Boat Localization and Border Alert System for Fishermen Safety Using GPS System

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ABSTRACT

In day-to-day life, many fishermen are being caught and put under custody and even killed. The sea border between the countries is not easily identifiable, which is the main reason for this cross-border cruelty. In several cases the ignorant and poor fishermen unknowingly cross the border due to lack of technical equipment and knowledge. In order to mitigate this issue, a system has been proposed which will alert the fishermen to realize that the threshold of the maritime border has been reached. The proposed border alert system uses Global Positioning System (GPS) to monitor and track the movement of spinning boat vessel which is strayed in sea. If the boat reaches the warning zone the LCD displays warning and an alert will be given with the help of an Apache Portable Runtime (APR) Voice playback circuit and a buzzer. Even after the subsequent alerts, when the fishermen cross the warning zone the Alarm continues to beep and the motor of the mechanized boat will be automatically turned off and an alert message is sent to the coast guard and control room with the help of the Global System for Mobile Communication (GSM) module. Thus, the proposed system helps in protecting the fishermen from crossing the marine border and help to save their lives.

Keywords - Global System for Mobile Communication (GSM), Global Positioning System (GPS), Apache Portable Runtime (APR)

I. INTRODUCTION

The fishermen even today invoke the historical rights and routinely stay into the International Maritime Boundary Line (IMBL) for fishing. The sea border between the countries is not easily identifiable, which is the main reason for this cross-border cruelty. But by accidentally crossing the border without knowledge, they get shot by the naval forces. This leads to loss in the both humans as well as their economic incomes. Thus, the proposed border alert system uses Global Positioning System (GPS) to monitor and track the movement of the spinning boat vessel. The fabricated hardware kit is placed on the boat. Depending on IMBL the area is divided into safe zone, warning zone, zone near to restricted zone and finally the restricted zone. When the boat stays within the safe zone it is allowed to roam freely without any restrictions. When it crosses the safe

zone, subsequent alerts are sent to the fishermen and to the coast guard officials.

Figure - 1 GPS Satellite

Figure 2 – Border Classification

II. SYSTEM OVERVIEW

In day-to-day life, many fishermen are being caught and put under custody and even killed. The sea border between the countries is not easily identifiable, which is the main reason for this cross-border cruelty. In several cases the ignorant and poor fishermen unknowingly cross the border due to lack of technical equipment and knowledge. In order to mitigate this issue, a system has been proposed which will alert the fishermen to realize that the threshold of the maritime border has been reached. The proposed border alert system uses Global Positioning System (GPS) to monitor and track the movement of spinning boat vessel which is strayed in sea. If the boat reaches the warning zone the LCD displays warning and an alert will be given with the help of an Apache Portable Runtime (APR) Voice playback circuit and a buzzer. Even after the subsequent alerts, when the fishermen cross the warning zone the Alarm continues to beep and the motor of the mechanized boat will be automatically turned off and an alert message is sent to the coast guard and control room with the help of the Global System for Mobile Communication (GSM) module. Thus the proposed system helps in protecting the fishermen from crossing the marine border and help to save their lives.

III. BACKGROUND STUDY

There are nearly 2,60,000 registered fishing vessels in India, including deep-sea fishing vessels (61), motorised mechanical vessels (62,130), motorised non- mechanical vessels (1,40,272), and non-motorised/traditional boats (55,748). These boats operate from 1,265 fish landing sites along the 7,516.6 km Indian coastline. A total of 54,00,000 fishermen are estimated to be employed full-time in the fishing industry. The gross value added (GVA) of the fisheries sector - one of the sectors of India's blue economy - in the national economy was Rs. 2,12,915 crore in 2018-19, accounting for 1.24 percent of the total national GVA .From 2014-15 to 2018-19, the average growth rate of the fisheries sector was 10.88 percent (Arun Prasanth et al.,2019) . In fiscal year 2019-20, India exported 12.89.651 metric tonnes of seafood worth US$ 6.According to the Food and Agriculture Organisation's (FAO) 2020 State of the World's Fisheries and Aquaculture report, India accounts for 6 percent of the world's capture fisheries and ranks fourth after China (15 percent), Indonesia and Peru (both 7 percent). As of 2017, India is also the fourth largest exporter of fish, after China, Norway and Vietnam. In 2008, the General Assembly of UN identified illegal, unreported and unregulated (IUU) fishing as a particular maritime security challenge. India's Maritime Security Strategy (2015) recognises IUU fishing as a non-traditional threat to maritime security (V. Yogalakshmi et al., 2019). Traditionally,

the fishing sector has not been directly associated with maritime security, making maritime security itself a modern concept. However, following the Mumbai attacks in November 2008, the Department of Animal Husbandry, Dairying and Fisheries (DADF) and state fisheries departments were integrated 4 into coastal (and marine) security coordination forums. On February 05, 2019, the Department of Fisheries (DoF) was spun off from DADF and placed under the Ministry of Fisheries .DoF is responsible for formulating policies and programmes for the promotion and development of fisheries in India, including infrastructure development and central fisheries institutes. Nowadays, many projects and inventions are used for maritime security to ensure the livelihood of fishermen.

IV. COMPONENTS REQUIRED

A. ARDUINO UNO

The boards are equipped with sets of digital and analog input/output pins that may be interfaced to various expansion board shields or breadboards for prototyping and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus USB on some models, which are also used for loading programs. The microcontrollers can be programmed using the C and C++ programming languages, using a standard API which is also known as the "Arduino language"

Figure 3 -Arduino UNO

B. LCD DISPLAY

A liquid crystal display is a special thin flat panel that can let light go through it, or can block the light. (Unlike an LED it does not produce its own light). The panel is made up of several blocks, and each block can be in any shape. Each block is filled with liquid crystal that can be made clear or solid, by changing the electric current to that block. Liquid crystal displays are often abbreviated LCDs.

Figure 4 – LCD Display

C. GSM MODULE

A GSM modem or GSM module is a device that uses GSM mobile telephone technology to provide a wireless data link to a network. GSM modems are used in mobile telephones and other equipment that communicates with mobile telephone networks. They use SIMs to identify their device to the network.

Figure 5 - GSM Module

D. APR9600 MODULE

The APR9600 provided all the necessary features for recording and playing the audio. APR9600 is a low-cost high performance sound record/replay IC incorporating flash analogue storage technique. Recorded sound is retained even after power supply is removed from the module. The replayed sound exhibits high quality with a low noise level. The APR9600 device offers true single-chip voice recording, non- volatile storage, and playback capability for 40 to 60 seconds. The device supports both random and sequential access of multiple messages.

Figure 6 - APR9600 Module

E. DC MOTOR

A DC motor is any of a class of rotary electrical motor that converts direct current (DC) electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in part of the motor.

Figure 7 - DC MOTOR

F. RELAY DRIVER

A relay driver circuit is a circuit type that runs a relay, therefore, contributing to an appropriate circuit function. In turn, the relay switch opens or closes, as per the circuit requirement and functioning.

Figure 8 – Relay

G. BUZZER

Buzzer is a kind of voice device that converts audio model into sound signal. It is mainly used to prompt or alarm. According to different design and application, it can produce music sound, flute sound, buzzer, alarm sound, electric bell and other different sounds. The buzzer is a sounding device that can convert audio signals into sound signals. It is usually powered by DC voltage. It is widely used in alarms, computers, printers and other electronic products assound devices.

Figure 9 - Buzzer

H. GPS MODULE

The GPS module is a wireless chip module combined on the mainboard of a mobile phone or machine. It can communicate with the global satellite positioning system in the United States. It can locate and navigate according to the condition of a wireless network signal. Many mobile phones

have Equipment with a GPS module can communicate with GPS synchronous satellites for free at any time and area.

Figure 10- GPS Module

I. ARDUINO IDE

The Arduino IDE is an open-source software, which is used to write and upload code to the Arduino boards. The IDE application is suitable for different operating systems such as Windows, Mac OS X, and Linux. It supports the programming languages C and C++. Here, IDE stands for Integrated Development Environment. The program or code written in the Arduino IDE is often called as sketching. We need to connect the Genuino and Arduino board with the IDE to upload the sketch written in the Arduino IDE software. The sketch is saved with the extension '.ino'.

Figure 10 - Arduino IDE

V. METHODOLOGY

The GPS system concept is based on time. The satellites carry very stable atomic clocks that are synchronized to each other and to ground clocks. GPS receivers have clocks as well-however; they are not synchronized with true time, and are less stable. GPS satellites continuously transmit their current time and position. A GPS receiver monitors multiple satellites and solves equations to determine the exact position of the receiver and its deviation from true time. At a minimum, four satellites must be in view of the receiver for it to compute four unknown quantities (three position coordinates and clock deviation from satellite time).
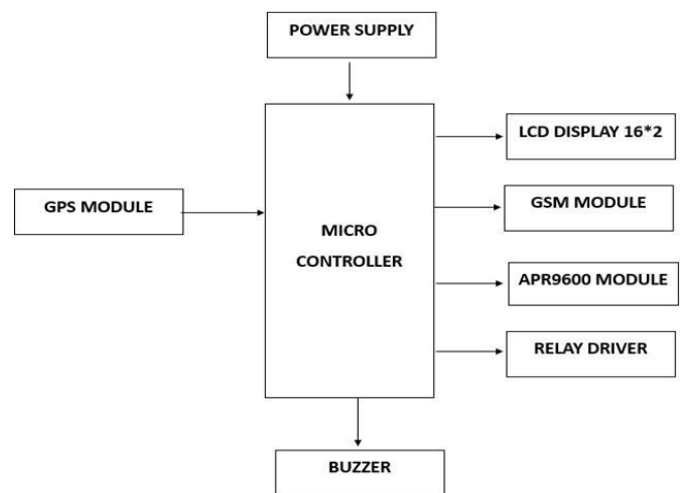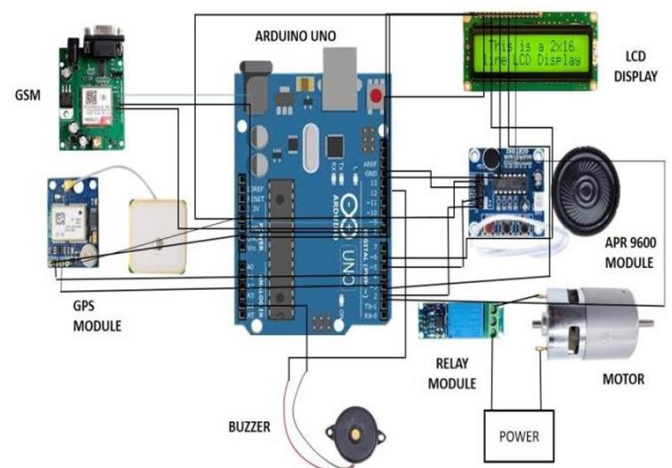

Block Diagram

Figure 12 – Circuit Diagram

VI. BORDER COORDINATES

Table 1 Border coordinates

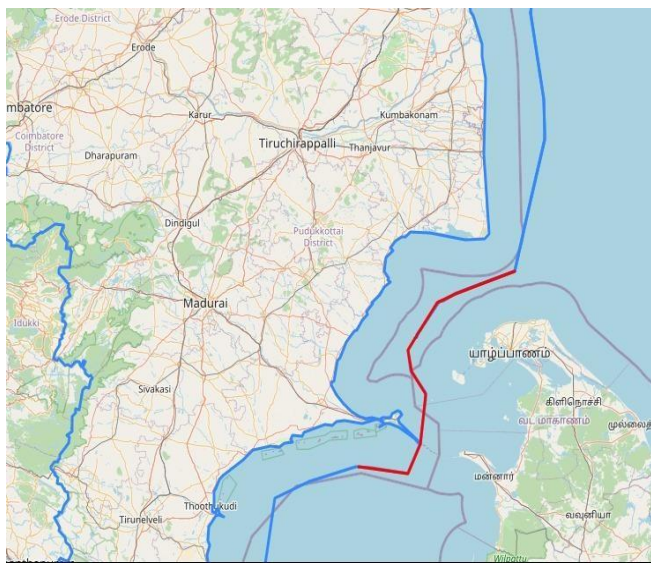| Postions	Latitude	Longitude
Position 1	12° 05'.0 N	82° 03'.0 E
Position 2	12° 05'.8 N	82° 05'.0 E
Position 3	12° 08'.4 N	82° 09'.5 E
Position 4	12° 33' 0 N	82° 46'.0 E

Figure 13 – International Maritime Border

A maritime boundary is a conceptual division of the Earth's water areas according to physiographic or geopolitical criteria. As such, it usually delimits areas with exclusive national rights over mineral and biological resources and includes maritime features, boundaries, and zones. Generally, a maritime boundary is defined at a certain distance from a country's coastline. However, in some countries, the term maritime boundary stands for the boundaries of a maritime nation recognized by the United Nations Convention on the Law of the Sea. The terminology does not include the boundaries of lakes or rivers, which are considered in the context of land boundaries.

VII. IMPLEMENTATION

The distance from the shore to the border will be predetermined. Based on the IMBL the area can be divided into four zones- normal zone, warning zone, zone near to restricted zone and finally the restricted zone. Using GPS the current latitude and longitudinal values of the boat is found and is sent to the microcontroller unit.
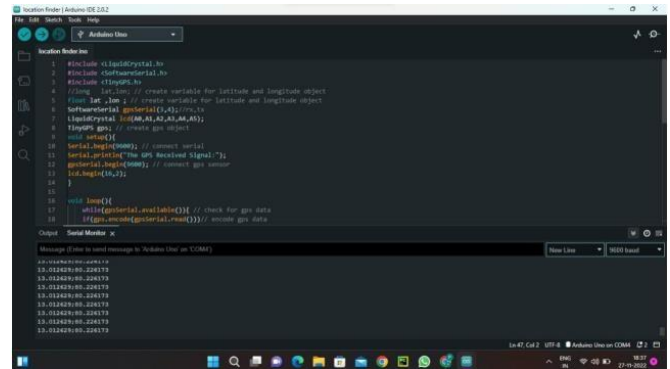

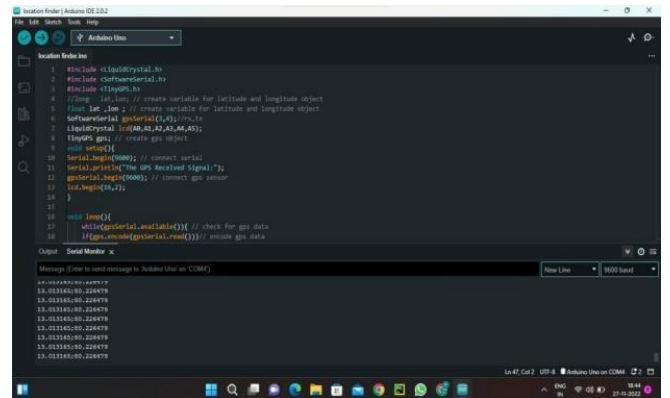Figure 14 – Current latitude and longitude output from gps module

Figure 15 – Current latitude and longitude output from gps module moved forward

The controller unit compares the present latitude and longitudinal values with the predefined value. Based on the result of the comparison, if the boat reaches the warning zone, the LCD displays warning and if the fisherman ignores the warning or fail to see the Display and move further, then the boat enters the zone nearer to the restricted zone and the alarm will

turn on and the speed of the boat engine automatically gets controlled by 50%. If the Fisherman did not take any reaction about the alarm and move further, then the boat will enter into the restricted zone and the Alarm continues to beep. Once it reaches the restricted zone, then the motor of the boat will be automatically turned off and an alert is sent to the coast guard with the help of the GSM module. Thus the proposed system helps in protecting the fishermen from crossing the marine border and help to save their lives.

VIII. RESULT

The current positions are compared with the user defined latitude and longitude of the 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.

IX. APPLICATION

The application can be widely used by people in the border to find the appropriate path to reach the destination. The notification will be sent to the border security forces which act as the server to all other devices that are operated by people in boats. This can act as an incident management application to avoid conflicts at varying situations. The automatic alarming system is going to be provided along with this device which alerts in case any sort of issues. This is devised in such a way that the application can easily be utilized by all the people in the surroundings. The application operates based on device tracking. This provides ease to operate even for illiterate people. Our objective is to give wireless support to those fishermen and also give information to the coastal guards as well as the boats crossing the border.

X. CONCLUSION AND FUTURE SCOPE

The "Boat Localization and border alert system for Fishermen's Safety Using GPS System" is a system that uses Arduino and GPS together to create a security system for fishermen boats. Fishermen unknowingly cross the sea boundary while navigating due to their inability to virtualize in the sea, resulting in loss of life. Through this project, fishermen will be provided with a GPS based safety system so that they can find out when they are in danger. In this way, fishermen can easily identify the national maritime boundary to prevent them from entering their territory, which saves their lives and creates good relationship with neighbouring countries. Piracy can also be easily brought under control. This system is an implication of security system for safe navigation of mariner's auto boat. It is a helpful step in saving the life of fishermen and a useful contribution to the society.

We can use the EEPROM to store the previous Navigating positions up to 256 locations. We can navigate up to N number of locations by increasing the memory of the EEPROM. We can reduce the size of the kit by using GPS+GSM on the same module of GPS navigator. We can increase the accuracy up to 3m by increasing the cost of the GPS receivers.

XI. REFERENCES

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