100 based on the Beidou satellite positioning system is further mainly used for sending a message (e.g., a Beidou short message) in a preset format to a back-end platform (e.g., a command center or a control center and the like) under the control of the microprocessor 140.

[0032] Specifically, a specific example of an operation executed by the satellite positioning communication module 100 based on the Beidou satellite positioning system is as follows: under the control of the microprocessor 140, the satellite positioning communication module 100 based on the Beidou satellite positioning system receives a radio frequency signal transmitted from the Beidou satellite positioning system (which can also be called a Beidou satellite), carries out a

DESCRIPTION

series of processing (e.g., frequency conversion processing and baseband signal processing and the like) on the received radio frequency signal, and then transmits the processed signal to the microprocessor 140; and under the control of the microprocessor 140, the satellite positioning communication module 100 based on the Beidou satellite positioning system sends a message with a preset format to the Beidou satellite positioning system, the message is sent to the Beidou satellite positioning system in the form of the radio frequency signal, and the message (e.g., the Beidou short message) generally contains destination address information, and location information and time information of the search and rescue terminal device, and the like. The time information herein can be time information corresponding to the location information, namely the time information represents a time when the search terminal device is located at the abovementioned location information.

[0033] A specific example of the structure of the satellite positioning communication module 100 based on the Beidou satellite positioning system of the present invention is that, the satellite positioning communication module 100 mainly comprises: a low noise amplifier, an analog-digital converter, a baseband signal processing unit, a radio frequency unit, a pre-amplifier and a satellite positioning antenna, wherein, an input end of the low noise amplifier is connected with the satellite positioning antenna, an output end of the low noise amplifier is connected with the input end of a receiving channel of the radio frequency unit, an output end of the receiving channel of the radio frequency unit and the input end of a transmitting channel of the radio frequency unit are respectively connected with the analog-digital converter, the analog-digital converter is connected with the baseband signal processing unit, the baseband signal processing unit is connected with the microprocessor, the output end of the transmitting channel of the radio frequency unit is connected with the input end of the pre-amplifier, the output end of the pre-amplifier is connected with the satellite positioning antenna, and the satellite positioning antenna can be a ceramic antenna.

[0034] Under the control of the microprocessor 140, the satellite positioning communication module 100 receives the radio frequency signal sent by the Beidou satellite positioning system through the satellite positioning antenna, the radio frequency signal is transmitted to the receiving channel of the radio frequency unit after the low noise amplifier carries out amplification processing on the same, the receiving channel of the radio frequency unit carries out frequency conversion processing on the radio frequency signal after the amplification processing, the signal after the frequency conversion processing is transmitted from the receiving channel of the radio frequency unit to the analog-digital converter, the analog-digital converter converts the signal after the frequency conversion processing into a digital signal and transmits the digital signal to the

DESCRIPTION

baseband signal processing unit, and the baseband signal processing unit carries out corresponding baseband signal processing on the received digital signal, and transmits the signal after the baseband signal processing to the microprocessor 140.

[0035] The microprocessor 140 can obtain the current location information of the search and rescue terminal device according to the received signal after the baseband signal processing, and the microprocessor 140 can generate a message containing contents such as destination address information, the location information and the current time information of the search and rescue terminal device based on specific requirements; the microprocessor 140 transmits this message to the baseband signal processing unit, and the message is transmitted to the analog-digital converter after corresponding baseband signal processing is performed thereon by the baseband signal processing unit; after the received signal is converted into an analog signal by the analog-digital converter, it is transmitted to the transmitting channel of the radio frequency unit; after frequency conversion processing is carried out on the received analog signal through the transmitting channel of the radio frequency unit, the signal is transmitted to the pre-amplifier; the pre-amplifier carries out amplification processing on the received radio frequency signal after the frequency conversion processing, and the radio frequency signal after the amplification processing is transmitted through the satellite positioning antenna. After receiving a message based on radio frequency signals from the search and rescue terminal device, the Beidou Satellite (such as the Beidou satellite positioning system) will send this message to a corresponding back-end platform according to the destination address information contained in this message, such as sending this message to a command center or a rescue center.

[0036] The satellite positioning communication module 100 based on the Beidou satellite positioning system in this embodiment can not only be in the form of a single-mode chip (namely this chip only has the Beidou satellite positioning function), but also be in the form of a multi-mode chip (namely this chip possesses not only the Beidou satellite positioning function, but also other types of satellite positioning functions). For example, in addition to the satellite positioning communication module 100 based on the Beidou satellite positioning system, this multi-mode chip also includes: at least one of a satellite positioning module based on the American global positioning system, a satellite positioning module based on the Russian GLOSNAS satellite positioning system and a satellite positioning module based on the European Galileo satellite positioning system; for example, in practical applications, this multi-mode chip can include the following modules simultaneously: the satellite positioning communication module 100 based on the Beidou satellite positioning system, the satellite positioning module based on the American global positioning system, the satellite positioning module based on the

DESCRIPTION

Russian GLOSNAS satellite positioning system and the satellite positioning module based on the European Galileo satellite positioning system.

[0037] What needs to be illustrated specially is that under the situation that the satellite positioning communication module 100 based on the Beidou satellite positioning system is in the form of a multi-mode chip, the location information and time information of the search and rescue terminal device in the message (such as a Beidou short message) with a predetermined format sent by the satellite positioning communication module 100 based on the Beidou satellite positioning system to the Beidou satellite positioning system under the control of the microprocessor 140 may be the location information and time information obtained by any of the satellite positioning communication module 100 based on the Beidou satellite positioning system, the satellite positioning module based on the American global positioning system, the satellite positioning module based on the Russian GLOSNAS satellite positioning system and the satellite positioning module based on the European Galileo satellite positioning system.

[0038] The AIS module 110 is connected with the microprocessor 140. The AIS module 110 is mainly used to transmit AIS signals under the control of the microprocessor 140. Moreover, it can also be used to receive AIS signals transmitted from other devices under the control of the microprocessor 140.

[0039] Specifically, a specific example of an operation executed by the AIS module 110 is: the AIS module 110 is controlled by the microprocessor 140 to start the operation of AIS signal monitoring, if the AIS module 110 does not catch any AIS signal transmitted from any other device within a predetermined time range, the microprocessor 140 controls the AIS module 110 to be in the stop-working state (i.e., non-working state); and if the AIS module 110 catches an AIS signal transmitted from other devices within the predetermined time range, the AIS module 110 informs the microprocessor 140 that it has received an AIS signal (e.g. by sending the received AIS signal to the microprocessor 140, etc.), and the microprocessor 140 controls the AIS module 110 to continuously transmit an AIS signal (i.e. an AIS signal in request of rescue, also known as the AIS distress signal), for example, the microprocessor 140 controls the AIS module 110 to transmit an AIS signal once every 30 seconds so that other devices can receive the AIS signal and then take corresponding rescue measures. The AIS signal transmitted from the AIS module 110 may include the current location information of the search and rescue terminal device, and the current location information may be obtained by the microprocessor 140 with a satellite positioning communication module 100 based on a Beidou satellite positioning system. In addition, regardless of whether the AIS module 110 has caught an AIS signal transmitted from other devices, the AIS module 110 may periodically transmit an AIS signal under the control of

DESCRIPTION

the microprocessor 140, i.e., the microprocessor 140 periodically controls the AIS module 110 at a predetermined transmission interval to transmit an AIS signal, for example, the microprocessor 140 controls the AIS module 110 to transmit an AIS signal once every minute, etc. Compared to the current AIS standard requiring AIS signals to be transmitted eight times per minute, the present embodiment can effectively reduce the transmission power of the AIS module 110.

[0040] In addition, the AIS signals transmitted from the AIS module 110 may specifically be an AIS message 1 and AIS message 14 of MMSI (Maritime Mobile Service Identify) with the first five bits of 97298.

[0041] The AIS module 110 of the present invention may mainly comprise: an AIS signal transmitting unit and an AIS antenna, and the AIS module 110 may also comprise: an AIS signal receiving unit; wherein the AIS signal transmitting unit is connected with the microprocessor 140 and the AIS antenna, respectively and the AIS signal receiving unit is also connected with the microprocessor 140 and the AIS antenna, respectively. The AIS signal transmitting unit is mainly used to transmit an AIS signal under the control of the microprocessor 140, for example, if the microprocessor 140 determines that the AIS signal receiving unit has received an AIS signal transmitted from other devices, it controls the AIS signal transmitting unit to transmit an AIS signal. The AIS signal receiving unit is mainly used to be in a working state under the control of the microprocessor 140, so as to receive an AIS signal transmitted from other devices, for example, the microprocessor 140 at a predetermined time interval triggers the AIS signal receiving unit to be periodically in the working state. The AIS antenna may specifically be a VHF (Very High Frequency) antenna, and the AIS signal transmitting unit and the AIS signal receiving unit generally share the same AIS antenna.

[0042] The AIS module 110 of the present invention may be selected from SiliconlabsEZRadio series of chips, e.g., the Si4463 model chip. Since the chip has the characteristics of commonly used ISM frequency band, high integration, low power, low data rate and high cost performance, the selection of the chip is very favorable for operation reliability, production cost and other aspects of the search and rescue terminal device of this embodiment.

[0043] The underwater acoustic transduction module 120 is connected with the microprocessor 140. The underwater acoustic transduction module 120 is mainly used to transmit an acoustic signal (such as ultrasound) under the control of the microprocessor 140. The underwater acoustic transduction module 120 in the present invention may use a crystal piezoelectric effect, ceramic piezoelectric effect or iron-nickel alloy magnetostrictive effect to generate and transmit an acoustic signal. The acoustic signal can remotely propagate under water preferably, so a rescue

DESCRIPTION

device, through the received acoustic signal, can generally and accurately position a search and rescue terminal device 60 meters under the water within the radius of 1000 meters.

[0044] The pressure sensor 130 is connected to the microprocessor 140. The pressure sensor 130 is mainly used for collecting pressure information and providing the collected pressure information to the microprocessor 140. The pressure sensor 130 can be in a signal collecting state or a non-working state under the control of the microprocessor 140. When the microprocessor 140 determines the search and rescue terminal device currently being at a predetermined depth underwater according to the pressure information transmitted from the pressure sensor 130, it no longer controls the AIS module 110 to be in a working state, but controls the underwater acoustic transduction module 120 to transmit acoustic signals.

[0045] The microprocessor 140 is connected to a satellite positioning communication module 100 based on the Beidou satellite positioning system, AIS module 110, underwater acoustic transduction module 120 and pressure sensor 130, respectively. The microprocessor 140 is the core element in the search and rescue terminal device, the microprocessor 140 is mainly used for coordinating the work of the satellite positioning communication module 100 based on the Beidou satellite positioning system, AIS module 110, underwater acoustic transduction module 120 and pressure sensor 130, thereby transmitting distress signals to the externality in various ways in case of saving the power resources of the search and rescue terminal device as much as possible.

[0046] In practical applications, a specific example for the microprocessor 140 to coordinate the work of the satellite positioning communication module 100 based on a Beidou satellite positioning system, AIS module 110, underwater acoustic transduction module 120 and the pressure sensor 130 is: when the ships equipped with the search and rescue terminal device of the present invention is damaged, the search and rescue terminal device is in the open state due to encountering water, the microprocessor 140 is in a working state, the microprocessor 140 control the single-mode chip or multi-mode chips including the satellite positioning communication module 100 based on a Beidou satellite positioning system to perform an active positioning operation, the microprocessor 140 receives the positioning signals from the satellite positioning system transmitted from the single-mode chip or multi-mode chip, and the microprocessor 140 determines the current location information of the search and rescue terminal device according to the received positioning signals; The microprocessor 140 uses the predetermined destination address information and the latest determined current location information to form a Beidou short messages which can also include the current time information, and the microprocessor 140 controls the satellite positioning communication module 100 based on the Beidou satellite positioning system in the single-mode chip or the multi-mode chip to transmit the Beidou short

DESCRIPTION

messages. Meanwhile, the microprocessor 140 can also form the AIS message 1 or AIS message 14 according to the latest determined current location information and control the AIS module 110 to transmit the AIS message 1 or AIS message 14. The microprocessor 140 can control the single-mode chip or the multi-mode chip to be in a non-working state and control the AIS module 110 to be in a monitoring state (i.e., the AIS signal monitoring state) after controlling the satellite positioning communication module 100 based on a Beidou satellite positioning system to continuously transmit multiple Beidou short messages, such that the AIS module 110 can receive the AIS signal transmitted from external devices, the microprocessor 140 can control whether the AIS module 110 is in a transmitting state depending on whether the AIS module 110 receives an AIS signal; if the control module 140 controls the AIS module 110 to be in the transmitting state (i.e., the AIS signal transmitting state) when receiving the AIS signal transmitted from the AIS module 110, so that the AIS module 110 can transmit the AIS signal externally, such that the external devices can rescue the same; and again, if the microprocessor 140 does not receive the AIS signal transmitted from the AIS module 110 within a certain time range, the microprocessor 140 control the AIS module 140 to be in a non-working state so as to save power resource of the search and rescue terminal device. The microprocessor 140 can obtain the collection signal of the pressure sensor 130 intermittently (e.g., activating the pressure sensor 130 to be in a signal collection state intermittently), and determine the water depth at which the search and rescue terminal device currently is according to the collection signals transmitted from the pressure sensor 130 currently, and when the current water depth is determined to reach the predefined water depth, the microprocessor 140 controls the underwater acoustic transduction module 120 to be in a working state such that the underwater acoustic transduction module 120 produces acoustic signals; when the current water depth is not determined to reach the predefined water depth, the microprocessor 140 can control the satellite positioning communication module 100 and the AIS module 110 to be in the working state alternately according to the predetermined time interval while controlling the underwater acoustic transduction module 120 to be in the non-working state, i.e., the microprocessor 140 controls the AIS module 110 to be in the non-working state while controlling the satellite positioning communication module 100 to be in the working state, as well as controlling the AIS module 110 to be in the working state while controlling the satellite positioning communication module 100 to be in the non-working state.

[0047] The power module 150 is connected with each electric appliance of the search and rescue terminal device so as to supply power resources for each electric appliance in the search and rescue terminal device. The connection herein may be a directly connection and may also be an indirect connection; an example of the indirect connection is: the power module 150 is directly connected with the microprocessor 140, and the other electric appliances obtain power resources

DESCRIPTION

from the microprocessor 140 via connecting with the microprocessor 140, i.e., other electric appliances are connect with the power module 150 via the microprocessor 140.

[0048] The power module 150 generally includes: a battery and at least one voltage-stabilizing chip, wherein the battery may be Lithium-Manganese battery and one voltage-stabilizing chip may provide one specification of power resources. As a specific example, the power module 150 includes a Lithium-Manganese battery and two voltage-stabilizing chips, wherein the Lithium-Manganese battery provides a 6 V supply voltage, one voltage-stabilizing chip provides a 3.3 V supply voltage and the other one provides a 4.8 V supply voltage; the supply voltage specification provided by the abovementioned Lithium-Manganese battery, the amount of voltage-stabilizing chips and the supply voltage specification provided thereby are illustrative only, and it is perfectly possible for the present embodiment to set the supply voltage specification provided by said Lithium-Manganese battery, the amount of voltage-stabilizing chips and the supply voltage specification provided by the voltage-stabilizing chips according to the actual demands of each electric appliance.

[0049] The foregoing is just the preferred embodiments of the present invention and is not intended to limit the invention in any form, although the invention has been disclosed above in the form of preferred embodiments, the abovementioned description is not used to limit the present invention, any person skilled in the art, without departing from the technical solution scope of the present invention, may utilize the technical content disclosed above to make some modifications or variations as equivalent embodiments of equivalent alterations, but all contents without departing from the content of technical solution in this invention, any simple variation, equivalent change and modification made to the abovementioned embodiments in accordance with the technical spirit of the present invention, all fall within the scope of the technical solution of present invention.

CLAIMS

1. A search and rescue terminal device based on Beidou, AIS and underwater acoustic technology, which is characterized by comprising:

a satellite positioning communication module based on a Beidou satellite positioning system, used for carrying out signal conversion processing on a radio frequency signal transmitted from a Beidou satellite, providing the processed signal to a microprocessor, converting a distress message transmitted from the microprocessor into a radio frequency signal, and transmitting the radio frequency signal to the Beidou satellite;

a marine automatic identification system AIS module, used for transmitting an AIS signal under the control of the microprocessor;

an underwater acoustic transduction module, used for generating an acoustic signal under the control of the microprocessor;

a pressure sensor, used for collecting a pressure signal and providing the collected pressure signal to the microprocessor;

a microprocessor, used for forming a distress message according to the received signal and transmitting the distress message to the satellite positioning communication module based on the Beidou satellite positioning system or the AIS module, and further used for, when it is judged that the current water depth of the search and rescue terminal device reaches a predetermined water depth according to a collection signal transmitted from the pressure sensor, controlling the satellite positioning communication module and the AIS module to be in a non-working state and controlling the underwater acoustic transduction module to generate an acoustic signal, or otherwise, controlling the underwater acoustic transduction module to be in the non-working state and controlling the satellite positioning communication module or the AIS module to be in a working state;

and

a power module, used for providing power resources for various electric elements in the terminal device.

2. The search and rescue terminal device of claim 1, which is characterized in that the satellite positioning communication module based on the Beidou satellite positioning system comprises:

a satellite positioning antenna, used for receiving the radio frequency signal transmitted from the Beidou satellite or transmitting the radio frequency signal to the Beidou satellite;

CLAIMS

a low noise amplifier, used for carrying out amplification processing on the radio frequency signal transmitted from the Beidou satellite through the satellite positioning antenna and transmitting the radio frequency signal to a radio frequency unit;

a radio frequency unit, used for carrying out frequency conversion processing on the radio frequency signal transmitted from the low noise amplifier, transmitting an analog signal after the frequency conversion processing to an analog-digital converter, modulating the analog signal transmitted from the analog-digital converter into a radio frequency signal and transmitting the modulated radio frequency signal to a pre-amplifier;

an analog-digital converter, used for converting the analog signal transmitted from the radio frequency unit into a digital signal, transmitting the digital signal to a baseband signal processing unit, converting the digital signal transmitted from the baseband signal processing unit into the analog signal and transmitting the converted analog signal to the radio frequency unit;

a baseband signal processing unit, used for carrying out baseband signal processing on the digital signal transmitted from the analog-digital converter, transmitting the digital signal to the microprocessor, carrying out the baseband signal processing on the signal transmitted from the microprocessor and transmitting the signal to the analog-digital converter;

and

a pre-amplifier, used for transmitting the radio frequency signal transmitted from the radio frequency unit to the Beidou satellite through the satellite positioning antenna.

3. The search and rescue terminal device of claim 1, wherein the satellite positioning communication module based on the Beidou satellite positioning system is a single-mode chip or a multi-mode chip.

4. The search and rescue terminal device of claim 3, which is characterized in that besides the satellite positioning communication module based on the Beidou satellite positioning system, the multi-mode chip further comprises: at least one of a satellite positioning module based on an American global positioning system, a satellite positioning module based on a Russian GLOSNAS satellite positioning system and a satellite positioning module based on an European Galileo satellite positioning system.

5. The search and rescue terminal device of claim 4, which is characterized in that the microprocessor is further used for forming a distress message according to the signal transmitted from the satellite positioning module based on the American global positioning system, the

CLAIMS

satellite positioning module based on the Russian GLOSNAS satellite positioning system or the satellite positioning module based on the European Galileo satellite positioning system, and transmitting the distress message to the satellite positioning communication module based on the Beidou satellite positioning system or the AIS module.

6. The search and rescue terminal device of claim 1, which is characterized in that the controlling the satellite positioning communication module or the AIS module to be in the working state comprises:

controlling the satellite positioning communication module and the AIS module to alternatively be in the working state according to a predetermined time interval.

7. The search and rescue terminal device of claim 1, 2, 3, 4, 5 or 6, which is characterized in that the AIS module comprises: an AIS signal transmitting unit and an AIS antenna, and the AIS signal transmitting unit is respectively connected with the microprocessor and the AIS antenna.

8. The search and rescue terminal device of claim 7, which is characterized in that the AIS module further comprises: an AIS signal receiving unit, and the AIS signal receiving unit is respectively connected with the microprocessor and the AIS antenna.

9. The search and rescue terminal device of claim 8, which is characterized in that the control of the microprocessor over the AIS module comprises:

the microprocessor controls the AIS module to be in an AIS signal monitoring state, and when determining the presence of a rescue facility according to an AIS signal received by the AIS module, controls the AIS module to be in an AIS signal transmitting state to enable the AIS module to transmit the AIS signal;

and/or

the microprocessor controls the AIS module to periodically be in the AIS signal transmitting state according to a predetermined transmission interval.

10. The search and rescue terminal device of claim 8, which is characterized in that the AIS module comprises a Si4463 model chip, and the AIS antenna is an antenna with a very high frequency.