

Submarine Navigation and Disaster Management System Using WSN

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ABSTRACT- *The application can be widely used by people on the edge to find the right route to reach the destination. In this mechanism, we have put in place an integrated system to save the lives of fishermen and avoid problems between two countries, so establish good relations between them. Therefore, this project provides border alerts for the fisherman at sea. The system alerts when the fisherman is about to reach the limit of other countries border through wireless sensor network. An emergency switch is placed on the ship while a disaster, by pressing this button an emergency message is sent to the nearest boatmen and to the base station with the current location of the boat for help. The boundary area is divided into three zones, boundary1, boundary2, and boundary3. Selecting three different boundary locations. When fishermen boat reaches any of the boundary lines a caution message is shown in an LCD display and SMS is also sent to the base station via GSM.*

Key Words: Renesas microcontroller, GPS (Global Positioning System), GSM (Global Service for Mobile Communication), Emergency switch, RFID, Buzzer, Android application, RF Transmitter and RF receiver.

1. OBJECTIVE

The goal of this project is to guide fishermen and guards armed with the due navigation and they also block the way misleading. In this system GPS used to navigate the ships and provide the location where the ship is exactly in the extended ocean, this system also give the weather alerts based on physical parameter of maritime.

2. INTRODUCTION

Unlike on land, visually distinguishing the border of a country at sea is impossible. We have seen many cases wherein the fishermen are found “trespassing” into other country’s border and as a result are jailed. Unfortunately, these fishermen fail to realize they are in the other country’s border and thus get caught.

This is one of the most tragic phenomenon’s seen (for example: between India and Srilanka & India and Pakistan). As of today, there is no system available (that is affordable and portable) for the fishermen that can help him in alerting him if he is venturing out of the country’s border at sea.

Thus this project has been proposed which gives audio alert to fisher man when he tries to cross boundaries unknowingly and fisher man can send signals when he is at risk, the GPS location is sent to base station via GSM and sudden weather change information is sent to fisher man so that he can come back to shore immediately and fisher man will be provided with RFID tags so that system can acknowledge which fisher man is out at sea.

3. TECHNOLOGY USED

3.1 WIRELESS SENSOR NETWORK

It refers to a group of spatially dispersed sensors dedicated to monitoring and recording physical conditions. Wireless sensors measure environmental conditions such as temperature, sound, humidity, wind, and so on.

3.2 MOBILE COMUNICATION

It is a form of technology-mediated communication that allows the user of a mobile device to communicate with someone in a different place. The range of services of the health system covers urban, rural and mountainous areas, wireless communication technologies become an important guarantee of the construction and operation of the system.

3.3 SATTELITE COMMUNICATION

It is an artificial satellite that relay and amplifies radio signals. It creates a communication channel b/w source transmitter and receiver at the different location on earth.

4. DESIGN OVERVIEW

A block diagram is the overall blue print of the proposed project. The essence and total operation of the project are represented in three simple functional diagrams which represent the pictorial representation of the work function of a project. The block diagram consists of the following components.

- Renesas Microcontroller
- RF transmitter and receiver
- RFID Reader

- GSM Module
- GPS Module
- LCD
- Piezo Buzzer
- Emergency switch



Fig -1: Block diagram of Border unit module

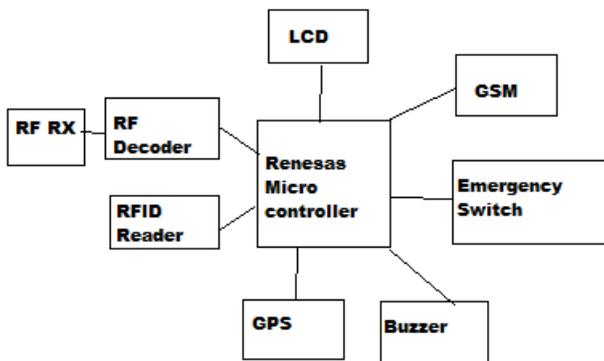


Fig -2: Block diagram of Ship unit module

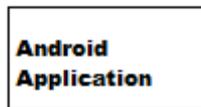


Fig -3: Block diagram of Base Station unit module

4.1 Microcontroller

Renesas RL78/G13 is a 16 bit Microcontroller and minimum instruction time can be changed from ultra-low speed to high speed. It is an 8051 family of microcontroller, with various in-built features. It incorporates processor registers, Control registers. The control registers control the program sequence, status and stack memory. The below figure shows the pin diagram of Renesas microcontroller.

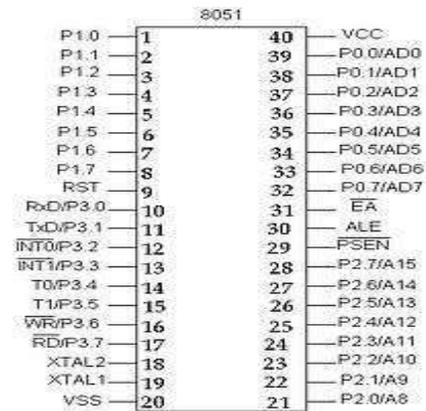


Fig -4: Renesas microcontroller pin diagram

4.2 RF Transmitter and Receivers

The RF module comprises of an RF Transmitter and an RF Receiver. The transmitter/receiver (Tx/Rx) pair operates at a frequency of 434 MHz, An RF transmitter receives serial data and transmits it wirelessly through RF antenna connected at pin4. The transmission occurs at the rate of 1Kbps - 10Kbps. The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter.

4.3 RFID Reader

An RFID reader is a device that is used to interrogate an RFID tag. The reader has an inbuilt antenna that emits radio wave. The tag responds by sends back its data. RFID technology does not require contact or line of sight for communication.

4.4 GSM Module

GSM is the acronym for Global System for Mobile Communications, originally Group Special Mobile, is a standard which was developed by the European Telecommunications Standards Institute (ETSI).Which describes a protocols for second-generation (2G), 3G and 4G digital cellular networks was used by mobile phones.

GSM supports voice calls and data transfer, also with the transmission of SMS (Short Message Service).GSM uses a time division multiple access (TDMA).It is the most widely used of the three digital wireless telephony technologies which is TDMA, GSM, and CDMA.

4.5 GPS Module

The Global Positioning System (GPS) is a space navigation system that provides location and time information in all weather conditions. The GPS detects the latitude and

longitude of the ship's position and sends the data to the microcontroller. This capability allows finding out whether the boat has crossed the restricted area or not. This gives the current position of the boat. It compares the current position and stored restricted position if the boat is at a distance of three kilometers from the restricted area and the processor to generate a message with the latitudes and longitudes received from the microcontroller and sent to the base station and buzzer is on till the boat stop.

4.6 LCD Display

It is an Alpha Numeric 16X2 LCD display. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data registers. The command register stores the instructions given to the LCD. A command is predefined instruction to perform task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed. The data is the ASCII code of the character to be displayed.



Fig-5: LCD Display

4.7 Piezo Buzzer

A buzzer can make sound on any frequencies, but we suggest that the highest and the most stable SPL come from the rated frequency. The sound output is measured by decibel meter. Applying rated voltage and square waves, and the distance of 10cm. A piezo buzzer is driven by square waves (V p-p) for normal operating.

4.8 Emergency Switch

An Emergency button is placed in a ship unit when the button pressed the buzzer on, an emergency message is sent to the base station with the current location of the boat for help.

5. PROJECT OUTCOME

Many embedded systems have substantially different designs according to their functions and utilities. This project is designed as three modules; they are ship unit module, Border unit module, and Base station module.

The ship unit module is mainly composed of a single microcontroller, LCD, GSM, RF receiver, RFID Reader, GPS, emergency switch, and buzzer. The microcontroller forms the control unit of the entire project. Embedded within the microcontroller, a program that helps the microcontroller to take action based on the inputs provided.

The fisher man out at the sea will be provided with RFID tag, as he enters to ship, information about person is sent to base station through GSM and if the ship about to reach or cross other country boundaries buzzer on and a caution message is displayed in LCD, also sent to base station, any emergency at sea is informed to base station using emergency switch, base station receives the GPS location of the ship and sudden change in the weather is intimated to fisher man from base station. Base station is represented by android application. The below figure represent the Ship unit module interface.

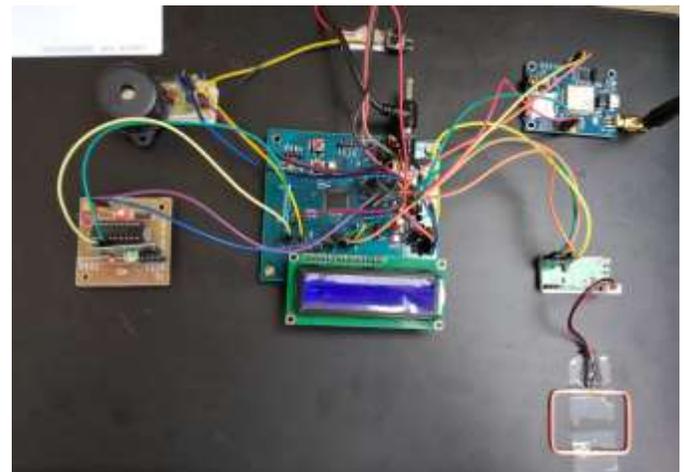


Fig 6: Ship Unit Module interface

The border unit module is mainly composed of an RF transmitter and three boundary locations are predefined. When the ship reaches the first boundary or second boundary, a voice alert and caution message are displayed in the LCD with a current location. Simultaneously through GSM, the fishermen details are sent to base station.

When the ship reaches the third boundary, a caution message is sent to the base station and buzzer sounds till the fishermen stop the boat. The below figure represent the border unit interface.



Fig 7: Border Unit Module interface



Fig 9: Base station main screen

Base station is represented by android application. In this application is log in with a valid username and password. On successful login, coastguard is registered with its ten digits mobile number. When the fisherman out at the sea will be provided with RFID tag, as he enters to ship information about person is sent to base station and if the ship about to reach or cross other country boundaries alert is obtained through GSM module, any emergency at sea is informed to base station using emergency switch, base station receives the GPS location of the ship and sudden change in the weather is intimated to fisherman from base station. Using Google map, the coastguard can fetch the navigation of the ship. The below figure represent the Base station unit interface.

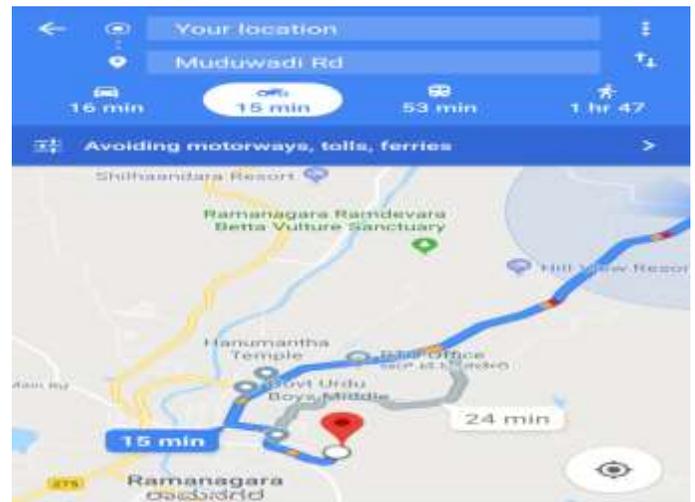


Fig 10: Navigation map



Fig 8: Base station login screen

6. PROJECT DESCRIPTION

The heart of project is microcontroller Renesas(RL78), the ship unit consist of RFID reader for fisher man identification, GPS to get location, GSM to send and receive emergency alerts, emergency switch to indicate risk situation, mp3 module to get alerts while boundary crossing and weather changes, RF transmitter to indicate boundaries. Android application referred as base station.

RF transmitter will be placed at other country boundary, RF receiver will be in ship unit, when the ship tries to enter the other boundaries alert will be given to fisherman through voice alert via ,mp3 module and fisher man information is sent to base station when he enters ship through RFID ,if any emergency occurs at the mid of sea ,it

is informed to base station using emergency switch, when emergency switch is pressed the present GPS location is fetched using GPS receiver and sent to base station and if any sudden changes in weather happens, it is informed to fisherman from base station through GSM module.

7. CONCLUSION

We had introduced the Submarine navigation and Disaster management system using WSN, controlled by Renesas microcontroller. It is an on-chip microcontroller which has the property of burning a program while running another program. It is reliable, flexible and of low cost.

The warning system we have developed will provide an effective solution to fishermen's problems and prevent them from crossing the border of another country. The app can save the lives of many fishermen. The application works as an automatic incident management application that informs the user if a border crossing is occurring.

If the sailor crosses the border the buzzer is on and the complete information of fisherman and alert message is given to base station.

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