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Monitoring border safety using IOT based systems

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ABSTRACT

In the recent days, it is observed that there are frequent issues related to the coastalboundary between countries. In many such cases the innocent fisherman (who is not aware of the boundary crossing), is put into trouble. This Paper about finding a solution to this problem using Information Technology in a cost effective manner. IOT devises are fitted to these small boats and their location is monitored by GPS. Using GIS, the boundary is also marked. The moment the fisher man crosses the boundary (or likely to cross the boundary), the signal is sent by the GPS system to the IOT devices and an alarm is given to the fisherman to take proactive action. Apart from this, when the fisherman falls sick (or some other emergency needs) , in addition to this issue related to border crossing, the same h/w system can be also used for giving an alarm to a rescue station (for medical / emergency help)

Key words: (Global positioning system(GPS), arduino, Global system for mobile communication, Geographic Information System (GIS),sensors, IDE,IOT.)

1. INTRODUCTION

The aim of this research work is to provide safety and security to fisherman who is lonely at sea. Fisherman who with small boat may not have the facility to monitor whether they are within their native country's boundary or not. This may result in entering into the alien boundary and be captured by them. Equipping their boats with costly devises may not be economically feasible for the small fishermen. In this project a cost effective solution is contemplated. And a prototype is developed. This monitors the actual position of the moving fisherman by recording the latitude and longitude using IOT devices. They are compared with the GIS data (from which actual boundary can be identified).The device gives timely warning (in case he is likely to cross his mother land boundary and enters to alien boundary). The fisher man need not have a computer installed in the boat and Cloud computing is used. Only the connectivity device need to be there in the boat, in addition to the IOT devices (for identifying the actual location).

2.EXISTING SYSTEM

The existing system consists of an embedded device that includes Global positioning system[1] which identifies the location, and the global system for mobile communication which will send the alert messages. The existing system cannot be used for small boats because of the cost and size.

3. PROPOSED SYSTEM

a. For ensuring Security

The proposed system is designed with Arduino (Microcontroller unit), with which the total implementation can be done. Border boundaries[2] can be also stored permanently in the memory of the microcontroller. It compares the latitude and longitude values sent by the GPS and the border level already mentioned in the microcontroller.Accordingly further process is done.

b. For ensuring Safety

Here the heartbeat sensor is used for monitoring the health condition of the fishermen. The heartbeat sensor in this system will measure the heartbeat of the fishermen and identify abnormal condition. During these abnormal conditions, the global system for mobile communication (GSM) will send the alert messages to fishermen and the coastal guard[4]. All these data can be stored in cloud storage and it can be viewed or retrieved later.The location details sent by the GPS can also be seen through Google maps[3].

4. METHODOLOGY

In this project, Internet of Things (IOT) technology is used. It has an API that is used to retrieve and collect the data by using a protocol through the internet.IOT provides the communication that connects the physical world with the digital world. It provides high flexibility by detecting, monitoring through sensors, actuators that can be controlled by the remote access and monitored through computers or any other monitoring devices.Nowadays, the internet of things plays a major role in the recent trends with enormous growth. IOT is connected with industry 4.0 that favorably produces new technology for easy access, optimization, data

integrity, cloud computing, and promotes less manpower, high accuracy, and high efficiency.

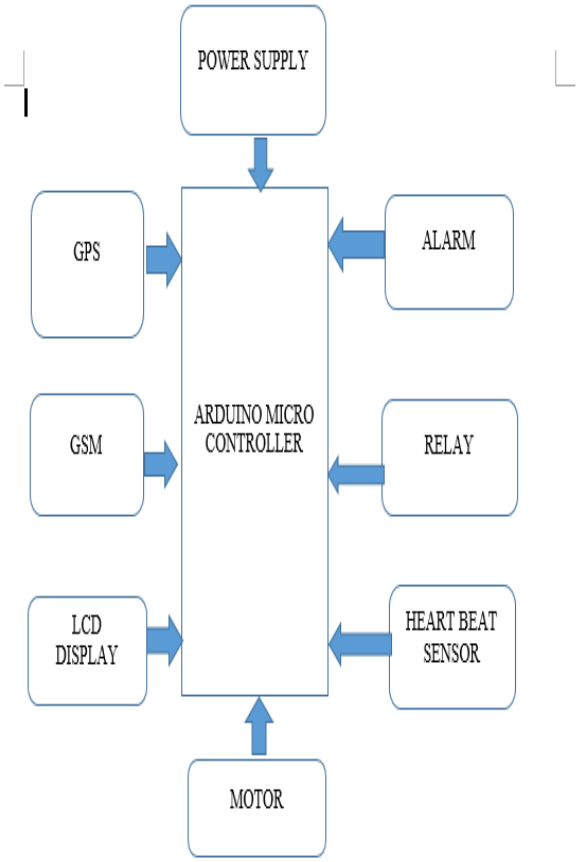

Figure 1: Architecture for Border safety system

From the Figure 1 **,** the architecture consists of GPS interfaced with an arduino microcontroller which will fetch latitude and longitude from the satellite to identify the location. GSM, relay,heartbeat sensor,is also connected to the microcontroller here GSM will send the alert message, heartbeat sensor used here will measure the heartbeat rate of the fishermen through pulse count. Relay is used to direct the path for power supply.

5.HARDWARE REQUIREMENTS

Arduino UNO microcontroller,Global Positioning System (GPS),Global System for Mobile Communication (GSM),Heartbeat sensor,IOT Module, Buzzer,LCD,LED, MotorTesting Board, Transformer(for Power supply),Jumper Wires, Bolts and Screws (for fitting).

6. SOFTWARE REQUIREMENTS

Arduino IDE , Messaging app

7. PRODUCT DESCRIPTION

Transformer

The transformer in this device is termed as stepdown transformer consisting of primary and secondary windings. This then converts electrical energy into electromagnetic induction and further produces an EMF (Electro Motive Force) inside the conductor.

Figure 2: Power supply

9V of the power supply as shown in figure 2 is required for this device

Arduino

The Arduino microcontroller in this kit is based on the model AT mega 328 shown in figure 3.The arduino board has 14 i/o pins, USB connection port, RESET button, 6 analog pins, power jack and so on. The coding can be copied to the board from arduino IDE software through the USB connection.

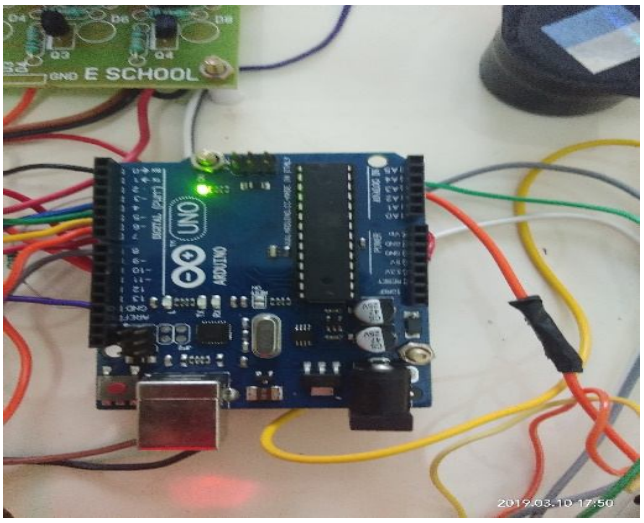

Figure 3: Arduino board

Global positioning system (GPS)

GPS works based on satellite. It is also called as a radio navigation system. It fetches the latitude values and longitude values from the satellite and sends the values

continuously to the control room. GPS in this device will receive the location details from 3 to 4 satellites. It works accurately in a range of 10 to 20 m. Operating temperature ranges from -40 to +85 degree c.

Global system for mobile communication (GSM)

GSM was developed by ETSI European Telecommunication Standard Institute, but now it has been developed over many countries. The GSM follows two types of technologies, Time division multiple access and Code division multiple access.This device includes the combination of both GPS and GSM module due to the advance technology as shown in figure 4. The model shown in figure 5 is based on SIM 800C. It has a maximum range of about 25 miles.

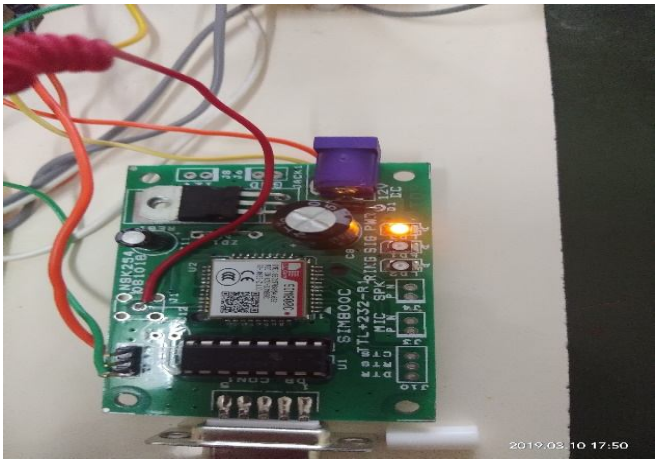

Figure 4: GPS+GSM Module

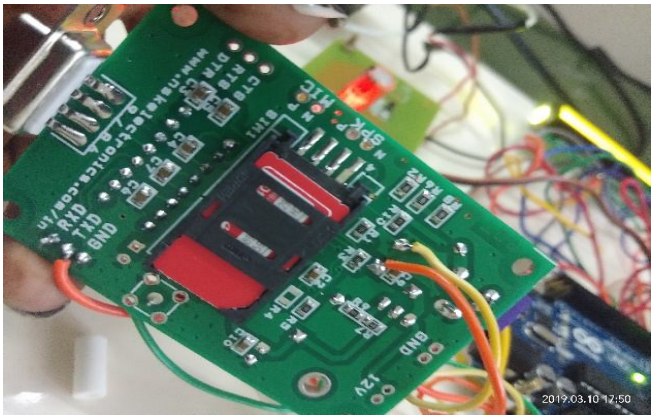

Figure 5: SIM slot in GSM

8. IMPLEMENTATION

Implementation can be done through different modules

- Preparation of layout
- Assembling the design parts
- Coding
- Testing

Layout

The connection between different modules can be discussed before assembling the hardware parts .Once this preparation is over, it further proceeds to assembling process.

Assembling

Here each and every part is assembled according to the architecture. Every connection can be made perfectly with respect to it.

Coding

The coding can be done in many programming languages. Some coding steps are shown in figure 6 and 7. According to this project, the arduino language is used in the arduino IDE software for coding. It isthen copied to the Arduino board through the given USB connection.

Sample code

```
DisplayGSMResponse( );
Serial println(AT+SAPBR=3,1,"Contype","GPRS"\n);
Delay(2000);
DisplayGSMResponse();
Serial.println( "AT + SAPBR = 3,1,\"APN\",\"web\"\r\n" );
delay(2000);
DisplayGSMResponse();
Serial.println( "AT + SAPBR = 1,1\r\n" );
delay(2000);
DisplayGSM Response();
```

Testing

Everything connection can be made in the proper way and tested at the OFF condition, this is termed as the cold test.The design can then be checked in the ON condition which is termed as hot test.

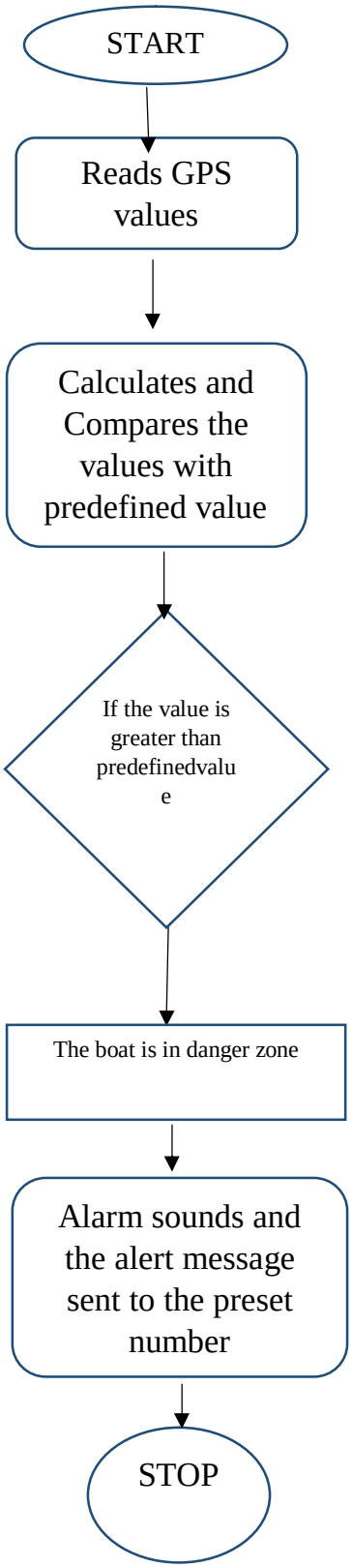

Figure 6: Calculating values

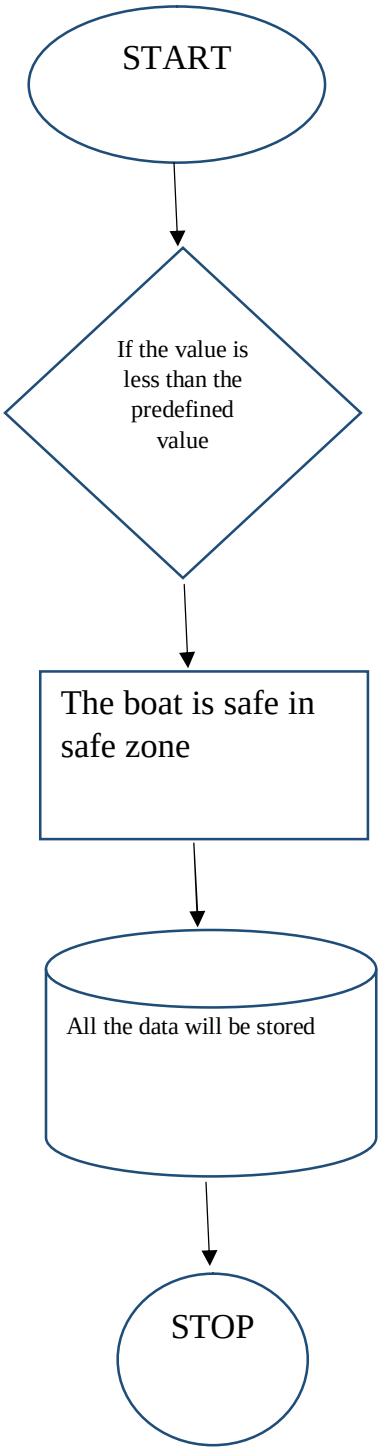

Figure 7 : Sending messages to the preset number

9.EXPERIMENTAL RESULT

The design given in figure 8 consists of power supply board, GPS+GSM module, alarm, LCD display, Arduino board, buzzer alarm, motor, relay and the heartbeat sensor, transformer etc. Stepdown transformer will convert the available voltage into the required voltage needed for the design kit. When the power is ON, the motor which is connected with the relaywill rotate automatically. The motor has two terminals and will rotate in both clock-wise and anti-clockwise rotation to indicate if the boat is running safely.

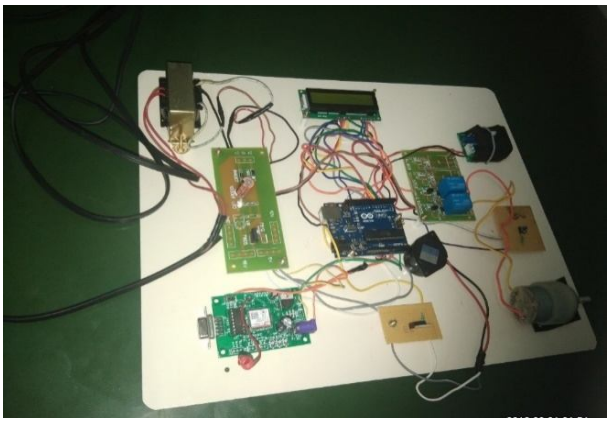

Figure 8: Hardware design for Border safety system

The LCD display will show a “HI” message when the kit is started for testing as in figure 9 . The GPS will receive the latitude and longitude value that will be compared with the border level which is already predefined in the micro controller by means of an equation (secured).

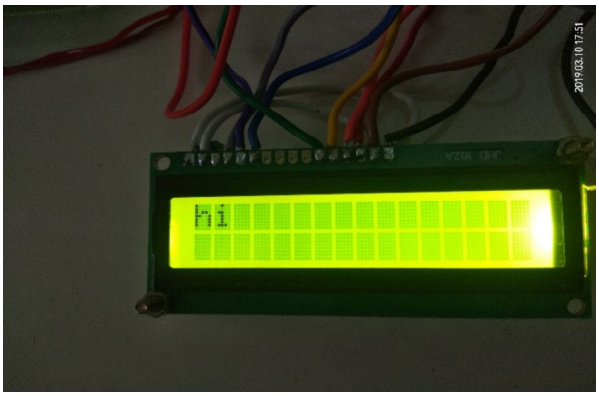

Figure 9: Displays “HI” message

The results from the equation willeither say that the border is crossed or it is in the safe zone. The continuous location can be sent to the control room which is really helpful. The heartbeat sensor is also used for monitoring the health condition of the fishermen. The alarm sounds either when the border is crossed or when the heartbeat goes very high/ very low.

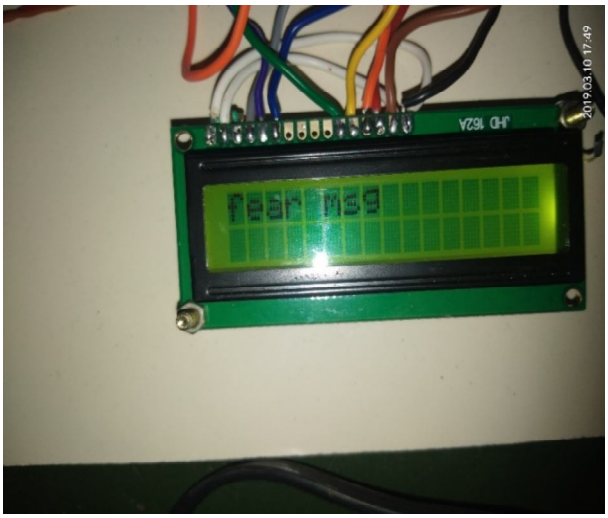

Figure 10: Fear alert message

And also the GSM sends fear alert messages to the mobile number (already mentioned in the code) shown as in figure 10,11and 12. These messages can be sent with the location when the border is crossed or when there is an abnormal heartbeat rate.

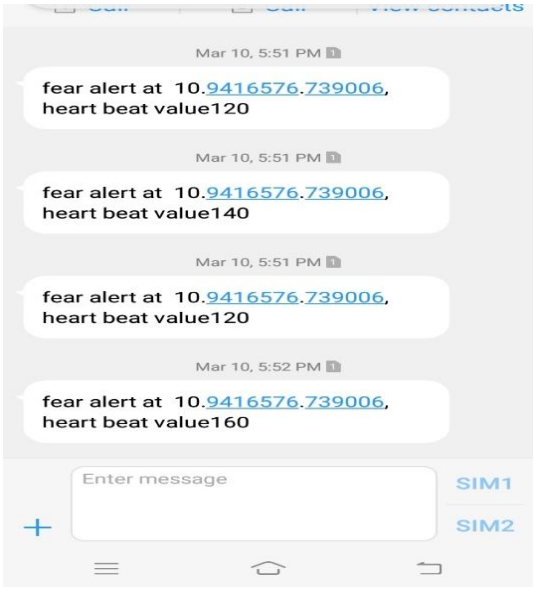

Figure 11: Result

The latitude and longitude values can be checked through the google mapsto predict the right location.

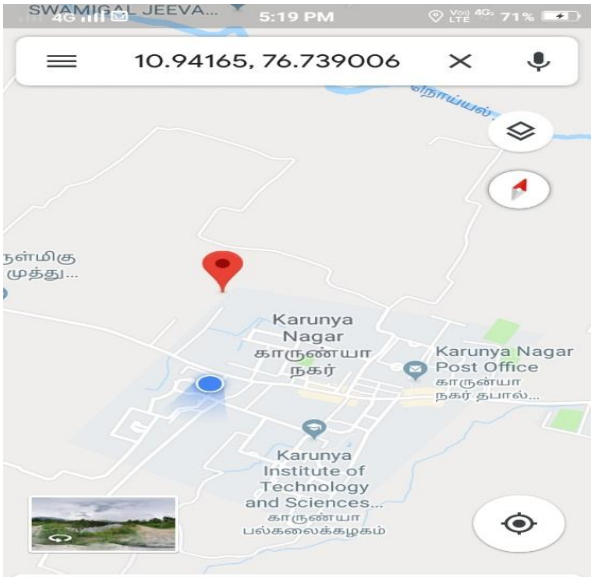

Figure 12: The location in Google maps

10.CONCLUSION

This project works withan embedded system and GPS which will provide safety to fisherman. This work can be extended further and put to use in certain security applications in land also. This helps to find the lost boat.

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