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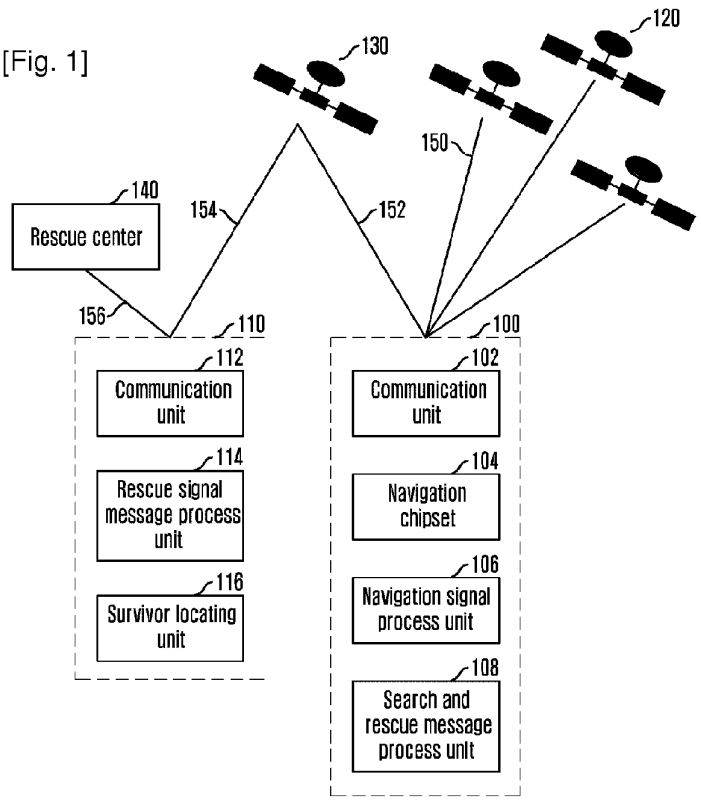
(54) Title: SURVIVOR LOCATING METHOD AND APPARATUS USING SEARCH AND RESCUE BEACON EQUIPPED WITH NAVIGATION CHIPSET

[Fig. 1]



(57) Abstract: Provided is a method and apparatus for locating a survivor. The method includes the steps of: receiving a rescue signal from the search and rescue beacon through a search and rescue satellite; extracting distance information from the search and rescue beacon to a navigation satellite measured by the navigation chipset and information on the navigation satellite from the rescue signal; receiving distance information from the search and rescue satellite to the search and rescue beacon measured by the search and rescue satellite; determining the location of the search and rescue beacon by unifying the distance information and the navigation satellite information when the number of available navigation satellites are less than 4.

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Description

SURVIVOR LOCATING METHOD AND APPARATUS USING SEARCH AND RESCUE BEACON EQUIPPED WITH NAVIGATION CHIPSET

Technical Field

[1] The present invention relates to a method and apparatus for locating a survivor; and, more particularly, to a survivor locating method and apparatus using a search and rescue beacon equipped with a navigation chipset.

[2] This work was supported by the IT R&D program for MIC/IITA [2007-S-301-01, "Development of Global Navigation Satellite System Ground Station and Search And Rescue Beacon Technologies"].

[3]

Background Art

[4] A typical search and rescue service is operated only by a beacon signal. It is designed to locate a survivor by receiving only a beacon signal of a search and rescue beacon in a low earth orbit (LEO) search and rescue satellite when a distress signal is generated, and measuring a distance based on Doppler effect. A two-dimensional (2D) location of the survivor can be acquired by measuring the distance at least twice. Since it takes about one hour and a half for the LEO search and rescue satellite to make a second visit, it takes quite a long time to determine an actual location.

[5] A 2nd generation search and rescue system equipped with a navigation chipset is introduced in order to make up for the shortcomings. With the navigation chipset, the 2nd Generation search and rescue system can detect the location of the survivor more precisely than the LEO search and rescue satellite system using Doppler effect. Furthermore, the 2nd Generation search and rescue system can detect the location of the survivor by using not only the LEO search and rescue satellite but also a geostationary search and rescue satellite.

[6] However, it has a limitation for the both pole areas in high latitudes of over south and north 75 degrees. Also, when the search and rescue beacon equipped with the navigation chipset has less than 4 visible satellites, it is difficult to measure the location.

[7]

Disclosure of Invention

Technical Problem

[8] An embodiment of the present invention is directed to providing a method and

apparatus for providing a locating service which can be provided in case that enough visible satellites are not acquired in a distress situation.

[9] An object of the present invention is to provide a service for locating a survivor continuously when a search and rescue beacon equipped with a navigation chipset does not have enough visible satellites in a distress situation. That is, another embodiment of the present invention is directed to providing a method and apparatus for determining a location of a survivor without delay by acquiring distance information based on Doppler effect with respect to a beacon signal of the search and rescue beacon, distance information by processing more than one navigation signal which is received by the navigation chipset of the search and rescue beacon.

[10] The objects of the present invention are not limited to the above-mentioned ones. Other objects and advantages of the present invention can be understood by the following description, and become apparent with reference to the embodiments of the present invention. Also, it is obvious to those skilled in the art of the present invention that the objects and advantages of the present invention can be realized by the means as claimed and combinations thereof.

[11]

Technical Solution

[12] In accordance with an aspect of the present invention, there is provided a method for locating a survivor using a search and rescue beacon equipped with a navigation chipset, including the steps of: receiving a rescue signal from the search and rescue beacon through a search and rescue satellite; extracting distance information from the search and rescue beacon to a navigation satellite measured by the navigation chipset and information on the navigation satellite from the rescue signal; receiving distance information from the search and rescue satellite to the search and rescue beacon measured by the search and rescue satellite; determining a location of the search and rescue beacon by unifying the distance information and the navigation satellite information.

[13] In accordance with another aspect of the present invention, there is provided an apparatus for locating a survivor using a search and rescue beacon equipped with a navigation chipset, including: a communication unit for receiving a rescue signal from the search and rescue beacon through a search and rescue satellite and receiving distance information from the search and rescue satellite to the search and rescue beacon which is measured by the search and rescue satellite; a distance information extracting unit for extracting the distance information from the search and rescue beacon to a navigation satellite measured by the navigation chipset and information on the navigation satellite from the rescue signal; and a location determining unit for de-

termining a location of the search and rescue beacon by unifying the distance information and the navigation satellite information.

[14] The present invention measures a distance by unifying distance information measured in the search and rescue satellite based on Doppler effect from the beacon signal of the search and rescue beacon and the distance information measured in and transmitted from the navigation chipset of the search and rescue beacon based on Doppler effect from more than one received navigation signal. The distance information measured by the navigation chipset is transmitted by the distress beacon signal with the information of the navigation satellite. When the number of visible satellites is more than 4, a mode is converted into a normal locating mode.

Advantageous Effects

[15] According to configuration of the present invention described above, a survivor can be located in the presence of only one visible navigation satellite. It takes at least an hour and a half to locate the survivor according to a conventional method. When the number of visible navigation satellites is limited even in a search and rescue system equipped with a navigation chipset, speed and exactness in locating the survivor are limited as well. However, the method suggested in the present invention can improve the speed and the exactness.

[16]

Brief Description of the Drawings

[17] Fig. 1 shows a survivor locating apparatus and network connection in accordance with an embodiment of the present invention.

[18] Fig. 2 is a flowchart describing a survivor locating method in accordance with an embodiment of the present invention.

[19]

Best Mode for Carrying Out the Invention

[20] The advantages, features and aspects of the invention will become apparent from the following description of the embodiments with reference to the accompanying drawings, which is set forth hereinafter. Therefore, those skilled in the field of this art of the present invention can embody the technological concept and scope of the invention easily. In addition, if it is considered that detailed description on a related art may obscure the points of the present invention, the detailed description will not be provided herein. The preferred embodiments of the present invention will be described in detail hereinafter with reference to the attached drawings.

[21] Fig. 1 shows a survivor locating apparatus and network connection in accordance with an embodiment of the present invention. As described above, the survivor locating system to which the present invention is applied includes a search and rescue

beacon 100, a search and rescue ground station 110 which is the survivor locating apparatus, a navigation satellite 120, a search and rescue satellite 130, and a rescue center 140.

[22] The search and rescue beacon 100 includes a communication unit 102, a navigation chipset 104, a navigation signal process unit 106, and a search and rescue message process unit 108.

[23] The search and rescue ground station 110 for locating a survivor includes a communication unit 112, a rescue signal message process unit 114, and a survivor locating unit 116. The communication unit 112 receives a rescue signal 154 from the search and rescue beacon 100 through the search and rescue satellite 130 and receives distance information from the search and rescue satellite 130 to the search and rescue beacon 100 which is measured by the search and rescue satellite 130. The search and rescue satellite 130 measures a distance from the search and rescue satellite 130 to the search and rescue beacon 100 based on Doppler effect with respect to a rescue signal of the search and rescue beacon 100. The rescue signal message process unit 114 extracts distance information from the search and rescue beacon 100 to the navigation satellite 120 which is measured by the navigation chipset 104 and information on the navigation satellite from the rescue signal 154. The navigation chipset 104 measures the distance from the search and rescue beacon 100 to the navigation satellite 120 from navigation signals 150a and 150b transmitted from the navigation satellite 120 based on Doppler effect. The survivor locating unit 116 determines a location of the search and rescue beacon 100, i.e., a location of the survivor, by unifying the distance information and the navigation satellite information. Meanwhile, when the number of visible satellites of the navigation satellite 120 is more than 4, a mode is converted into a normal locating mode and the location of the search and rescue beacon 100 is determined based on the distance information measured by the navigation chipset 104 and the navigation satellite information. The determined location of the search and rescue beacon 100 is notified to the rescue center 140 through the communication unit 112 so that the survivor can be rescued.

[24] Fig. 2 is a flowchart describing a survivor locating method in accordance with an embodiment of the present invention.

[25] The rescue signal 154 is transmitted from the search and rescue beacon 100 through the search and rescue satellite 130 at step S202. Distance information from the search and rescue beacon 100 to the navigation satellite 120 measured by the navigation chipset 104 and information on the navigation satellite are extracted from the rescue signal 154 at step S204. The navigation chipset 104 measures distance information from the search and rescue beacon 100 to the navigation satellite 120 from the navigation signals 150a and 150b transmitted from the navigation satellite 120 based

on Doppler effect.

[26] Distance information from the search and rescue satellite 130 to the search and rescue beacon 100 which is measured by the search and rescue satellite 130 is transmitted from the search and rescue satellite 130 at step S206. The search and rescue satellite 130 measures the distance information from the search and rescue satellite 130 to the search and rescue beacon 100 based on Doppler effect with respect to a rescue signal 152 of the search and rescue beacon 100.

[27] A location of the search and rescue beacon 100 is determined at step S208 by unifying the distance information and the navigation satellite information. When it is not possible to exactly measure the location by receiving a navigation signal 150 from less than 4 navigation satellites 120 by the search and rescue beacon 100 equipped with the navigation chipset, the present invention measure 2-dimensional location upon receiving at least one navigation signal 150 based on the distance information measured from a beacon signal 152 of the search and rescue beacon 100 of the survivor which is received through the search and rescue satellite 130 and a distance distance value based on Doppler effect of the navigation satellite 120 which is measured by the search and rescue beacon 100.

[28] To be specific, the search and rescue beacon 100 equipped with the navigation chipset 104 is in a distress and the number of visible navigation satellites 120 is less than 4, the search and rescue beacon 100 processes the navigation signal 150 transmitted from the visible satellite, acquires distance to the navigation satellite based on Doppler effect, sends the distance information to the rescue message process unit 108, adds the distance information to a message, and transmits the message in the form of the beacon signal 152 to the search and rescue satellite 130 through the communication unit 102. The received rescue the beacon signal 152 is transmitted to the search and rescue ground station 110, processed in the rescue signal message process unit 114, and processed with the distance information measured by the search and rescue satellite 130 and the distance information from the signal process received from the visible navigation satellite. Accordingly, the location of the survivor is determined. The rescue center 140 dispatches a rescue party based on the determined location.

[29] When the number of visible navigation satellites is more than 4, a mode is converted into a normal mode and a location of the search and rescue beacon 100 is determined based on the distance information measured by the navigation chipset 104 and the navigation satellite information. The locating procedure of the search and rescue beacon 100 is performed by the navigation chipset 104 for receiving and processing the navigation signal 150 from the navigation satellite 120 in the search and rescue beacon 100. In a distress situation, locating information is transmitted to the search and rescue satellite 130 as the beacon signal 152 of the beacon with the information of

beacon owner. The survivor can be rescued by instantly checking the location of the survivor and dispatching the rescue party.

[30] The determined location of the search and rescue beacon 100 is notified to the rescue center 140 at step S210. The rescue center 140 performs a rescuing work for the survivor referring to the notified location of the search and rescue beacon 100, i.e., the location of the survivor.

[31] As described above, the technology of the present invention can be realized as a program. A code and a code segment forming the program can be easily inferred from a computer programmer of the related field. Also, the realized program is stored in a computer-readable recording medium, i.e., information storing media, and is read and operated by the computer, thereby realizing the method of the present invention. The recording medium includes all types of recording media which can be read by the computer.

[32] The present application contains subject matter related to Korean Patent Application No. 2007-0091565, filed in the Korean Intellectual Property Office on September 10, 2007, the entire contents of which are incorporated herein by reference.

[33] While the present invention has been described with respect to certain preferred embodiments, it will be apparent to those skilled in the art that various changes and modifications may be made without departing from the scope of the invention as defined in the following claims.

Claims

[1] A method for locating a survivor using a search and rescue beacon equipped with a navigation chipset, comprising the steps of:
receiving a rescue signal from the search and rescue beacon through a search and rescue satellite;
extracting distance information from the search and rescue beacon to a navigation satellite measured by the navigation chipset and information on the navigation satellite from the rescue signal;
receiving distance information from the search and rescue satellite to the search and rescue beacon measured by the search and rescue satellite;
determining a location of the search and rescue beacon by unifying the distance information and the navigation satellite information.

[2] The method of claim 1, wherein the rescue signal of the search and rescue beacon is formed of beacon signals including GPS navigation measurements.

[3] The method of claim 1, wherein the search and rescue satellite measures the distance information from the search and rescue satellite to the search and rescue beacon based on Doppler effect of the rescue signal of the search and rescue beacon.

[4] The method of claim 1, wherein the navigation chipset measures the distance information from the search and rescue beacon to the navigation satellite based on Doppler effect of the navigation signal transmitted from the navigation satellite.

[5] The method of claim 1, wherein when the number of the visible navigation satellites is more than 4, the location of the search and rescue beacon is determined based on the distance information measured by the navigation chipset and the navigation satellite information.

[6] The method of claim 1, further comprising the step of:
notifying the determined location of the search and rescue beacon to a rescue center.

[7] An apparatus for locating a survivor using a search and rescue beacon equipped with a navigation chipset, comprising:
a communication means for receiving a rescue signal from the search and rescue beacon through a search and rescue satellite and receiving distance information from the search and rescue satellite to the search and rescue beacon which is measured by the search and rescue satellite;
a distance information extracting means for extracting the distance information from the search and rescue beacon to a navigation satellite measured by the navigation chipset and information on the navigation satellite from the rescue

signal; and

a location determining means for determining a location of the search and rescue beacon by unifying the distance information and the navigation satellite information.

[8] The apparatus of claim 7, wherein the rescue signal of the search and rescue beacon is formed of beacon signals.

[9] The apparatus of claim 7, wherein the search and rescue satellite measures the distance information from the search and rescue satellite to the search and rescue beacon based on Doppler effect of the rescue signal of the search and rescue beacon.

[10] The apparatus of claim 7, wherein the navigation chipset measures the distance information from the search and rescue beacon to the navigation satellite based on measurement of the navigation signal transmitted from the navigation satellite.

[11] A computer-readable recoding medium for recoding a program executing a survivor locating method using a search and rescue beacon equipped with a navigation chipset, the program comprising the steps of:

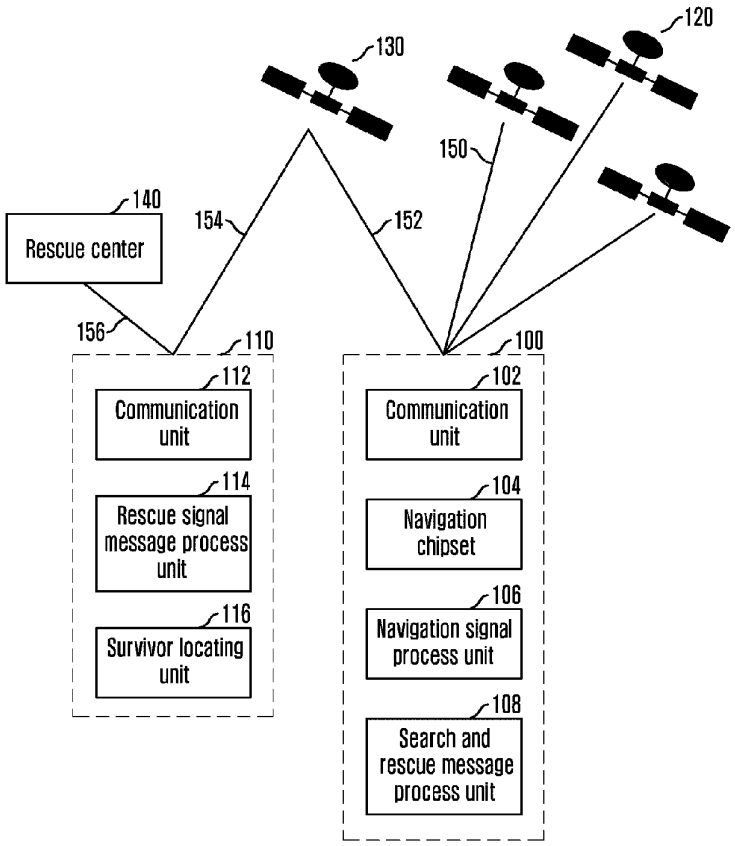
receiving a rescue signal from the search and rescue beacon through a search and rescue satellite;

extracting distance information from the search and rescue beacon to a navigation satellite measured by the navigation chipset and information on the navigation satellite from the rescue signal;

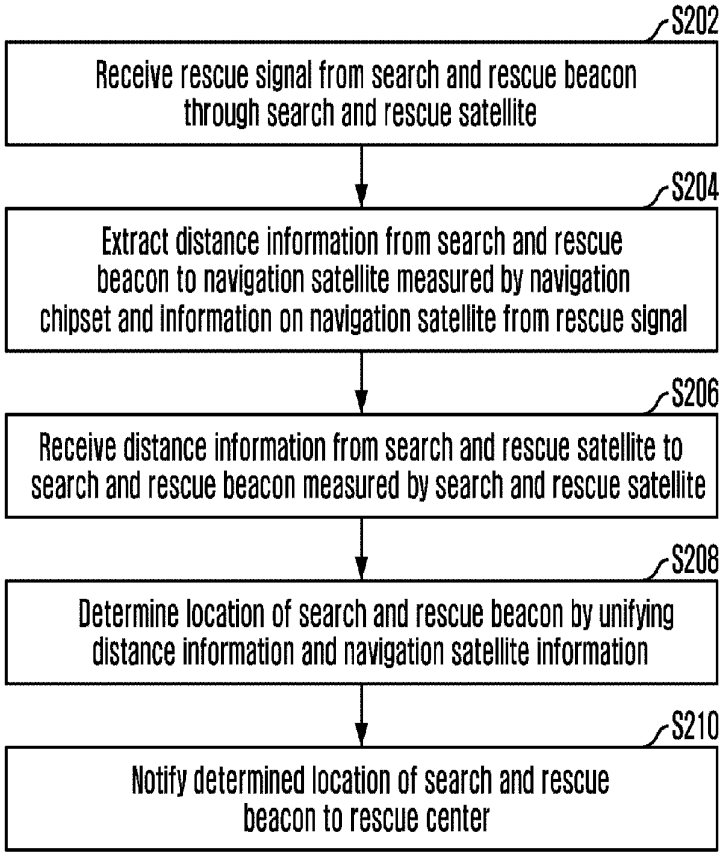
receiving distance information from the search and rescue satellite to the search and rescue beacon measured by the search and rescue satellite; and

determining a location of the search and rescue beacon by unifying the distance information and the navigation satellite information when the number of available navigation satellites are less than 4.

[Fig. 1]


120
130
150
140
Rescue center
154
152
156
110
112
Communication unit
114
Rescue signal message process unit
116
Survivor locating unit
100
102
Communication unit
104
Navigation chipset
106
Navigation signal process unit
108
Search and rescue message process unit

[Fig. 2]


S202
Receive rescue signal from search and rescue beacon through search and rescue satellite
S204
Extract distance information from search and rescue beacon to navigation satellite measured by navigation chipset and information on navigation satellite from rescue signal
S206
Receive distance information from search and rescue satellite to search and rescue beacon measured by search and rescue satellite
S208
Determine location of search and rescue beacon by unifying distance information and navigation satellite information
S210
Notify determined location of search and rescue beacon to rescue center