International Journal of Multidisciplinary Research and Growth Evaluation.

Border security alert system with RF transreceiver for nautical application

Priyadharshini K [1*], Prathisha K [2], Rabina Salini N [3], Saranya E [4]
[1, 2, 3] Student, Department of Computer Science and Engineering, E.G.S. Pillay Engineering College, Nagapattinam, Tamil Nadu, India
[4] Assistant Professor, Department of Computer Science and Engineering, E.G.S. Pillay Engineering College, Nagapattinam, Tamil Nadu, India

* Corresponding Author: **Priyadharshini K**

Article Info

ISSN (online): 2582-7138
Impact Factor: 5.307 (SJIF)
Volume: 05
Issue: 02
March-April 2024
Received: 11-02-2024;
Accepted: 14-03-2024
Page No: 646-649

Abstract
Now a days we come across a news that many Tamil fishermen are arrested by Sri Lankan navy and even killed. The sea border between the countries is not easily recognizable, which is the main reason for this cross-border cruelty. Here we have created an embedded system that protects fishermen by notifying them of the border via Global Positioning System (GPS). We use a GPS receiver to determine the current location of the fishing vessel or vessel. Using GPS we find the current latitude and longitude and send it to the microcontroller device. The controller then finds the current location by comparing the current latitude and longitude values with the given value. Then, as a result of the comparison, this system makes the fishermen aware that they are approaching the sea border. The area is divided into four zones: the normal zone, the warning zone, the zone close to the restricted zone and finally the restricted zone. When the boat is in the normal zone, the LCD will show the normal zone. That way they can tell the boat is in the normal range. When it moves further and reaches the warning area, the warning area will be displayed on the LCD screen. If the fisherman ignores the warning or does not see the indicator and moves on, and if the boat enters a zone closer to the restricted zone, the alarm is activated and the speed of the boat's engine is automatically controlled at 50%. If the fisherman did not respond to the alarm and moves on, the boat will move into the restricted zone, the alarm will sound as before, and touching the restricted zone, the boat's engine will turn off, checking the engine's fuel supply.

Keywords: managers, Vietnamese companies, integration context

1. Introduction
One of the main issues with the Indo-Srilankan border is well recognized to be marine border crossing. The primary reason for this is that fisherman have a poor understanding of the maritime borders. We needed to come up with a framework to handle this problem in order to get out of this predicament. After being shot by the Sri Lankan navy for crossing the border, our suggested strategy lets the fishermen escape death. The solution to this problem is to install an appropriate monitoring system that uses an IOT-based alert system to notify fishermen of any unidentified sea borders. The GPS receiver module used in this proposed work uses signals supplied by satellites in orbit and base stations on Earth to precisely track the boat's latitude and longitude coordinates.

Literature Reviewe
A fishermen guiding system utilizing Zigbee and GPS technology was proposed by Mr. Krishnamurthy, K. T. in his article titled "A low-cost embedded sea navigation and security systems for fisherman" [1]. An electronic system that tracks the coordinates.

of a fisherman's boat is fully designed and presented in this research. An warning message will be sent to the boat if it appears to be crossing national borders. It also has a function that allows it to send SOS signals in the event that there is a maritime disaster. It makes use of the Arduino Uno and Renasis RL78 [R5F100LE] microcontrollers. Wireless communication is facilitated via Zigbee. The fisherman presses a push button to broadcast SOS signals to neighboring boats in case he is in danger of being rescued. SOS signals are sent from neighboring boats using a Zigbee receiver module, and the MP3 module plays them back. An alarm system utilizing RSSI was proposed by Mr. Krishnamoorthy. 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.

3. Components Used

Arduino UNO:

The Arduino UNO microcontroller is the one utilized in this project. The Arduino UNO microcontroller board is shown in Figure 1. Beginners are free to explore the extensive libraries on this open-source platform for creating electronic devices in order to achieve their desired results. To develop, compile, and upload code, it has an IDE (Integrated Development Environment) built into its own piece of software. A collection of digital and analog input and output pins on this board allow it to be interfaced with a variety of expansion boards and breadboards. Six PWM output pins with a 16 MHz resonator are among its fourteen digital input/output pins, along with six analog input ports. The Arduino Uno is the system's central controlling component.

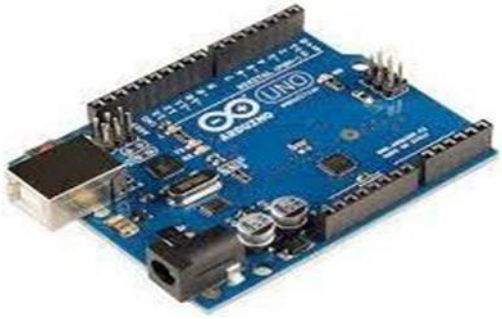

Fig 1: Arduino UNO.

GPS receiver

GPS receiver The GPS receiver module, which uses satellite-based navigation, is employed in this instance to track the boat's present location [4]. The NEO-6M GPS receiver module is seen in Figure 2. It has the extremely potent NEO-6M chip. With the NEO-6M chip, global position identification is possible up to a maximum of 22 satellite tracking. Anywhere in the world, in whatever weather, it functions. There is a built-in battery type GPS receiver. USART communication is used by the NEO-6M GPS receiver module to communicate with the micro controller. It gets data from the satellites in the form of an NMEA string, which includes latitude, longitude, altitude, UTC time, and other information [6]. To extract the desired data, such as latitude and longitude, from this string, parsing is required. 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 2: GPS receiver.

LCD

A liquid crystal display is an electronic device that shows text on the screen, such as latitude and longitude coordinates and an alarm message [5]. Portrait LCD display in Figure 3. To display a clear, readable image or text, liquid crystals are employed in LCDs. A 16 x 2 LCD is utilized in this application. It displays a maximum of 16 characters on each of its two lines. Moreover, it has 19 distinct Liquid Crystal library functions, such as lcd.begin(), lcd.write(), and lcd.display(). An Arduino UNO microcontroller is connected to an LCD. When the fisherman is within the danger zone, the micro controller will send a command to the LCD to display the alarm message and coordinates.

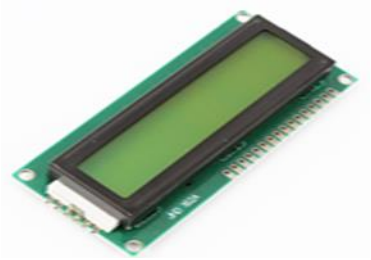

Fig 3: LCD display.

Engine Control Unit

The boat's speed can be changed by adjusting the fuel injector's rate using the Engine Control Unit [7]. The Engine Control Unit (ECU) will shut down the motor to 50% speed if it detects that the ship is in the alert zone. An electromagnetic valve called a solenoidal valve is part of the ECU. The fuel injector's fuel flow rate is regulated by it.

Buzzer

The primary purpose of a buzzer is to sound an auditory signal to alert someone. This device is powered by DC electricity. There are many different kinds of buzzers available, but the most popular ones are electromagnetic and piezoelectric buzzers. The piezoelectric buzzer is employed in this suggested design. It creates sound by causing the metal plate to vibrate using the pulse current. The fishermen might be alerted by this sound when he approaches the border between Sri Lanka and India.

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.

4. Existing System

There are some previous studies that address the problem statement that have been identified, but they are not very trustworthy due to the increased likelihood of incorrect results. Complete embedded systems are also absent from those works; for example, in some systems, there is no appropriate data monitoring system, and in other systems, the alert information is not properly sent to the control unit; that is, the alert message is sent only to the boat and not to the centralized data hub [8]. There isn't an engine control unit in any of the current systems. Here, the border is split into a restricted area and a warning area. As a result, before the boat crosses the national border—which is not covered by the current system—an alarm message will be delivered while it is in a danger zone. There should be fewer fisherman captured by foreign nationals if the current border security alert system for fishermen is highly accurate. However, the other rural populations continue to capture the fisherman. The Sri Lankan Navy recently detained 20 Indian fishermen and confiscated two vessels on March 25, 2021, for allegedly fishing in the nation's waterways.

Circuit design

Figure 4 displays a complete circuit diagram of the proposed system. To provide the system with DC power, a step-down transformer, bridge rectifier circuit, and smoothening filter are employed from above. The LCD is used to display alarm messages and is linked to a microcontroller. GPS receiver module is attached to the Arduino controller's Rx pin. The buzzer to provide a warning sound and the motor to portray engine speed reduction are connected via a transistor that will function as a switch. The IOT module, specifically the ESP8266 Wi-Fi module, is linked to the Arduino controller's Tx pin.

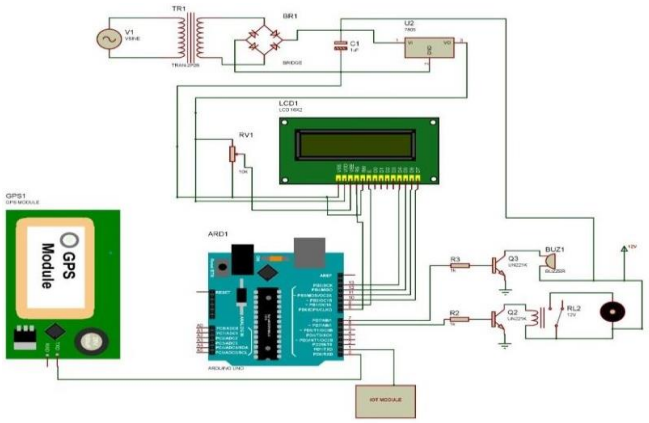

Fig 4: Circuit design

Proposed system Working

Figure 5 shows the proposed system's entire block diagram. The Arduino Uno microcontroller is employed in the suggested system [6]. It contains fourteen digital input/output pins, six PWM output pins with a 16 MHz resonator, and six analog input ports. It is not just sturdy but also dependable. The Arduino Uno is the system's controlling module.

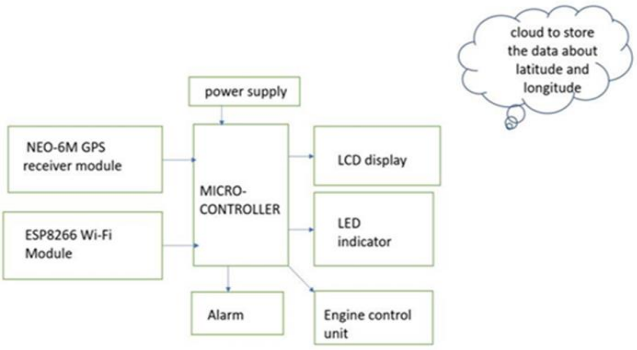

Fig 5: Block diagram.

The input of the controller is the GPS receiver module. Specifically, the NEO-6M GPS receiver module. It has a very powerful NEO-6M chip. This NEO-6M chip can track up to 22 satellites and detect locations anywhere in the world. This low power chip makes it the most suitable navigation system for fishermen because they have to be at sea for months and even years. GPS receivers work on a process called triangulation. A GPS receiver tracks a location by calculating how far it is from multiple satellites. These satellites transmit information about their location and real-time radio signals, which are picked up by a GPS receiver to map the boat's position. This GPS receiver uses data from the three most distant satellites to determine the exact position of the ship. This whole process is called triangulation. The ESP8266 Wi-Fi module is used to store data to facilitate access to the microcontroller. This cheap Wi-Fi chip is embedded SOC and the TCP/IP protocol is integrated. In this case, the GPS location data is uploaded to the IOT cloud for a centralized data monitoring system. The microcontroller constantly monitors the vessel's location data for boundary violations. The maritime borders of the kingdom are divided into warning zones and prohibited zones. If a vessel is detected in the warning zone, the engine control unit (ECU) reduces the engine speed to 50%. The ECU consists of a solenoid valve, which is an electromagnetic valve. It controls the fuel flow through the fuel nozzle. When the engine speed decreases, an alarm will sound and the alarm message and GPS coordinates will be displayed on the LCD screen. In this way the fisherman himself is stopped in the warning zone. The Navy can use a centralized information control device to secure our fishing lanes. The complete workflow of the proposed system is shown in Fig 6.

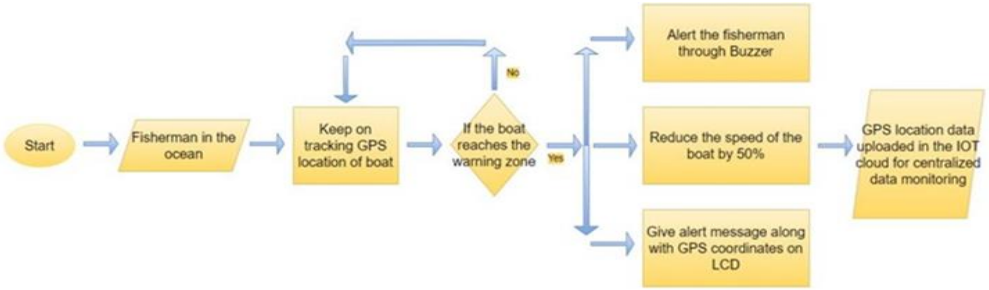

Fig 6. Working flow chart.

5. Conclusion

The internet of things-based fishermen border security alert system that is being proposed is a fully embedded system that handles all aspects of data acquisition, processing, actuator activation in response to sensor triggers, and cloud uploading of the data for centralized data monitoring—all without sacrificing accuracy. With an accuracy of two meters, which is industry standard, this device actively tracks the location of the boat and transmits the data to the cloud. And if the border is crossed, the warning system will notify the fishermen. Additionally, the boat's speed will be lowered by 50% via the engine control unit. In the event that foreign nations capture our fishermen on our soil, the centralized data hub may be watched over by naval troops, and we can demand justice. So, a productive system aids in preventing fishermen.

6. References

1. KT Krishnamurthy. A Low-Cost Embedded Sea Navigation and Security Systems for Fisher Man", International Conference on Networking, Embedded and Wireless Systems, 2018.
2. E Krishnamoorthy, et al. Border alert system and emergency contact for fisherman using RSSI, 2017.
3. International Conference on Information, Communication & Embedded Systems (ICICES 2017).
4. V Ulagamuthalvi, G Kulanthaivel, A Jesudoss, Anudeep A Sharma. "IoT-Based Nautical Tracing System," 2019 International Conference on Intelligent Computing and Control Systems.
5. Design of border alert system for fishermen using GPS. International Journal of students Research in Technology & Management. 2014; 2(02).
6. R Dinesh Kumar, MS Aldo JCF Joseph. Alert system for fishermen crossing border using Android," International Conference on Electrical, Electronics, and Optimization Technique, 2016.
7. K Suresh Kumar, K Sharath Kumar. Design of low-cost maritime boundary identification device using GPS system", International Journal of Engineering Science and Technology, 2010.
8. Jim Isaac. The paper titled as Advanced border alert system using GPS and with intelligent Engine control unit International Journal of Electrical and Computing Engineering, 2015.
9. R Karthikeyan, A Dhandapani, U Mahalingham. Protecting the Fishermen on Indian Maritime Boundaries, Journal of Computer Applications.