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## FISHERMEN BORDER SECURITY ALERT SYSTEM USING IOT

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### ABSTRACT

This paper describes about the "Fishermen border security alert system". Now-a-days, we can see many fishermen were caught by other country because of border violation. This is mainly due to sea borders being unidentifiable. In this paper Arduino Uno (microcontroller) with microchip ATmega328p is used to collect and manipulate the sensor data. NEO-6M GPS receiver module is used to sense the location of the boat. The collected GPS location is uploaded in the IOT cloud using ESP8266 Wi-Fi module. There by the data can be monitored by navy. If GPS location is in the warning zone an alert message will be identified with the help of the buzzer, then the speed of the boat i.e., motor is reduced to 50%. The main idea involving Arduino Uno microcontroller and NEO-6M GPS receiver module to alert the fisherman during maritime.

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### I. INTRODUCTION

It is known that sea border crossing is a major problem in Indo-Srilankan border. This is mainly happening due to poor knowledge about the sea borders among the fishermen. To overcome this situation, we had come up with a framework to solve this issue. Our proposed system helps the fishermen to save their life who were shot by Lankan navy force for border violation. This issue can be rectified by providing proper monitoring system which will alert the fishermen about the unidentifiable sea border through IOT based alert system. In this proposed work uses NEO-6M GPS receiver module which accurately track the latitude and longitude coordinates of the boat by using the signal sent by satellite in space and ground station on earth. Along with GPS receiver module, ESP8266 Wi-Fi Module is used to convert the serial port or TTL level signal into an embedded module which behave similar to the Wireless Network communication protocol stack and also TCP/IP protocol stack. This Traditional hardware device embedded in the ESP8266 Wi-Fi module can directly use Wi-Fi to connect to the internet and this plays a major part for uploading the location information in Internet of things cloud. The hardware interfaces are as follows Arduino Uno micro-controller, NEO-6M GPS receiver module, ESP8266 wi-fi module, LCD display unit and Integrated with Engine control unit. The LCD (Liquid Crystal Display) is integrated with the proposed work to display the information about the latitude and longitude coordinates of the current position of the boat which helps the fishermen and also the base station to track the boats which are about to cross the Indo-SriLankan border. The information about the co-ordinates is stored in IOT cloud with the help of ESP8266 Wi-Fi module. The information like latitude and longitude can be extracted from NMEA String (National Marine Electronics Association). The co-ordinates which are used to compare the current position of the boat are taken from GML file (Geography Markup Language) obtained from border security authority. By implementing this system one can avoid the chaos which are happening due to border violation of fishermen in the ocean.

### II. LITERATURE REVIEW

Mr. Krishnamurthy. K. T, in his paper on the title "A low-cost embedded sea navigation and security systems for fisherman" proposed a fisherman guiding system using Zigbee and GPS technology [1]. In his paper a complete design of an electronic system that tracks the location coordinates of a fisherman's boat. If it seems to cross the national borders, an alert message will be sent to the boat. Additionally, it has another feature for sending SOS messages in case of any calamities caused in the ocean. The Renasis RL78[R5F100LE] and Arduino Uno microcontrollers are used. Zigbee is used for wireless communication. When the fisherman is feeling any distress, a push button is pressed to telecast SOS messages to nearby boats for chances of getting rescued. Zigbee receiver module is used to receive transmitted SOS messages from nearby boats and it is made sound in the MP3 module. This system lacks a centralized data monitoring system. Mr. Krishnamoorthy. E in his paper

on the title "Border alert system and emergency contact for fisherman using RSSI" [2] proposed an alert system in case of emergency using RSSI. RSSI is used in separation estimate among the transmitter and receiver i.e., used to identify the area between shore and the boat. LCD is used for displaying the output when alarm sound found. Ultrasonic sensor, vibration sensor, single switch, relay and DC motor are used. These sensors are used to detect any abnormal conditions in the ocean. URAT is a key segment which takes the bytes of information and transmit. These sensors are connected to the microcontroller (Arduino). This system lacks complete security and the alert message is not sent to the centralized data hub. Ms. Ulagamuthalvi V and et al in their paper titled "IOT based Nautical Tracing system" [3] proposed a framework to help the fishermen using microcontroller which is interfaced with GPS, gas sensor, temperature sensor, humidity sensor, LCD, Zigbee transmitter to check the location of the fishermen in the ocean. In this system, GPS will track the latitude and longitude of the current position with the help of satellite signal. The gas, temperature and humidity sensor are used to detect the climatic changes when they are in the ocean and intimate them prior to disasters. In addition to all these features, Zigbee transmitter is used for wireless communication, it will send the message about the warning zone by computing the separation and displays related information in the liquid crystal display when it crosses the warning zone and it will start the ringing sound of buzzer. This is simple and effective but the Zigbee transmitter covers over a range of 10-100 meters. This system lacks the Engine control unit and also Zigbee transmitter has a limited range of coverage.

### III. COMPONENTS USED

#### Arduino UNO:

The micro-controller used in this project is Arduino UNO. Figure 1 depicts Arduino UNO microcontroller board. It is an open-source platform used for making electronic products allows beginners to freely explore the rich libraries to obtain desire outcome. It has its own piece of software with IDE (Integrated Development Environment) used to write, compile and upload the code. This board has been designed with set of digital and analog input and output pins that may be interfaced with various expansion boards and breadboards. It has six analog input and fourteen digital input/output pins which includes six PWM output pins with 16 MHz resonator. Arduino Uno is controlling unit of the entire system.



Fig 1. Arduino UNO.

#### ESP8266 Wi-Fi module:

Figure 2 depicts ESP8266 Wi-Fi module. The ESP8266 Wi-Fi module has L106 32-bit RISC micro-processor core based on the Ten silica Xtensa Diamond Standard 106 Microcontroller running at 80 MHz along with IEEE 802.11 b/g/n Wi-Fi. It is a device which converts the serial port signal into an embedded module to behave in the same way like wireless Network communication protocol stack and also TCP/IP protocol stack. This module helps binding the target network BSSID address in the networking process. It also supports wireless roaming based on 802.11 protocol. In this framework it mainly used to store the co-ordinate information in the IOT cloud which are gathered during the comparison process. This stored data can be monitored from centralized data hub.



Fig 2. ESP8266 Wi-Fi module.

**GPS receiver module:**

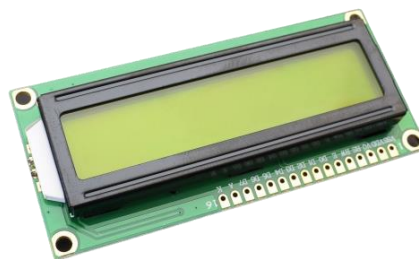
Here GPS receiver module (satellite-based navigation) is used for tracking the current location of the boat [4]. Figure 3 shows NEO-6M GPS receiver module. It has very powerful chip NEO-6M. This NEO-6M chip can track to the max of 22 satellites to identify the locations all over the world. It works in any weather condition anywhere in the world. This GPS receiver is built in battery type. The NEO-6M GPS receiver module uses USART communication to communicate with micro controller. It receives information like latitude, longitude, altitude, UTC time, etc. from the satellites in the form of NMEA string [6]. This string needs to be parsed to extract the information like latitude and longitude that we want to use. This GPS receiver makes use of three least distant satellite information to figure out exact position of the ship. This entire process is called Trilateration.



**Fig 3.** NEO-6M GPS receiver module.

**LCD:**

A Liquid Crystal Display is an electronic device which is used to display text i.e., latitude and longitude coordinates along with alert message on the screen [5]. Figure 4 portraits LCD display. In lcd, liquid crystals are used for the purpose of displaying clear visible image/text. Here in this application a 16 x 2 LCD is used. It has two lines and each line display a maximum of 16 characters. It also has 19 different functions like lcd.begin(), lcd.write(), lcd.display() etc., on Liquid Crystal library. LCD is connected to micro controller (Arduino UNO). Micro controller will command the LCD to display the alert message along with location coordinates when the fisherman is in the warning zone. Alert information like “You are in warning zone” with location coordinates will be displayed on LCD display.



**Fig 4.** LCD display.

**Engine Control Unit:**

Engine Control Unit is a system that controls the fuel rate to the fuel injector, thereby can increase or decrease the speed of the boat [7]. If the ship is identified to be in the warning zone, the speed of the motor will be reduced to 50% by the Engine Control Unit (ECU). ECU comprises of solenoidal valve, which is an electromagnetic valve. It controls the fuel flow rate through fuel injector.

**Buzzer:**

The buzzer is a device which produce the audio signal predominantly to alert someone. The power for this device is DC voltage. There are various buzzers available among them the most common are piezoelectric buzzer and electromagnetic buzzer. In this proposed system, piezoelectric buzzer is used. It uses the pulse current to drive the vibration of the metal plate to generate sound. With this sound the fishermen can get notified that he is moving towards the Indo-SriLankan border.

**Motor:**

Motor is a device which converts the electrical energy into mechanical energy. It can be powered by DC source in the form of battery or AC source in the form of power grid or rectifiers. In this proposed work, it plays a major role to demonstrate reduction of speed of the boat by 50% when it reaches the warning zone.

**Transformer:**

Transformer is known as a passive electrical device which transfers the electrical energy from one circuit to another circuit. Here transformer is used to stepdown the ac voltage from the supply. The principle involved in transformer is electromagnetic induction. There is a magnetic core over the transformer with two sets of windings named as primary and secondary. One of the winding is connected to the AC supply whereas in another winding an emf is induced on that which directly proportional to the number of turns. The step-up transformer increases the voltage from primary to secondary whereas the stepdown transformer decreases the voltage from primary to secondary.

**Jumper wires:**

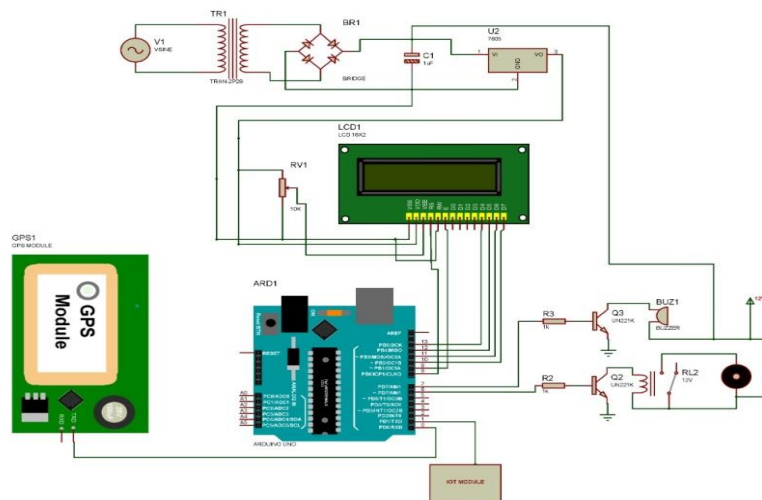
A jumper wire is also called as jumper cable with a pin at each end of the wire. It is used to interconnect the components on the breadboard. There are three versions of jumper wire: male-to-male, female-to-female and male-to-female. These are used according to our need.

**IV. EXISTING SYSTEM**

There are some existing works for the problem statement identified but they are not much reliable because the probability of getting erroneous output is more. Those works also lacks complete embedded systems for instance, in some system there is no proper data monitoring system and in other system the alert information is not sent properly to the control unit i.e., the alert message is sent only to the boat but the alert message is not sent to the centralized data hub [8]. The engine control unit is not present in some existing system. Here the border is divided into warning and restricted zone. Thus, an alert message will be sent when the boat is in warning zone, before crossing the national border which is not in the existing system. If the existing system for fishermen border security alert is very accurate, the number of fishermen caught by other country people must be reduced. But still the fishermen are caught by the other country peoples. Recently on March 25, 2021 the Sri Lankan Navy had arrested 20 Indian fishermen and seized two vessels for allegedly fishing in the country's waters.

**Circuit design:**

Figure 5 depicts complete circuit diagram of the proposed system. From the top, a step-down transformer along with bridge rectifier circuit and smoothing filter is used to deliver DC supply to the system. LCD is used to display alert message is connected to microcontroller. GPS receiver module is connected to Rx pin of Arduino controller. Buzzer to give alert sound and motor to depict engine speed reduction is connected via transistor which going to act as a switch. IOT module i.e., ESP8266 Wi-Fi module is connected to Tx pin of Arduino controller.



**Fig 5.** Circuit design.

**Proposed system Working:**

The complete block diagram of the proposed system is depicted in figure 6. In the proposed system, the microcontroller used is Arduino Uno [6]. It has six analog input and fourteen digital input/output pins which

includes six PWM output pins with 16 MHz resonator. Besides being robust it is reliable too. Arduino Uno is controlling unit of the entire system.

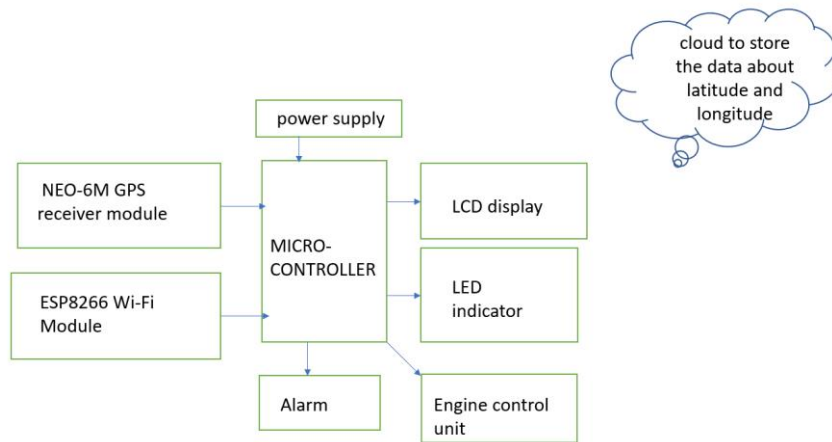


Fig 6. Block diagram.

Input to the controller is GPS receiver module. More specifically NEO-6M GPS receiver module. It has very powerful chip NEO-6M. This NEO-6M chip can track to the max of 22 satellites to identify the locations all over the world. This low power chip makes it as the most suitable for fisherman navigation system, as they have to be in ocean for even months and years. GPS receivers works based on the process called Trilateration. GPS receiver track the location by calculating how far it is from a number of satellites. These satellites send data about their location and the actual time as radio signals which will be captured by the GPS receiver to map the boat’s location. This GPS receiver makes use of three least distant satellite information to figure out exact position of the ship. This entire process is called Trilateration. To facilitate the microcontroller to access the cloud for data storage, ESP8266 Wi-Fi module is used. This affordable Wi-Fi microchip is in-built SOC with TCP/IP protocol is being integrated. Thereby the GPS location data is uploaded in the IOT cloud for centralized data monitoring system. The location information of the ship is checked for border violation all the times by the microcontroller. National borders along the sea are divided into warning zone and prohibited zone. If the ship is identified to be in the warning zone, the speed of the motor will be reduced to 50% by the Engine Control Unit (ECU). ECU comprises of solenoidal valve, which is an electromagnetic valve. It controls the fuel flow rate through fuel injector. Along with engine speed reduction, an alarm will ring and an alert message along with GPS coordinates will be displayed on LCD display. Thus, the fisherman will be stopped in the warning zone itself. The centralized data monitoring unit can be used by naval forces to safeguard our fishermen. The complete working flow of the proposed system is depicted in the figure 7.

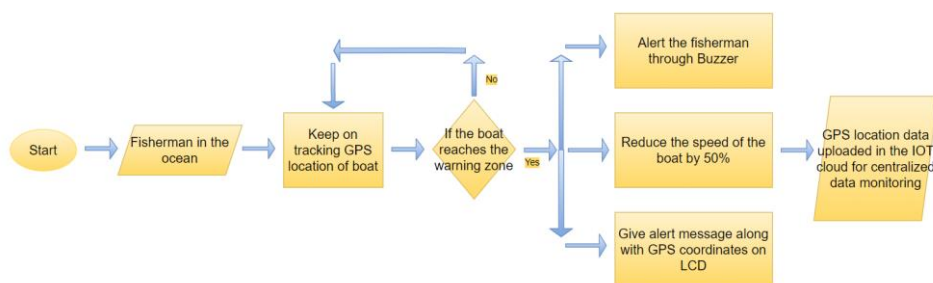


Fig 7. Working flow chart.

### V. CONCLUSION

The proposed system of fishermen border security alert system using internet of things will be a complete embedded system, right from data acquisition, processing the data, actuating the actuators when the sensor is triggered and uploading the data in cloud for centralized data monitoring and without compromising the accuracy. This system actively tracks the location of the boat with industry standard accuracy of 2 meters and sends the data to cloud. And alert system will alert the fisherman, if border is reached. Also, the engine control

unit will reduce the speed of the boat to 50%. The centralized data hub can be monitored by naval forces and claim justice if other countries caught our fishermen within our territory. Thus, an efficient system helps prevent fisher.

#### **VI. REFERENCES**

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