

A WIRELESS MODE OF PROTECTED DEFENCE MECHANISM TO MARINERS USING GSM TECHNOLOGY

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Abstract - The aim of the project is to provide scrutiny for fisherman in order to keep their lives from disasters such as ice berg, Tsunami, Cyclones etc. Defence is a key factor to enable safe navigation in fishing in sea is observed for crossing neighbouring country's boundary. Hence an effective system is designed to overcome the threat with Global positioning system (GPS) which provides dynamic location of fishing vessel in water and microcontroller which competes on GPS and predefined border locations to detect whether the boat has crossed the border or not. If so the mariner is alerted and the message is transmitted to nearby coast guard ships through RF signals at VHF (30-300MHz) range which covers wide area. The information from the GPS receiver is given to the coastguard where the data's are verified and actions are taken accordingly to retrieve the boat from the peril.

Index Terms— Global Positioning System, MEMS sensor, Ultrasonic Sensor, GSM modem, PIC controller, RF module

I. INTRODUCTION

This project aims at another possible application of GPS which can aid small scale fishermen from accidentally crossing over into international waters. The heart of the system is a GPS receiver which is connected to a microcontroller unit and a display device which shows the fishermen their current position and the country they are in at any point in time. RFID (radio frequency identification) systems usually consist of a microchip, antenna, and it can store up to 2 kilobytes of data. A **GPS navigation device** is a

device that accurately calculates geographical location by receiving information from GPS satellites. Initially it was used by the United States military, but now most receivers are in automobiles. Additionally, an active tag uses the internal battery to broadcast the signal to a user, the broadcasted frequency in this case can reach 950 Hz and be read 31 meters away. If more batteries are added into the tag, the broadcasting will be boosted and the distance code not use an internal battery instead they relay completely on the reader that induces a current in the tag antenna by sending an electromagnetic wave. This type of tags has a decreased range of broadcasting comparing to that of active and semi active - only 13 meters- however it has longer useful life that goes up to 30 years or more and costs much less than an active or semi active tag since it does not contain any internal batteries. The one main criterion of MEMS is that there are at least some elements having some sort of mechanical functionality whether or not these elements can move. A wireless radio frequency (RF) transmitter and receiver can be easily made using HT12D Decoder, HT12E Encoder and ASK RF Module. Wireless transmission can be done by using 433MHz or 315MHz ASK RF Transmitter and Receiver modules.

II. PROBLEM STATEMENT

The objective is to implement a system of effective navigation where the ship has to reach the destination without any obstacle and deceive of pathway.

The learning objective was to obtain knowledge in the fields of electronics, robotics and communication and programming. In addition, it improved planning and organizing skills, critical thinking and analytical skills, research skills, team work and observation skills.

While implementing this project, some technical problems occurred due to inaccuracy and timing delay. Those problems were taken care of by changing the software coding which were dumped in the microcontroller.

III. BLOCK DIAGRAM

The block diagram consists of two sections. The first one is Boat section unit. This unit consists of the RF transmitter, Encoder and the battery. It is the transmitter section of the existing system. The second is the Border section. If there are any difficulties felt by the fishermen then the information is passes to the coastguard section.

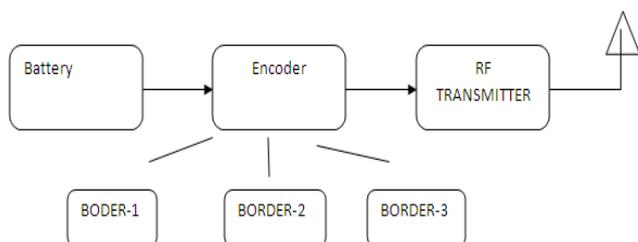


Fig 1: Block Diagram for Boat section

In microcontroller we have already programmed. When an ultrasonic wave reflected from any one objects, the received signal is given to microcontroller to display the corresponding distance of the object on the LCD display. At the same time microcontroller activates the alarm circuit and gives the buzzer to alert the fisherman from crossing the border of neighbouring country.

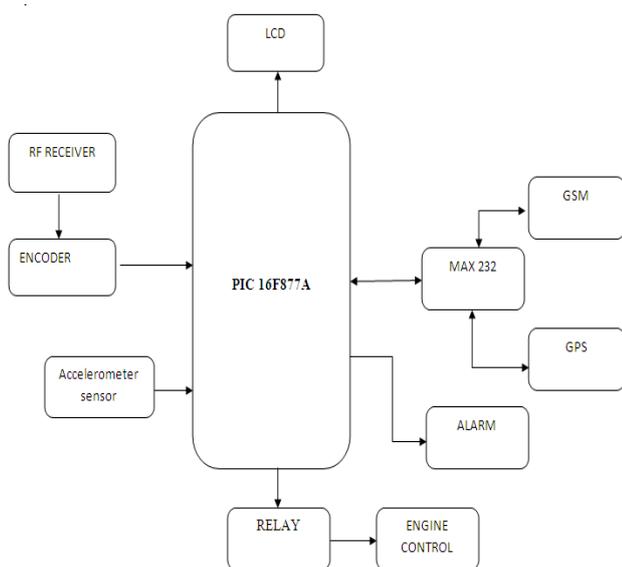


Fig 2: Block Diagram for Border section

The Border section consists of PIC micro controller, RF receiver, Relay, Max 232, GPS and GSM module. It has a LCD interface to display the alert and warning message. The border section is known as the Receiver block of the navigation system. The GPS is used to detect and locate the ship with its correct location. The latitude and longitude values are calculated correspondingly to determine the location. GSM modem is used to transmit the data to the border section. In addition to this, two sensors which are called Accelerometer sensors are being used in the receiver side. Ultrasonic sensor is used to measure the distance of the ship from the shore to border. Then the vibration sensor is used to detect any kind of disaster like Tsunami, hurricanes, cyclones etc.

RF module:

It is the useful and low cost element used to transmit the data over long distances. It uses RF signals for transmission of data. RF Communication works on the principle of Serial Communication. It converts the conventional n-bit (4-bit, 8-bit, 16-bit, etc) data into serial data. This serial data can be directly read in the RF Transmitter, which could perform ASK modulation on it and transfer the data through antenna whereas the receiver side has RF Receiver which is used to receive the modulated signal and performs all kinds of processing, filtering, demodulation, etc.

GPS Broadcast Signal:

GPS satellites broadcast three different types of data in the primary navigation signal. The first is the almanac which sends coarse time information along with status information about the satellites. The second is the ephemeris, which contains orbital information that allows the receiver to calculate the position of the satellite. This data is included in the 37,500 bit Navigation Message, which takes 12.5 minutes to send at 50 bps.

IV. CALCULATING POSITIONS

Microcontroller receives the data from the GPS receiver through UART. The Collected data has details of latitude and longitude. The latitude L1 is compared with default latitudes. If latitudes go with each other, those values are retrieved from memory.
 $diff_lat = lat (fixed) - lat (current)$
 $diff_long = long (fixed) - long (current)$

Where lat=latitude
 long=longitude

$R = \text{earth's radius (mean radius} = 6,371 \text{ km)}$
 $\text{diff_lat} = \text{lat}2 - \text{lat}1$
 $\text{diff_long} = \text{long}2 - \text{long}1$
 $a = \sin^2(\text{diff_lat}/2) + \cos(\text{lat}1) \cdot \cos(\text{lat}2) \cdot \sin^2(\text{diff_long}/2)$
 $c = 2 \cdot \text{atan}2((a)^{1/2}, (1-a)^{1/2})$ distance = $R \cdot c$

The current positions are compared with already stored latitude and longitude of country's boundary locations. Received values from GPS is stored at L1 (latitude), L2 (longitude).

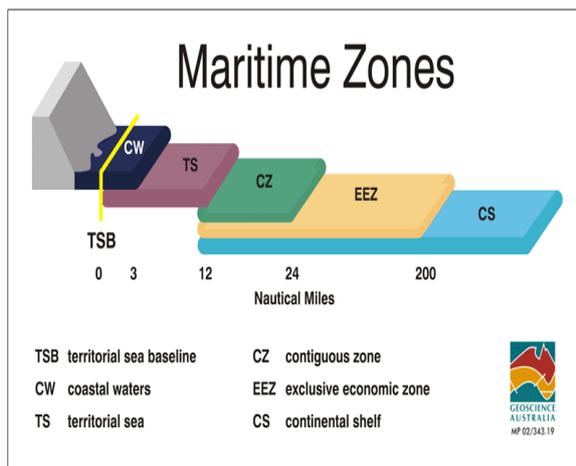


Table 1: Maritime Zones

The Maritime Zones are used to analyze the various border indications in the sea. It helps to drive towards the right path. On crossing the border, location is transmitted and viewed by LCD by coast guard.

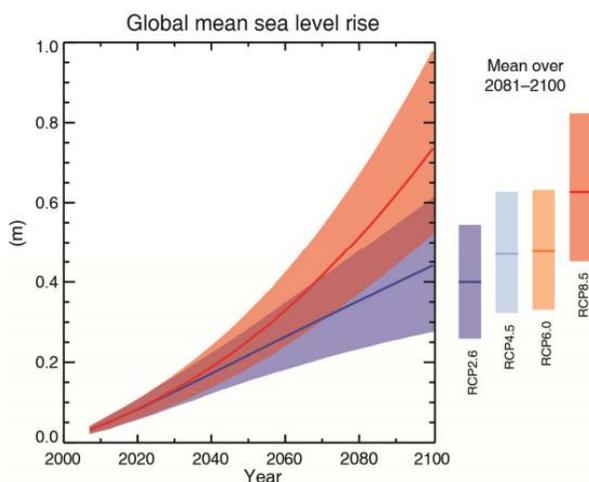


Fig 3: Graphical representation of Sea level Rise

The so-called greenhouse effect or global warming may cause a **Sea Level Rise**, which will have a great impact on the long-term coastal morphology. The possible and gradual **Sea Level Rise** will cause a

general shoreline retreat and an increased flooding risk and has to be handled according to the local conditions.

This Project has a great deal of recovering the Ship from hyper sea level Rise. Sea levels can be affected by many factors and are known to have varied greatly over geological time scales. The careful measurement of variations in mean sea levels can offer information about climate change and has been interpreted as evidence supporting the view that the current rise in sea level is an indicator of global warming. The sea level should be maintained at constant without any lead or lag so that the fisherman can reach the destination without any difficulty of waveguides. It enhances the navigation system thereby increasing level of convenience to mariners for the defence system.

Maritime boundary Issues:

Sri Lanka has exercised maritime jurisdiction over its ports and the adjoining sea, with regard to the access of ships to ports, long before the concept of territorial waters began to be operational in the International law arena. In 1702, during the Dutch colonial times, Sri Lanka maintained a three mile Territorial Sea which is within reach of cannon shot.

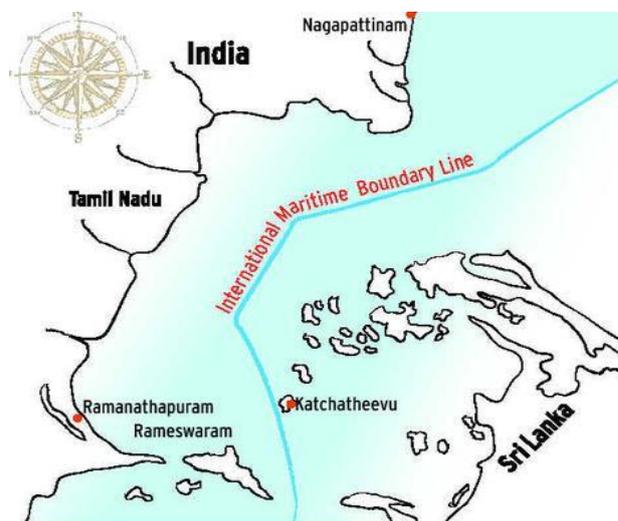


Fig 4: Maritime Boundary Line

The issues on the boundary between the two countries were in rhetoric for some time. On 04th September 1918 authorities of Madras proposed to the Government of India that the existing three mile limit of Indian territorial waters should be extended

to twelve miles for safeguarding their fisheries. The Madras authorities also suggested that the Gulf of Mannar and the Palk Strait should be declared mare clausum (Open Waters) and that the waters should be delimited between India and Sri Lanka.

The fishermen have to keep watch the maritime border, which cannot be easily separated as land region. If they crossed certain limit on the sea. They have to pay the penalty or got arrested by the naval guards of the neighbour country.

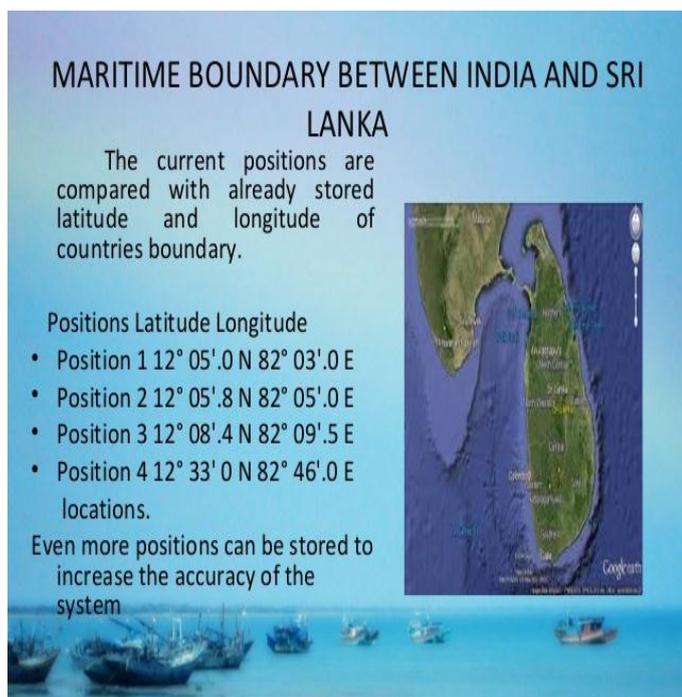


Fig 5: Boundary between India and Srilanka

V. HARDWARE REQUIREMENTS

- RF Module
- GSM
- GPS Transmitter & receiver
- Sensor
 - MEMS
 - Ultrasonic
- PIC Controller

PIC 16F877A MICROCONTROLLER:

Various microcontrollers offer different kinds of memories. EEPROM, EPROM, FLASH etc. are some of the memories of which FLASH is the most recently developed. PIC16F877 uses flash technology, so that the data can be retained even when the power is switched off.

MEMS SENSOR:

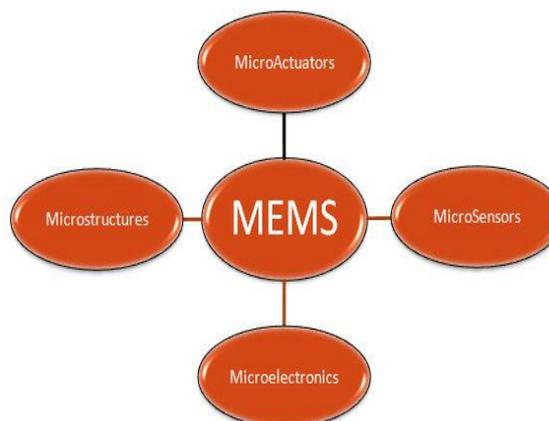


Fig 5: MEMS Module

Micro-Electro-Mechanical Systems, or MEMS, is a technology that in its most general form can be defined as miniaturized mechanical and electro-mechanical elements (i.e., devices and structures) that are made using the techniques of micro fabrication.

While the functional elements of MEMS are miniaturized structures, sensors, actuators, and microelectronics, the most notable elements are the micro sensors and micro actuators. Micro sensors and micro actuators are appropriately categorized as “transducers”, which are defined as devices that convert energy from one form to another. In the case of micro sensors, the device typically converts a measured mechanical signal into an electrical signal.

ULTRASONIC SENSOR:

Ultrasonic sensor provides an easy method of distance measurement. This sensor is perfect for any number of applications that require performing measurements between moving or stationary objects. A single I/O pin is used to trigger an ultrasonic burst and then “listen” for the echo return pulse. The sensor measures the time required for the echo return, and returns this value to the microcontroller as a variable-width pulse via the same I/O pin.



Fig 6: Ultrasonic Sensor

Key Features:

- Provides precise distance measurements within a 2 cm to 3 m range.
- Ultrasonic measurements work in any lighting condition, making this a good choice to supplement infrared object detectors.
- Burst indicator LED shows measurement in progress.
- 3-pin header makes it easy to connect to a development board, directly or with an extension cable, no soldering required.

VII RESULT AND CONCLUSION

Purpose of the current work is to study and analyze the surveillance of the navigation system. It enables reliability of the safe sailing of boat towards its correct path of destination. The need for a more efficient, balanced and safer transportation system is obvious. This need can be best met by the implementation of RADAR based navigation system.

Current work focuses on how to protect the fisherman from crossing the border of neighbouring country using RF signals. In the future, automated alert system will help to avoid accidents and reduce jamming. The ship will be directly monitored by Radar system thus capable of determining the best route and warn each other about the conditions ahead.

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