

# **Design and Implementation of Search and Rescue System Using Power PC Target**

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**ABSTRACT:** This documentation explains Design and Implementation of Search and Rescue System Using Power PC Target. This documentation helps the Search and Rescue team to find out ship or aircraft or individual in distress situation. The system provides design for transmitter and receiver used in the Search and Rescue System. Whenever lives are at risk emergency beacons are activated and these beacons have in-built Global Positioning System that provides precise location coordinates. These emergency signals tracked by the satellites are retransmitted to worldwide ground stations called LUTs. Then these signals are routed to MCCs which operates the LUT. The routed alerts include latitude, longitude, beacon ID, beacon name and time. These data Sends to RCCs and Rescue Team save the person or aircraft or individual who are in dangerous situation.

**KEYWORDS:** ELT, PLB, LUT, MCC, RCCs.

## **I. INTRODUCTION**

Search and Rescue System transmits and detects the signals of emergency beacons or personal locating beacons carried out by aircrafts or ships or individuals. Search and rescue system accumulates the people who are in emergency condition such as anyone who has fallen from ship, or from an aircrafts and is in the need of help. Forces or the citizens are both at risk of falling from aircraft or ships. Falling from ships and aircraft can be very hazardous, and these people such as forces, citizen's needs to be save fast and competently. According to the US explore and save mission power, the person who has fallen from ship in sea water which is less than sixty degrees Fahrenheit, person can become insensible or even expire within one hour. Between 1980 and 2002, in the navy about thousand mariners fallen from ships and among which 133 of which did not stay alive. In the marketable fishing division, falling from ships reported for 46% of fishing sufferers between the years 2000 to 2009. Presently, the most excellent way is the person who has fallen from ship or aircraft is to accumulate through a search and rescue team and to take care for the injured person. The objective of this project is to accumulate the people timely and rapidly from the disaster condition or any emergency situation whose lives are at risk.

A search and rescue systems originated from Canada, France and United State of America. Search and rescue system begins when the people falls from ship or aircrafts and there are usually four outcomes: first one is - the person is effectively institute living and is then saved; second one is person is initiate lifeless; third one is the person is never initiate, and last one is search should be stop after trying all other options. In May of 2003, person fell from ship from a Navy semi aquatic attack then the team members immediately throw him a float coat and coat provided was warm and resilience to stay afloat, and the team got a alerted signals of a man who has fallen in water, A rescue boat was appeared there that to within 5 minutes, and a rescue helicopter had taken off within 10 minutes. But regrettably, five minutes it took to arrange a rescue team, the mariner had disappeared. After continuous nine hours of searching, it became too mysterious and the search and rescue team returned to the ship and aircraft. One particular goal of this project is without delaying and within a fraction of seconds to reach the people who are in emergency or dangerous

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condition and rescue them from imminent conditions.

In March of 2007, the people who fell from a ship US aircraft delivery service into the Atlantic. The team members were alerted of the emergency conditions, that the people were fallen from the ship and an immediately rescue helicopter team was dispatched. The people were found and saved within an hour. The main goal of this project is to design emergency locating beacon and SAR receiver which is nothing but local user terminal so that whenever the people lives are at risk or in emergency condition or dangerous situation these emergency locating transmitter generates the signal these signals were tracked by antenna and as soon as getting the signals these signals are transfer to local user terminals these are nothing but ground station these ground station send these signal alerts to message control center and the message control center program the location of the person who is in emergency and send alerts to nearby rescue team and save the person.

- Locate the person,
- Send a rescue team to the person,
- Return the rescue team to the ship once it has acquired the person, and
- Complete all of the above objectives.

There are many search and rescue systems that is conceded out by several authorized organizations. Currently there are many diverse schemes to search and rescue people such as image, perceptible and electronic which are used by the individual(s) in anguish on aircrafts, vessels and on earth. Mirrors, flares and global signal flags are included by some of the visual methods. Whistles and horns are included by the audible methods. Message via sophisticated means of communication as well as via crisis beacons of an enthusiastic SAR system are included in electronic methods. These are the some of the methods which has been used by diverse organizations to hunt and accumulate the people who are in emergency conditions or inaccessible area such as mountains, deserts, forest and oceanic and their lives are at risk. In Search and Rescue System As explained in an earlier paradigm, even a delay of only five minutes can be the difference between life and death of the people who are in emergency condition. So that we have designed the transmitter which have in built global positioning system receivers, with airplane navigation scheme these beacons are interfaced and can give alerts, place, beacon name and beacons id in about 2 minutes with location accuracy of up to 100 meters through the geostationary satellite. All these can be done within few minutes and the people who are in emergency condition or dangerous situation can save as soon as possible without any delays efficiently without harming their lives.

## II. OVERVIEW OF SYSTEM



Fig.1: Over view of the SAR system

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### A. BEACONS

Usually 3 categories of beacons are there:

1. ELTs. (Emergency Locator Transmitter)

ELTs beacons are the first beacons developed and are mainly used in aircrafts. ELTs beacons use the frequency of 121.5 MHz to send the alert signals. These ELTs can usually be activated either manually or involuntarily

2. EPIRBs. (Emergency Positioning Indicating Radio Beacons)

EPIRBs beacons are mainly developed for the marine application. The location accuracy of EPIRBs is 15 Kms and use the frequency of 243.0 MHz these beacons can be activated either manually or involuntarily.

3. PLBs. (Personal Locator Beacons)

PLBs are mainly developed for the individual person instead of the aircraft or the marine. PLBs continuously repeat the message at the rate of 50 seconds. The memorandum contains in series about the place of origin to which the beacon belongs, which type of the beacon is used whether ELT, EPIRB or a PLB, beacon Id, etiquette of the beacon to identify it is a test beacon or real one and beacon location value with built-in GPS receivers. These beacons can only manually activate.

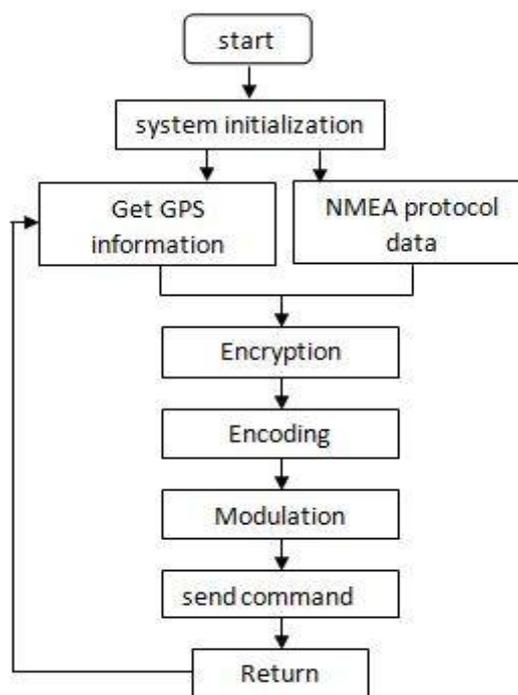


Fig.2: Algorithm for ELT/PLB

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## B. SEARCH AND RESCUE SATELLITES

Search and rescue satellites are mainly used to detect and transmit signals generated by the emergency beacon carried out by the aircrafts, ships and individuals. Search and Rescue satellites idea was originated from weather satellite. There are mainly two types of search and rescue satellites.

### 1. LEOSAR Satellite (Low –Earth Orbiting Search and Rescue Satellite)

The main goal of the LEOSAR satellites<sup>3</sup> are to detect and transmits the signals generated by the emergency

beacons of 406 MHz frequency to worldwide ground stations known as local user terminals. LEOSAR satellites include National Oceanic and Atmospheric Administration Polar Orbiting Environmental Satellites (POES), European Space Agency Polar Orbiting Meteorological Satellite. These satellites are at an altitude of 528 miles. These satellites every 100 minutes completes there orbit which are 99 degrees inclined from the equator.

### 2. GEOSAR Satellites (Geostationary Search and Rescue Satellite)

To view large areas of the earth GEOSAR satellites are used. Which provides the quick signal detection and transmission compared to low earth orbiting search and rescue satellites includes ISRO (Indian Space Research Organization) Indian National Satellite, European Space Agency Metosat Second Generation satellites. GEOSAR satellites are responsible for increasing the chance of life saving.

## C. LOCAL USER TERMINALS (LUT)

Local user terminals are satellite receiving unit's ground stations which receives the emergency alerts generated by the beacons. There are mainly two types of Local User Terminals in the search and rescue Systems.

### 1. LEOLUT (Low Earth Orbiting LUTs).

Those which are premeditated to function with the LEOSAR satellite group are referred to as LEOLUTs, and LEOLUT operators are estimated to offer the SAR group of people a consistent aware and place data, without limitation on utilize and sharing. These are mainly designed to track the low earth orbit. The low earth orbit local user terminals consists of the tracking enabled antenna, processor and communication equipment's.

### 2. GEOLUTs (Geostationary LUTs).

Those which are premeditated to function with the geostationary search and rescue system satellite group are called as the GEOLUTs. And LEOLUT operators are estimated to offer the Search and rescue system group of people a consistent aware and place information, lacking limitation on utilize and sharing. geostationary search and rescue systems receives the distress signals detected by them. This operation takes fraction of seconds when emergency beacons are activated.

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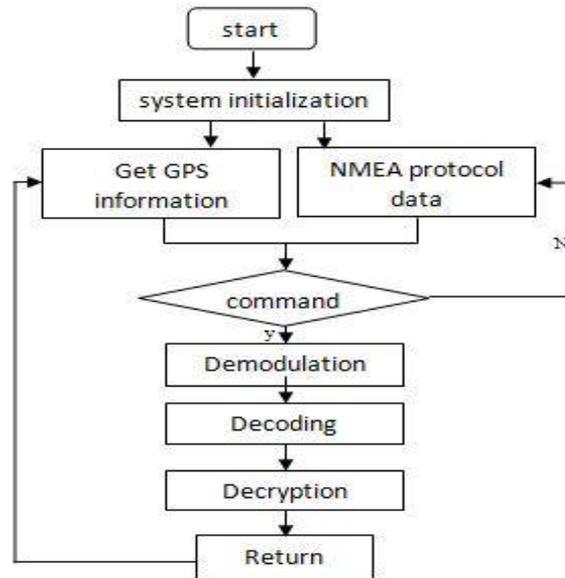


Fig.3: Algorithm for SAR receiver or (LUT)

### D. MISSION CONTROL CENTERS (MCC)

Mission control centers are situated in many countries with at least one local user terminal or ground station. Mission control center mainly developed to collect the data from local user terminals in our project mission control center collects the data such as beacon name, beacon Id, precise location coordinates and store this data and based on this data collection send alerts to the nearby rescue team to save the person who is in emergency condition. The main function of the system is to keep the search and rescue system working efficiently and to grant the participants with precise and appropriate aware information. Mission control center consists of the beacon locations, existing states of the space and earth segments and synchronization posts necessary to function search and rescue system. Most of the Mission Control Centers in the system are interrelated throughout suitable networks to share the system information and awareness information. To distribute the information to the nearby rescue teams the mission control centers uses the Telephone, TCP(Transmit control protocol), Fax, X.25, AFTN (Automatic Fixed Telecommunication Network and secure), FTP(File transfer protocol) over VPN communication links.

### E. RESCUE COORDINATION CENTER

The primary search and rescue facility is the rescue coordination centers which are mainly responsible for coordinating and controlling the SAR operation. These centers are mainly developed for all major maritime and aviation search and rescue operation. These centers work 365 days a year, 7 days a week, 24 hours a day. These centers are well trained in both maritime and aviation search and rescue operation. These centers secondary services are: Health checks suggestion and support to mariners, Maritime support tune-up, Ship safety attentive scheme, Marine mishap coverage, Aviation mishap coverage, Blast and safety alerts on aircraft, Alerts of tsunami.

**III. RESULTS**

```

vsim275
Physical Top Address: 0x12000000 Physical Size: 0x02000000 (32Mb)
Loading
0x100000 + 0x14904 + (0x17d74)
Loading symbol table from host:C:/Users/Cabs/Desktop/data/prj/default/vxWorks.symb
...done

Development System
VsWorks 6.7
KERNEL: WIND version 2.12
Copyright Wind River Systems, Inc., 1984-2008

CPU: Windows 6.1 Processor #275
Memory Size: 0x1f000000, BSP version 2.0/3.
Created: Mar 19 2016 11:11:22
EMR Policy Mode: Deployed
WDB Conn Type: WDB_CONN_PIPE
WDB: Ready.

*****Data Processing at transmitter side*****
Enter the string->
str_len=5
str_size_req=40
***** ENCRYPTION PART *****
Enter the key string
Encrypted value=JGNHQ
***** ENCODING PART OF ENCRYPTED VALUE *****
char : J ascii :74 01010010
char : G ascii :71 11100010
char : N ascii :78 01110010
char : N ascii :78 01110010
char : Q ascii :81 10001010
binary_string : 0101001011100010011100100111001010001010
Encoded_string : 0100101001000111010011100100111001010001

***** BFSK MODULATION *****
Binary information at transmitter
-1 1 -1 -1 1 -1 1 -1 1
-1 -1 -1 1 1 -1 -1 1 -1 1
-1 -1 1 -1 -1 1 -1 -1 -1 1
-1 -1 1 -1 -1 1

*****Data Processing at Receiver Side*****
***** BFSK DEMODULATION *****
Binary information at receiver
-1 1 -1 -1 1 -1 1 -1 1
-1 -1 -1 1 1 -1 -1 1 -1 1
-1 1 -1 1 -1 1 -1 -1 1 -1 1
-1 -1 1 -1 -1 1

***** DECODING *****
Decoded value=JGNHQ
***** DECRYPTION *****
Decrypted value=hello
  
```

Fig.4: Data Processing at Transmitter (Beacon)

The above figure represents the data processing at transmitter side which include the NMEA protocol data encryption, encoding and binary frequency shift keying modulation on VxWorks real time operating system.

```

vsim275
*****Data Processing at transmitter side*****
Enter the string->
str_len=5
str_size_req=40
***** ENCRYPTION PART *****
Enter the key string
Encrypted value=JGNHQ
***** ENCODING PART OF ENCRYPTED VALUE *****
char : J ascii :74 01010010
char : G ascii :71 11100010
char : N ascii :78 01110010
char : N ascii :78 01110010
char : Q ascii :81 10001010
binary_string : 0101001011100010011100100111001010001010
Encoded_string : 0100101001000111010011100100111001010001

***** BFSK MODULATION *****
Binary information at transmitter
-1 1 -1 -1 1 -1 1 -1 1
-1 -1 -1 1 1 -1 -1 1 -1 1
-1 1 -1 -1 1 -1 -1 1 1 1
-1 -1 1 -1 -1 1
  
```

Fig.5: Data Processing at receiver side(LUT).

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The above figure represents the data processing at receiver side which is nothing but local user terminals where decryption, decoding and binary frequency shift keying demodulation is done.

## IV. CONCLUSION

Design and Implementation of Search and Rescue Systems Using PowerPC Target is based on GPS search and rescue system. It has proved very successful in assisting the search and rescue organizations worldwide by providing reliable and timely alerts and location data of the person(s) in distress. The 406 MHz beacons which have an in built GPS receivers, or interfaced with the aircraft navigation system can provide alerts, location, and a beacons serial number in about 2 minutes from the GEOSAR satellite with location accuracy of up to 100 meters. This almost eliminates the search function from the search and rescue operation. A person who is in distress at sea and has a survival 406 MHz EPIRB with built-in GPS receiver with him could be located even in a severe drift at sea, as the beacon transmits its position data every twenty minutes. Similarly, alert, location and identification information of any person in distress on land could be provided reliably and timely to the relevant rescue coordination center (RCC) in minutes of occurrence of distress in most of the cases.

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