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RESEARCH ARTICLE

Designing a Web Based Module for SAR to Ensure Data Security Using JAVA

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Abstract: "Save our souls" is the phrase often uttered by the people who are in distress, whether they are in a sinking ship or in an Aircraft which is about to crash etc. In order to save them, a Satellite Aided Search and Rescue system was founded. This system works under the collaboration of many Nations. It plays a vital role in Search and Rescue operations universally. This Satellite Aided Search and Rescue system is named as the COSPAS/SARSAT contributing to the nations, which founded it. The main objective of this system is to support all organizations worldwide with responsibility for Search and Rescue Operations, whether at sea, air or on land. The COSPAS/SARSAT is a successful operational system designed to detect and locate distress locations with the help of radio beacons, (These signals are received by the Low Polar Orbiting satellites and relays a signal either at 121.5 MHz or 406.025 MHz). These signals are received by the Low Polar Orbiting satellites and down linked to the ground stations (LUT's & MCC's) where the signal is processed, providing the distress location.

My project involves designing a website for SATELLITE AIDED SEARCH AND RESCUE SYSTEM PROVIDED MY INDIAN MISSION CONTROL CENTRE, ISTRAC BANGALORE. This project gives very detailed information about Satellite Aided Search And Rescue System. Which includes the information about- working of the system, the system principle, LEOSAR and GEOSAR satellites which are used by the system, the Indian contribution to the search and rescue system, information about beacons and there types, INMCC's response to real distress calls and facility for Online Beacon Registration and links to the INMCC Current Status.

1. INTRODUCTION

Satellite Aided Search and Rescue (SASR) has evolved over the years with an objective to provide unambiguous and precise location along with other relevant information about objects in distress in real time to ensure that rescue forces can plan and carry out successful rescue operations. Fortunately, COSPAS-SARSAT, a space-based Search and Rescue (SAR) system, is listening for emergency signals from an aircraft, ship or person in trouble. Once COSPAS-SARSAT hears a signal on an emergency frequency, it is able to rapidly locate the source of the signal and to transmit the location to SAR personnel. COSPAS-SARSAT has been able to drastically reduce the amount of time required to locate people in distress. When teamed up with well-trained SAR personnel, this has resulted in many people being saved who otherwise may have died.

The COSPAS-SARSAT system detects the signals from emergency radio beacons. There are three kinds of emergency radio beacons, classified by who uses them. Aircraft use Emergency Locator Transmitters (ELTs); ships use Emergency Position Indicating Radio Beacons (EPIRBs); and Personal Locator Beacons (PLBs) are used by people taking part in land activities such as hiking, camping or canoeing in the wilderness.

The first generation of beacons, mostly ELTs, transmit on 121.5 MHz. Their signals can be received by aircraft and by COSPAS-SARSAT satellites. The beacons can be located by a suitable homer and by COSPAS-SARSAT satellites. The second generation of radio beacons, developed to be more readily detected by satellites, transmit on 406 MHz. Codes transmitted by these beacons can include identification of the beacon, vehicle and its country of registration. The origin of the signal can be located within a radius of two kilometers world-wide. All these features make it much easier for Search and Rescue forces to respond to distress signals and to react quickly.

The location of the received beacon is determined by Doppler frequency analysis performed in the ground stations. The Doppler shift is caused by the relative motion of the satellite as it orbits with respect to the stationary beacon on the earth's surface. The satellite relays these distress signals to a ground station known as a Local User Terminal (LUT) where the origin of the distress call is calculated. The ground station then relays this information to a Mission Control Centre (MCC) which alerts the SAR resource.

All these services is provided in ISRO with the help of email. This is a time consuming process. In case anyone wants to own a beacon, he has to send a mail to the association. After it is approved by the department, they give the response. So in order to make the process faster and easier, we have developed an online registration system. Now all that to be done is to fill an online form and submit. This will automatically get stored in the database. And by doing so it makes the count reliable and easy to keep the record on the data.

2. Objectives

INMCC supports 24/7 operations providing the SAR services to user communicating in India and its neighbourhood. The majority of user community belongs aviation and maritime industries, and the SAR services are supported by Indian Coast Guard, Airport authority of India, defence services and regulated by Directorate General of shipping (DGSP) and Directorate general of Civil Aviation (DGCA).

The objective of Mission Control Center (MCC) is to search and rescue people or ships/aircrafts in distress situations. This process is performed with the help of a device called

Beacon. The Beacon is a transmitter, which emits distinct distress signals when activated either manually or automatically in case of a disaster.

CORPAS SARSAT orbiting satellites detect these distress signals from ship/aircraft. These signals are relayed to the Local User Terminals (LUTs) located at Bangalore and Lucknow. Indian Mission Control Center (INMCC) receives data from LUTs and after processing at INMCC, the location of the Beacon can be found using a principle known as Doppler Shift. Alert messages along with the location data are sent to appropriate Rescue Coordination Centers (RCCs), Search and Rescue Point Of Contact (SPOCs) or to Mission Control Centers (MCCs)

In order to provide direct and easy access to distress alerts and related information, it is proposed to make the relevant data available to users online through Internet. This will provide wider outreach to all related agencies at the same time almost in real time saving a lot of precious time for saving human lives, and will also integrate latest data like aircraft and ship registration info from other agencies, which are very useful for successful SAR operations. In case of false alarms, the information from various agencies could be shared immediately before an expensive and risky SAR mission is undertaken/ launched.

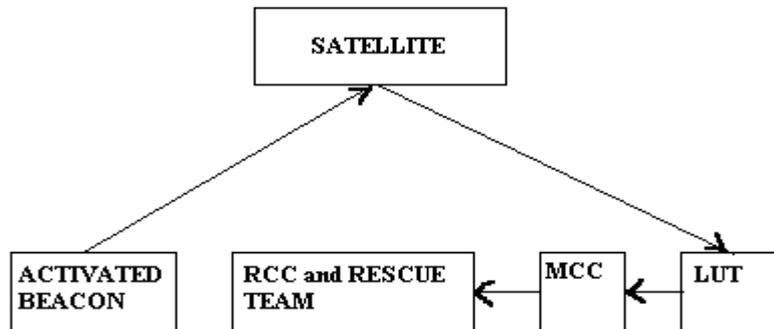
Proposed INMCC Enhancements:

For access of SAR data and information online through Internet, software development has to be under taken ensuring data security. To meet these requirements following software development and management proposed:

1. Formatting each alert in a format with minimum required data, which could be easily understood by users and SAR authorities, additional data can be provided as an option.
2. To provide a global email id, which can be used by anyone to share known information regarding the alert/vessel/aircraft/owner etc. This email can be accessed by all relevant SAR agencies, and then update the alert status online.
3. Online registration of beacons which are detected by the system but not registered in the INMCC database directly through the users or from the available information gathered during the alert follow-up.
4. To create SQL queries for access by users based on specific requirements (daily, monthly, annual reports, beacon test report, real/false/undermined alerts etc.)
5. Propose a software maintenance procedure to maintain SQL database in terms of trouble shooting, system recovery from any problem, reinstallation if system crashes, data backup/archival and retrieval
6. To provide system availability status (LUTS, INMCC), directory of important contact numbers, links to related websites, history of SAR missions supported by the system, important mile stones etc.
7. A software security system to ensure data and system security while providing Internet interface to users, and from virus attack and hacking
8. Network and database configuration maintenance
9. Periodic software maintenance requirements
10. To provide access to alert messages as per RCC/MRCC service areas (Area of responsibility).

3. Working of the system

Fig 3.1: Working of SASR



Satellite Aided Search and Rescue (SASR) has evolved over the years with an objective to provide unambiguous and precise location along with other relevant information about objects in distress in real time to ensure that rescue forces can plan and carry out successful rescue operations. Fortunately, COSPAS-SARSAT, a space-based Search and Rescue (SAR) system, is listening for emergency signals from an aircraft, ship or person in trouble. Once COSPAS-SARSAT hears a signal on an emergency frequency, it is able to rapidly locate the source of the signal and to transmit the location to SAR personnel. COSPAS-SARSAT has been able to drastically reduce the amount of time required to locate people in distress. When teamed up with well-trained SAR personnel, this has resulted in many people being saved who otherwise may have died.

The satellite aided search and rescue is broadly divided into three parts:

- Beacon Segment
- Space Segment
- Ground Segment

i. Beacon Segment:

Beacon is the starting part of the rescue process. A Beacon or a radio Beacon is a buoyant, self-contained radio transmitter and when activated emits a repeated distant distress signal for a period not less than 24 hours.

Based on the type of user beacons are of three types:

- Emergency Locator Transmitter (ELT)
- Emergency Position Indicating Radio Beacon (EPIRB)
- Personal Locator Beacon (PLB)

The COSPAS-SARSAT system detects the signals from emergency radio beacons. There are three kinds of emergency radio beacons, classified by who uses them. Aircraft use

Emergency Locator Transmitters (ELTs); marine ships use Emergency Position Indicating Radio Beacons (EPIRBs); and Personal Locator Beacons (PLBs) are used by people taking part in land activities such as hiking, camping or canoeing in the wilderness. The first generations of beacons, mostly ELTs, transmit on 121.5 MHz

ii. Space Segment:

Their signals can be received by aircraft and by COSPAS-SARSAT satellites. The beacons can be located by a suitable homer and by COSPAS-SARSAT satellites. The second generation of radio beacons, developed to be more readily detected by satellites, transmit on 406 MHz Codes transmitted by these beacons can include identification of the beacon, vehicle and its country of registration. The origin of the signal can be located within a radius of two kilometers worldwide. All these features make it much easier for Search and Rescue forces to respond to distress signals and to react quickly.

iii. Ground Segment:

The location of the received beacon is determined by Doppler frequency analysis performed in the ground stations. The relative motion of the satellite causes the Doppler shift as it orbits with respect to the stationary beacon on the earth's surface. The satellite relays these distress signals to a ground station known as a Local User Terminal (LUT) where the origin of the distress call is calculated. The ground station then relays this information to a Mission Control Center (MCC), which alerts the SAR resource.

4. Proposed work

Online access is made available to users and SAR agencies so that more details on alert are provided. These details will help them to decide on the further course of action. The users need to log in through their ID provided by INMCC. Online access provides

- Beacon registration
- Beacon deregistration
- Beacon test request
- RCC/MRCC feedback
- Online search contact
- Add contact
- Real alert
- False alert
- daily report, monthly report and annual report.

For registering a beacon, you need to login to the website with the given id and password. Then fill the given form and submit it. The data of the form will be stored in the database. Thus the registration process will be accomplished.

To deregister the beacon, all that has to be done is to enter the beacon ID and deregister in the deregistration form. Thus the beacon will be deregistered from the database.

All the details regarding the alert will be available on the website. Thus by logging in to the website the users can access the information and thereby decide the further course of action. Users, SAR agencies are given specific email IDs and passwords through which they can login to the website. They have to login by entering their allocated ID and password.

After it is entered, it is checked in the login tables for authentication. If the email ID or password is incorrect, it will display an error message. If the authentication is successful then the required information on the alert is found out by contacting the respective person and checked if the alert is true. If it is a false error then the task is stopped. If true, the rescue mission will be initiated.

Step 1: open the website.

Step 2: Login through user ID and password

Step 3: authentication takes place and checked if the ID exists in the table.

Step 4: if the ID and password match then go to step 5 else display an error message.

Step 5: Get the Required information on alert.

Step 6: check if the alert is true

Step 7: if true, go to step 8 else stop the task.

Step 8: the rescue mission will be initiated.

Step 9: required help is done.

Once the user logs in to the website, he should be able to view the alert data statistics for false alerts, undetermined alerts, real alerts, beacon registration growth, Indian beacon detection statistics and foreign beacon detection statistics along with plots.

- False alerts have a negative impact on search and rescue resources worldwide. They tie up people and equipment/ resources that would otherwise be available to respond to a real distress call. The false alerts are costly to pursue and put search and rescue personnel/ crews at possible risk in adverse environments
 - I. Beacon mishandling: improper installation, testing, maintenance, disposal or shipping a beacon with a battery connected to it.
 - II. Beacon malfunction: faulty activation switch/ water ingress/ transmitting distress signal while in test mode/electronics malfunction etc...
 - III. Mountain failure: strap or bracket failure/ release mechanism failure/ faulty mounting magnet for externally mounted ELT, removing a beacon from its bracket without properly disarming it.
 - IV. Environmental conditions: extreme weather conditions may sometimes trigger beacon activation.
- Undetermined alerts: Sometimes the location of the beacon is unidentified, if location estimation is not done properly. After each pass is tracked, estimates are made for the real and image locations of all 406 MHz beacons from which atleast three correct PDS data points are received. The locations are determined by an iterative gradient following weighted least squares procedure with deletion of outliers. Regional and global mode data from the same beacon event, received during the same satellite pass, is combined to produce a single solution.
- Real alerts: after authentication, the required information on the alert is found out by contacting the respective person and checked if the alert is true. If it is found to be true then it is a real alert.
- Beacon registration growth, Indian beacon detection statistics, foreign beacon detection
Statistics are displayed as plots.

Follow-up procedure for Indian Vessels/Aircraft

- Soon after detection before sending to RCC first try to establish the identity of the Indian beacons.
- Verify with available database at INMCC. If the beacon is registered with INMCC, the owner name and contact details are automatically appended to the RCC messages.
- If not in database, send fax to DG shipping and then talk over the phone to concerned officer.
- Once owner is known, talk to the owner and find out whether it is real distress or false alarm.
- After knowing the owner and status of alert (real or false), advice concerned RCC accordingly.
- For each detection regular RCC/SPOC message will be transmitted automatically.
- Additional follow-up with RCCs must start at INMCC end when we know about owner and other related details regarding the distress.
- For alerts on sea, the follow up may be initiated with concerned regional coast guard headquarters.
- For alert on land, it can be followed up with concerned RCC operated by Airport Authorities of India at \$ metro airports (Mumbai, Chennai, Delhi and Calcutta)
- If the signal stops coming in the next expected passes, before initiating search, RCCs may follow up with other available sources to ensure about the distress.
- Once feedback is known on the alert, and if it happened to be false, advice RCC/SPOC/Coast guard immediately that alert is false and no action is required.
- As long as alert is single located or unlocated by GEO, do the above follow up and do not initiate any additional follow up with RCC/SPOC/Coast guard until location is confirmed.
- Do not send any extra messages to any agency, which is not defined, in the INMCC follow up procedures.

Importance of the Proposed Work

- Speed (timely distribution of alert data);
- Reliability (distribution of alert data and System information in the event of failure of LUTs or MCCs);
- Accuracy (correctness of information delivered);
- Efficiency (economic and smooth flow of data); and
- Accountability (tracking of messages in the Ground Segment).

5. METHODOLOGY

SYSTEM ENVIRONMENT:

The software used here is MYSQL for database. All the data provided by the user will be stored in the database. JDK (JAVA development kit) is used for developing the application. JAVA is used since it is platform independent and also for data security since it is a language to develop web based application.

The tools used are Eclipse and Tomcat. Eclipse is a developmental tool used in developing applications. Tomcat is used to run the application so that it is available on the net. It is used for hosting the application.

➤ **Feature of HTML**

To publish information for global distribution, one needs a universally understood language, a kind of publishing mother tongue that all computers may potentially understand. The publishing language used by the World Wide Web is HTML (Hyper Text Markup Language). HTML gives authors the means to publish online documents with headings, text, tables, lists, photos, etc. Retrieve online information via hypertext links, at the click of a button Design forms for conducting transactions with remote services, for use in searching for information, making reservations, ordering products etc. Include spread - sheets, video clips, sound clips, and other applications directly in their documents

➤ **Features of JAVASCRIPT:**

JavaScript is a scripting language developed jointly by Sun and Netscape and is meant for the WWW. A scripting language is a simple programming language designed to enable programmers to write useful programs quickly. A script is similar to a macro, which tells a program how to perform a specific procedure.

JavaScript Facts:

- JavaScript Is Embedded Into HTML
- JavaScript Is Browser Dependent
- JavaScript Is an Interpreted Language
- JavaScript Is a Loosely Typed Language
- JavaScript Is an Object-Based Language:
- JavaScript Is Event-Driven
- JavaScript Is Not Java
- JavaScript Is Multifunctional:

JavaScript can be used to

- Enhance HTML pages
 - Develop client side applications
 - Build to a certain extent client/server Web applications
 - Create extensions to a Web server.
 - Provide database connectivity without using CGI.
- JavaScript Is Evolving:

➤ **JAVA Database Connectivity (JDBC)**

JDBC is a Java API for executing SQL statements. (JDBC is a trademarked name and is not an acronym; nevertheless, JDBC is often thought of as understanding for "Java Database Connectivity".) It consists of a set of classes and interfaces written in the Java programming language. JDBC provides a standard API for tool/database developers and makes it possible to write database applications using a pure Java API.

Using JDBC, it is easy to send SQL statements to virtually any relational database. In other words, with the JDBC API, it is not necessary to write one program to access a Sybase database, another program to access a Oracle database, another program to access a Informix database, and so on... One can write a single program using the JDBC API, and the program will be able to send SQL statements to the appropriate database. And

with in an application written in Java programming language, one also doesn't have to worry about writing different applications to run on different platforms. The combination of Java and JDBC lets a programmer to write it once run it anywhere.

The operations are conducted manually in the existing system including the RCC feedbacks, uploading the daily report, sending the monthly report and maintaining the contact directories.

- Daily/Monthly report generated and sent via mail.
 - RCC feedback received from mail.
 - Contact details are maintained in the system.
- For these manual operations lot of time is consumed as well as memory.

➤ **System Requirements Specifications**

Software Requirements

Operating System	:	Windows XP or Linux
User Interface	:	HTML, CSS
Client-side Scripting	:	JavaScript
Programming Language	:	Java
Web Applications	:	JDBC, Servlets, JDK
IDE/Workbench	:	Eclipse with My Eclipse Plug-in
Database	:	MYSQL

Hardware Requirements

Processor	:	Pentium IV
Hard Disk	:	120GB
RAM	:	1GB

6. CONCLUSION

The purpose of the online System is to provide distress alert and location data for Search and Rescue (SAR) by using spacecraft and ground facilities to detect and locate distress signals. The computed position of the distress and other related information is transmitted to appropriate SAR authorities. The Cospas-Sarsat Ground Segment consists of LUTs and MCCs, is an important link in the rescue effort. The advantages of the online application are

- Speed (reduces time consumption);
- Reliability (data is reliable);
- Accuracy (correctness of information delivered);
- Efficiency (economic and smooth flow of data) ;
- Accountability (tracking of messages in the Ground Segment)
- Robust and secure.

- Easier for both ends.

The front ends for different modules are created using JAVA for the different applications of INMCC. The back ends are created using MYSQL. The connection between the front end and the back end done using JDBC.

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