

## Automatic Border Alert System for Fishermen using GPS and GSM Techniques

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### Abstract

Countries with the International Marine time Boundary Line (IMBL) will always has security problems and continuous life threatens for those fishermen whose family's main economical support is fishing. Even in the peninsular country like India has their boundary limit in the ocean, the people of these coastal regions has the main work of fishing, due to carelessness or without knowing their boundary limit of their country they crosses the borders. In such situation the lives of fishermen continued to be difficult. They may face bullets and attacks from opposite Navy, at the end of attack fishermen are being abducted and their boats are being captured. So our paper is designed to avoid such kind of accidents and to alert the fishermen about border area well before using latest technology of Global Positioning System (GPS) and Global System for Mobile communication (GSM). And also this paper shows how this technology can be used for detecting natural hazards and obtaining meteorological information of the ocean for the safe navigation of fishermen.

**Keywords:** IMBL, RF module, Meteorology, GPS, GSM, PIC-Microcontroller, host navy

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### 1. Introduction

The Tamil Nadu fishermen even today invoke the historical rights and routinely stay into the International Maritime Boundary Line (IMBL) for fishing. From Tamil Nadu about 18,000 boats of different kinds conduct fishing along the India-Sri Lanka maritime border. But by accidentally crossing the border without knowledge, they get shot by the Lankan navy. This leads to loss in the both humans as well as their economic incomes. We have developed a system which eliminates such problems and saves the lives of the fishermen [1].

### 2. Working Principle

The GPS Modem will continuously give the signal which determines the latitude and longitude and indicates the position of the fishermen to them. Then it gives the output which gets read and displayed in the LCD. The same data is sent to the mobile of the fisherman and simultaneously the same data is sent to the Sea border security. An EEPROM is used to store the data, received by GPS receiver. The hardware which interfaces with microcontroller are LCD display, GSM modem and GPS Receiver. GPS (Global Positioning System) is increasingly being used for a wide range of applications [2]. It provides reliable positioning, navigation, and timing services to world wide users on a continuous basis in all weather, day and night, anywhere on or near the Earth. 24 satellites inclined at 55° to the equator orbit the Earth every 11 hours and 58minutes at a height of 20,180 km on 6 different orbital Lanes and each one of these satellites has up to four atomic clocks on board. All we require is an accurate clock. By comparing the arrival time of the satellite signal with the on board clock time, at which the signal was emitted, the latitude and longitudinal degree of the boat's location is determined. The current design is an embedded application, which will continuously monitor a moving Boat and once the boat goes beyond the level of the defined layer the particular operation will be done. For doing so an PIC microcontroller is interfaced serially to a GSM MODEM AND GPS receiver.



Figure 1. GPS working

### 3. Existing System

At the present time there are few existing systems which help to identify the current position of the boats/ships using GPS System and view them on an electronic map. For the purpose of identification the fisherman are using the GPS72h, equipment used for the navigation in sea. It provides the fastest and most accurate method for mariners to navigate, measure speed, and determines location. This system enables increased levels of safety and efficiency. It ensures whether the ship reaches its destination safely. The accurate position information becomes even more critical as the vessel departs from or arrives in port .

### 4. Proposed System

The proposed system uses a GPS receiver which receives signal from the satellite and gives the current position of the boat. The proposed system is used to detect the border of the country through the specified longitude and latitude of the position, not only between Sri Lanka and India but all over the world. The particular layer level i.e. border can be predefined and this can be stored in microcontroller memory. The current value is compared with predefined values and if these values are same, immediately the particular operation will be done i.e, the microcontroller gives instruction to the alarm to buzzer. It also uses a message transmitter to send message to the base station which monitors the boats in the sea. The system provides an indication to both fisherman and to coastal guard. Thus it saves the lives of the fisherman and alerts the base station to provide help [3].

Basically there are three different locations which are pre stored those location points are just few nautical miles away from border at each location each warning system is proclaimed at first location there will be warning buzzer and there will be exact display of distance between present location and border in LCD display and also there is a 50 percent reduction of boat speed if fishermen misses warning if he moved ahead then it shows distance information and also motor will stop now fishermen can start a boat once it is an indication that border is just few nautical miles away from the border if he ignored and moved on towards third location whole boat will stop and the location of that point is send to navy control room and they will come and verify the legitimacy of fishermen and they have to put an randomly generated key to start boat and same location is sent to family members through GSM. Thus we can stop fishermen before the border and lives of fishermen are saved.

### 5. Proposed System Architecture

The GPS receiver receives the signal and converts it into desired data message. The data is sent to microcontroller and microcontroller extracts the latitude and longitude from the data. The positions are compared with the stored Boundary latitude and longitude positions. If the vessel is found to be in predefined location certain warning methods will occurs [4].

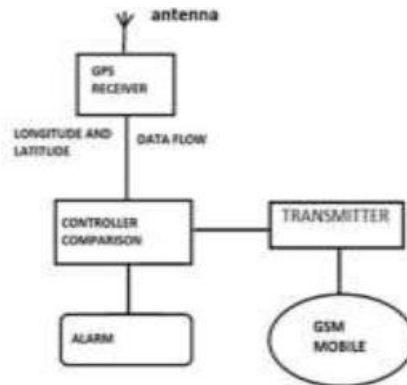


Figure 2. Flow of operation

## 5.1. GPS & GSM

### 5.1.1. Global Positioning Device

A GPS navigation device is any device that receives Global Positioning System (GPS) signals for the purpose of determining the device's current location on Earth. GPS devices provide latitude and longitude information, and some may also calculate altitude. GPS devices are used in military, aviation, marine and consumer product applications.

### 5.1.2. GPS Accuracy

The accuracy of GPS depends on the type of receiver. Most hand-held GPS units have about 10-20 meter accuracy. Other types of receivers use a method called Differential GPS (DGPS) to obtain much higher accuracy. DGPS requires an additional receiver fixed at a known location nearby. Observations made by the stationary receiver are used to correct positions recorded by the roving units, producing an accuracy greater than 1 meter.

### 5.1.3. Controller

PIC microcontrollers (Programmable Interface Controllers), are electronic circuits that can be programmed to carry out a vast range of tasks. They are found in most electronic devices such as alarm systems, computer control systems, phones, in fact almost any electronic device. PIC Microcontrollers are relatively cheap and can be bought as pre-built circuits or as kits that can be assembled by the user.



Figure 3. PIC microcontroller

Microcontroller receives the data from the GPS receiver through UART. the data received contains many details along with latitude and longitude. The latitude and Longitude of the current position is separated from the detailed data from GPS. The current positions are compared with already stored latitude and longitude of countries boundary locations. At first the latitude is compared with stored latitude which identifies if the current position is located near to the boundary. If the latitude matches then the adjacent latitudes and longitudes of the present latitude is retrieved from the microcontroller. The current position received from GPS is stored as S1(latitude), S2 (longitude). The latitude S1 is compared with stored latitudes. If latitude match, then adjacent latitude and longitudes (X1, Y1 and X2, Y2) are retrieved from stored table and compared and simultaneously warning techniques are implemented as shown in Table 1.

Table 1. Table of latitude & Longitudes

Positions	Latitude	Longitude
Location 1	12° 05'.0 N	82° 03'.0 E
Location 2	12° 05'.8 N	82° 05'.0 E
Location 3	12° 05'.4 N	82° 09'.5 E
Location 4	12° 33'.0 N	82° 46'.0 E

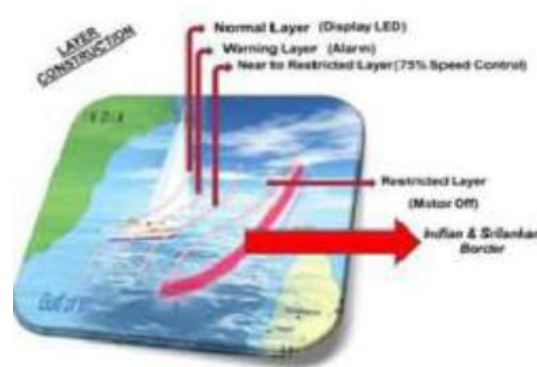


Figure 4. Pictorial representation of locations

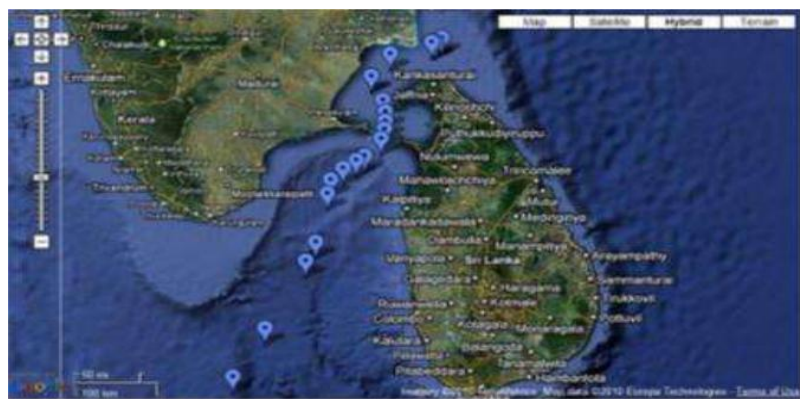


Figure 5. Indo-Sri lanka reference locations

The boundary between India and Sri Lanka in the waters from Adam's Bridge to Palk Strait shall be arcs of Great Circles between the following positions, in the sequence given above, defined by latitude and longitude.

## 6. Maritime Boundary between Indian and Sri-Lanka

The boundary points are marked above. These points should be stored in microcontroller. The computation is done in microcontroller with these points. Thus vessel crossing the border is being calculated.

### Consequence

Boat Position and Navigation System contains,

Location 1: buzzer indication

Location 2: motor speed control indication.

Location 3: motor stops.

Location 4: final verification

### GSM Module

GSM module is used for transmission of message seeking assistance. GSM cannot be used in oceans as towers cannot be placed in oceans. Thus CDMA network or satellites can be used for message transmissions. When vessel crosses border, the stored message along with current latitude and longitude positions is sent to the desired GSM module which is stored already. The prototype of the device is show in Figure 6.

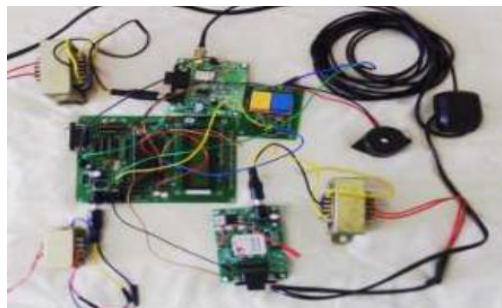


Figure 6. Working prototype

Because GPS receivers do not have atomic clocks, there is a great deal of uncertainty when measuring the size of the Spheres. Each radius corresponds to the distance calculated to the satellite. All possible distances to the satellite are located on the circumference of the circle.

## 7. Experimental Results

Border alert system for fishermen is used to detect the boundary location and warn the fishermen in danger situations. It not only finds the GPS value, but also compares with the stored value in the microcontroller, and makes a decision as to whether the fishermen is in the warning range or not.

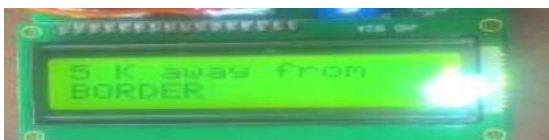


Figure 7. Warning indication



Figure 8. Entering GPS locations



Figure 9. GSM message

## 8. Future Scope

We can use the EEPROM to store the previous Navigating Positions up to 256 locations. We can navigate up to a number of locations by increasing the memory of EEPROM.

We can reduce the size of the kit by using GPS+GSM on the same module of GPS receiver.

We can increase the accuracy up to 3m by increasing the cost of the GPS receivers.

### Benefits

1. The hijack of the ship by the pirates can be eradicated.
2. The lost ship wrecks due to natural calamities can be identified
3. By keeping the kits in the entire boats and by knowing the locations of all the boats we can use our kit to assist the traffic.
4. In case of any accident on the sea, it can be detected by the system and the accident location of the boat is sent to the rescue team.

### Application

1. We can use this device also as bomb detector
2. Location of any lost vehicle could be found

### Advantages

1. Accuracy determination of location
2. Maintenance cost is low
3. Easily replaceable with traditional method of verification.

## 9. Conclusion

Thus the fishermen can easily identify the national sea borders and therefore prevent them from entering their area. Thus saving their lives and providing good relationship with the neighbouring countries. Also, the piracy of ship can be easily brought under control.

## References

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