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Live Streaming Fisherman Border Security System Using Radio Frequency Technology

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Abstract

The issue of border cross brutality is a significant problem that arises due to the difficulty in identifying water borders between neighbouring nations. This challenge often results in fishermen coming under attack by opposing fleets. Fishermen's lives are at risk as they may face gunfire or abduction. This problem requires an urgent solution to safeguard the lives of these fishermen and ensure better border security. To address this issue, an embedded system has been developed that utilizes advanced technology to alert border authorities of fishermen's whereabouts. This device uses Global Positioning System and radio frequency technology to track the location of the fishermen. When the fishermen are in danger, they can use a built-in panic button that triggers a buzzer sound, which alerts the authorities. This system is designed to ensure quick response times and ensure the safety of the fishermen. The embedded device also includes a feature that enables it to record the surroundings when the panic button is pressed. This feature ensures that the coastal guards have access to live footage of the situation and can make informed decisions. The coastal guards can receive live alerts via their application, which enables them to take immediate action. This technology-based solution is a significant step towards safeguarding the lives of fishermen and improving border security. It is hoped that this device will help to reduce the incidents of border cross brutality and create a safer environment for the fishermen. Overall, the development of this embedded system-based device is an important step towards addressing the challenges of border cross brutality and ensuring the safety of those who risk their lives every day to make a living.

Key Words: Embedded system, Global Positioning System(GPS), Radiofrequency technology, Border cross brutality

I. Introduction

The fishermen border security application has an innovative and practical solution to enhance border security in coastal areas. By utilizing Radio Frequency technology and live streaming capabilities, the application can provide real-time monitoring and tracking of fishing boats and vessels in the area. To make the monitoring more effective, live streaming capabilities can be added to the system, allowing for real-time video and audio feedsto be transmitted from the boats to a central monitoring station. This would enable security personnel to visually inspect each boat and identify any suspicious activity or behaviour. The system can also be equipped with sensors to detect and track other vessels, such as those engaged in smuggling or illegal fishing activities. This data can be combined with live streaming video feeds to provide a comprehensive view of the maritime environment.

Radio Frequency techniques are used to transmit and receive information over long distances

without the need for physical connections. This is accomplished by converting information, such as voice or data, into electromagnetic waves that are transmitted through the air using an antenna. The waves are then received by another antenna and converted back into the original form of the information. RF technique used in border security for fishermen is the Automatic Identification System. AIS is a system used to track and monitor the movements of ships and vessels in real-time. It uses RF signals to transmit vessel identification, position, and other relevant information to other vessels and shore-based stations. By monitoring AIS data, border security officials can track fishing vessels in border areas and detect any unauthorized or suspicious activity. Another RF technique used in border security for fishermen is the use of radio frequency identification tags. RFID tags can be attached to fishing gear, such as nets and traps, to track their location and movements. By monitoring RFID data, border security officials can detect any suspicious activity, such as the use of illegal fishing gear or fishing in prohibited areas. RF techniques can be used in conjunction with other technologies, such as cameras and sensors, to provide a comprehensive and integrated border security solution for fishermen. For example, cameras and sensors can be used to detect and track fishing vessels, while RF techniques such as AIS and RFID can be used to identify and monitor individual vessels and their activities. RF techniques can play an important role in border security applications for fishermen by providing realtime monitoring and detection of suspicious activity, helping to prevent illegal fishing and protect sensitive border areas.

Global Positioning System technology plays a crucial role in border security applications for fishermen by providing real-time tracking and monitoring of fishing vessels and their activities. GPS is a satellite-based navigation system that provides location and time information anywhere on the planet. GPS receivers can be installed on fishing vessels, enabling border security officials to track their location and movements in real-time. This allows officials to monitor fishing activities in sensitive border areas and detect any unauthorized or suspicious activity. GPS create electronic maps that display the location and movements of fishing vessels over time. This data can be used to identify patterns of fishing activity, such as areas where illegal fishing is occurring or where endangered species are being targeted. GPS technology can also be used to enforce fishing regulations and prevent violations. For example, fishing vessels can be required to remain outside 3 certain areas or to adhere to specific fishing quotas. GPS can be used to monitor compliance with these regulations and detect any violations in real-time. GPS technology can be integrated with other technologies, such as cameras and sensors, to provide a comprehensive and integrated border security solution for fishermen. For example, GPS data can be combined with camera footage to provide visual confirmation of fishing activities in sensitive areas. GPS technology plays a critical role in border security applications for fishermen by providing real time tracking and monitoring of fishing vessels, helping to prevent illegal fishing and protect sensitive border areas.

The ESP32 is a powerful microcontroller that can play a significant role in border security applications for fishermen. Here are some examples of the role of the ESP32 in such applications: Real-time tracking: The ESP32 can be used to create a real-time tracking system for fishing vessels. By integrating the ESP32 with GPS technology and wireless communication protocols such as Wi-Fi or Bluetooth, border security officials can track the location and movements of fishing vessels in real-time. Environmental monitoring: The ESP32 can be used to create a real-time tracking system for fishing vessels. By integrating the ESP32 with GPS technology and wireless communication protocols such as Wi-Fi or Bluetooth, border security officials can track the location and movements of fishing vessels in real-time. Environmental monitoring: The ESP32 can be used to monitor environmental parameters such as water temperature, salinity, and oxygen levels. This data can be used to identify areas where illegal fishing is occurring or where endangered species are being targeted. Image processing: The ESP32 can be used to process images captured by cameras on board fishing vessels or at fixed locations in sensitive border areas. By analysing the images in real-time, border security officials can detect any 4 unauthorized or suspicious

activity. Secure communication: The ESP32 can be used to implement secure communication protocols to protect sensitive data such as GPS locations, environmental data, and images. This can be critical in preventing unauthorized access to this data. Automation: The ESP32 can be used to automate various tasks in border security applications for fishermen, such as controlling cameras and sensors, processing data, and alerting officials of suspicious activity. Overall, the ESP32 can be a valuable tool in border security applications for fishermen by providing real-time tracking, environmental monitoring, image processing, secure communication, and automation capabilities.

II. LITERATURE SURVEY

The system was created in a way that will allow it to continue operating for a very long period. Rechargeable batteries were utilised to power the whole system and a solar panel was also installed so that the solar panel could continue to charge. This allowed the systems to remain operational for a longer period of time. As long as there is light in the sky, the battery will be virtually completely depleted during the day. Additionally, the power unit now has a Liquid Crystal Display that displays the status of the tracking and communication unit's charging, its battery life, and whether it is on or off. the tracking and communication component that informs the coast guard/rescue squad of the boat's location. GPS is used in the tracking and communication device. [1]

The fishermen can know their current location from the beach thanks to several existing devices. However, the "fisher friend mobile application" Android app serves as the foundation for this system. Even if the fisherman miss the system's initial signal, the boat automatically reverses course once it reaches the border, which was highlighted as one of the suggested modules' benefits. The lives of fisherman are saved. protects fishermen's property against loss. protects the nation from unwarranted conflict with its neighbours. One of the few drawbacks was that current engine systems must be converted to DC stepper motors. need position-controlled gadgets and a steady power source, which adds weight and expense. [2]

The permit minimum effort oceanic security framework is primarily focused on small-scale anglers who live just below the poverty line. This security-ready framework includes a transmitting unit that includes all data and interfaces with ready framework and remote sensors, a processing unit that determines the correct position of the vessel using limitation calculations, and a receiving unit that displays the entire transmitter and PC control process. The detailed development of the proposed framework is discussed in the sections that follow. With the use of RSSI and in addition to using personal waterfront protection, this framework is used to designate the regions and boundaries of three stages in seashores. [3]

Which level of intensity is suitable in which circumstance is determined by a user notification profile. Availability of the user who needs to be alerted or the user's present location may affect how intense the notifications are. Consideration of other people's co-presence is another choice. The notification profiles are generally dynamic and enable users to consider all available context data. Users have the option to mix the various parameters when modifying their unique user notification profiles to determine the right amount of intensity for different circumstances. An ANS conflict method is used to resolve conflicts when a user sets settings that are incompatible. The user has the option of using or modifying one of the predefined profiles. A standard profile is utilised if a user hasn't established a notification profile. The user notification process operates as follows. The Controller delivers a notification event to the Notifier if a rule in the Controller evaluates to true. The event is turned into a notice by the Notifier. A message, a user's ID who needs to be alerted, and application references are all included in an event. The Notifier first chooses the appropriate level of notification intensity. It accomplishes this by locating the pertinent user notification profiles. The Notifier consults the Event Monitor if further context parameters are required to decide the level of the notice. [4]

Designing context-aware apps that can utilise devices like GPS, web services, and webcams to deliver location-aware computing is made much easier with the help of the Android operating system. Technology advancements have made it

possible for applications to have tailored user interfaces that can connect directly to hardware, creating new possibilities for ubiquitous computing. An example of one of these applications is an attendance management system, which uses an electronic card with the essential data to track employee attendance. Password-based authentication is used to confirm attendance, and the card is put into a device that logs the time and other data to a server system. The same ideas may be used to create a border security programme for fisherman that will assist keep them from entering the borders of other nations. It is possible to create an Android application that uses RF technology and live streaming capabilities to track and monitor nearby fishing boats in real-time. This might increase border protection in coastal areas and save the lives of numerous fisherman. [5]

The explanation of a distributed system that offers remote location and diagnostic monitoring of on-road vehicles using an OBSB and GPRS. With the potential to be preprogrammed with the acceptable speed limits, this technology allows a highly accurate and reliable supervision from within the vehicle. Overspeeding, which is one of the primary causes of accidents in many countries, might be greatly reduced as a result. The system also transmits other critical data, like the vehicle's real-time location, to a distant server. The transmitted parameters can be utilised for a number of activities, such as remote engine diagnostics, automatic accident notification, accident investigations, and vehicle path tracking for stolen cars. They are maintained in the server's memory for a configurable period of time of a functional system [6]

The primary screen shows the number of defective parts, vehicle speed, top permissible speed, citations issued, and connection status. The GPS screen displays the current vehicle position's latitude and longitude, which are utilised to determine the top speed limit. Both a voice message and a warning message urge the driver to slow down when the maximum speed limit is exceeded. This caution will only be in force for a brief period of time. In the event that the driver does not respond to the warning message within the specified period, a driving citation will be generated and sent to the remote server of the traffic control authority. [7]

There is a substantial amount of research on LBS and many of these services have been tried and used. The best examples of these applications are traveller information systems. These software give information to passengers while taking into account where they are right now. Location-based services provide consumers tailored services based on their current location by utilising the Global Navigation Satellite System, Geographic Information Systems, and Wireless Communication Technologies. LBS offers a tool for efficient administration and continual control in the modern environment. More people are using LBS in their daily lives and businesses to help them achieve their goals. Due of the growing need for commercial LBS, scientists are focusing on creating more accurate location algorithms. It connects people to sites of interest using precise, real-time location and informs them of the present circumstances, such as the traffic and weather, or it offers routing and tracking information utilising wireless devices. In order to satisfy the requirements of LBS, which is regarded as one of the most promising uses of GIS, it is crucial to connect mobile computing with GIS technology. [8]

The RSSI, which measures the relative signal strength in wireless networking, is usually available to users of IEEE 802.11 equipment. The intensity of the Radio Frequency signal is measured by a produced hardware kit fitted on a boat using the Received Signal intensity Indicator, which is similar to the signal strength indicators on mobile phones. The signal strength is used to divide the ocean into safe, intermediate, and dangerous zones in order to keep fisherman safe and stop them from straying outside international maritime limits. The recommended method helps with obstacle detection, maritime traffic management, and preventing unauthorised transactions. They centralise control room operations to guarantee the security of fisherman. [9]

As the boat passes borders, an RFID scanner on board finds RF tags. When fisherman breach the first two boundaries, the warning systems warn them using voice boards and LCD displays, and the Indian government receives messages about the fishermen nearby. The boat and motor are

automatically disconnected from the relay switch and two messages are sent to the two governments upon crossing the third border. Fishermen can get back to the safe area by pressing an emergency button. Even at night, the embedded system, which uses ARM Microcontroller, GSM, and RFID technology, assists fisherman in avoiding unauthorised crossings and guards against naval arrests and shootings. [10]

The location-based catastrophe management system is a mobile application for Android that makes use of OpenStreetMap (OSM), Google C2DM, and catastrophe Management Server as a third-party server. On the application's map, users in potential disaster-affected areas may get disaster alerts and assistance with evacuation. The system enables the authorities to keep track of the status of the evacuation in real-time. The largest problem, however, is the lack of knowledge of Bangladesh's OSM, which may be resolved with more volunteers. Future objectives include implementing an extra server-side application to automate the process of identifying disaster-prone places as well as an additional application for rescue and relief operations. The proposed system consists of Android, DMS, and users with national IDs. The system uses a modified version of the Ray Casting Algorithm to identify whether the user is in an area that will likely be affected by a disaster and then sends out visual and audible early warning alerts. [11]

Iii Proposed System

The planned border alert system aims to provide protection to fishermen and promote good relations between states that share a sea border. The system utilizes GPS technology and radio frequency techniques to send and receive signals between the seashore and the fishermen's boat.

Technology

The system uses a handheld module with a NODEMCU (ESP8266) controller,GPS connection, and buzzer. The module also has an embedded button that connects the base station to live broadcasting when pressed by the fisherman. A transmitter is set up on the seashore, and a receiver is installed on the boat to receive signals emitted by the transmitter.

Signal Transmission

The transmitter emits signals according to the strength of the antenna, and the receiver can only receive signals within the distance of the transmitter's signal. This wireless communication is made between the seashore and the fishermen's boat using radio frequency techniques. Location Retrieval If the receiver is unable to receive signals from the transmitter, the GPS on the handheld module will retrieve the specific boat's current latitude and longitude. The location information is transmitted to the base station's web application through a local server.

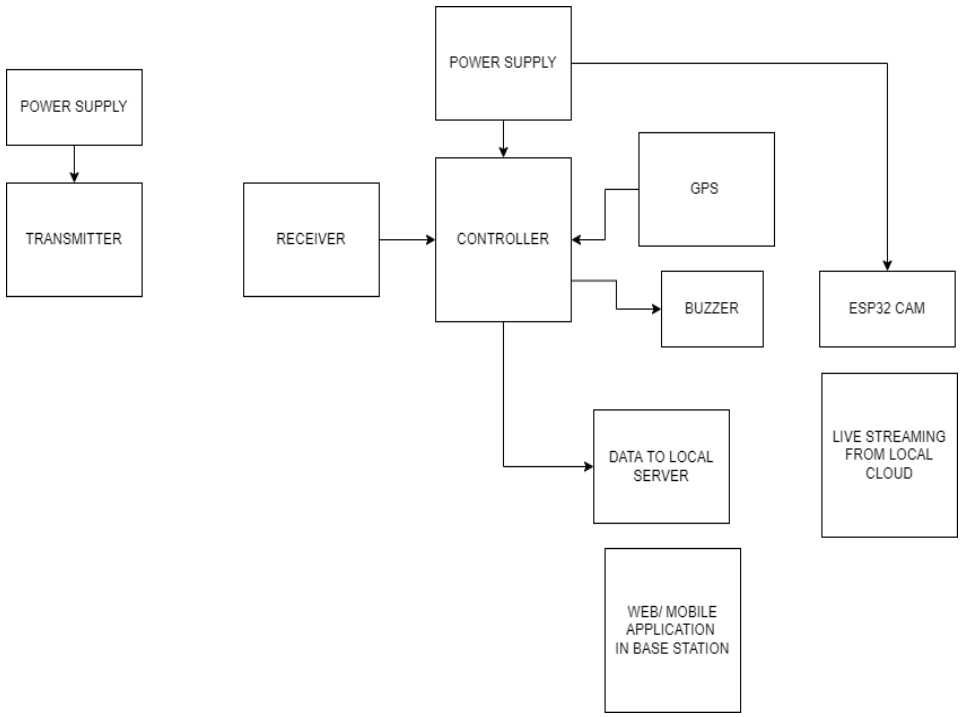
Alarm System

Once the boat crosses the border, the buzzer on the handheld module will sound an alarm, indicating that the border has been crossed.

Emergency Button

The handheld module has an integrated panic button connected to the power supply. If there is a problem, the fishermen can press that button, and the ESP 32 CAM will use live streaming to connect from the boat to the online application. The web application can access the local cloud storage here the live broadcasting is kept for later retrieval.

BLOCK DIAGRAM



Functionality

Hardware components for the system include a transmitter and receiver, LCD display, ESP32 camera, NODEMCU, GPS, and buzzer. To create the web application, software tools like the Arduino programming environment and libraries are needed. An application for Fishermen border protection will be created by merging the hardware and software elements. Create a live video broadcast using the ESP32 camera: To programme the camera to send live video over the internet, use either the Arduino IDE or the ESP32 SDK. You must set up an IP address for the camera and link it to a WiFi network.

Create a web application to display the live video stream: Web development framework like React or Vue.js to create a web application that displays the live video stream from the ESP32 camera. IP address of the camera is used to connect to the stream.

Add GPS functionality to track the location of the fishermen: Use the NodeMCU and GPS module to track the location of the fishermen. GPS libraries areused to parse the GPS data and send it to the web application.

Set up a notification system using the buzzer: Use the NodeMCU and buzzerto create a notification system that alerts the fishermen when they are in a restrictedarea or when the coastal guards need to contact them. Buzzer libraries to playdifferent tones or melodies depending on the notification.

Test and refine the application: Once you have all the components workingtogether, test the application in a real-world environment to ensure that it functionsas expected. You may need to refine the application based on feedback fromfishermen or coastal guards.

Once all the components are working together, the application is tested in areal-world environment to ensure that it functions as expected. The applicationmay need to be refined based on feedback from fishermen or coastal guards.

MODULES

- Integrating Transmitter and Receiver
- Integrating Node MCU
- Integrating GPS
- Integrating ESP32 Camera
- Integrating Buzzer
- Integrating all components with web application

INTEGRATING TRANSMITTER AND RECEIVER

Choosing Radio Frequency (RF) modules: RF modules come in differentfrequencies and power ratings. RF module has chosen that meets the applicationrequirements, such as the distance between the transmitter and receiver, and the datarate.

Setting up the transmitter module: The ESP32 camera must be linked to the transmitter module,

which must then be configured to relay the live video stream. Select the most appropriate modulation method for the data and calibrate the transmission's frequency and power.

Setting up the receiver module: The sent data must be received by the receiver module, which is linked to the Node MCU microcontroller. Choose the modulation method and transmitter frequency for the receiver. an assessment of communication The transmitter and receiver modules should be tested for good inter-module connectivity. Use of an oscilloscope or logic analyzer to watch the signals and data being sent and received is possible.

Integrating the RF communication with the web application: The module may be incorporated with the web application when the RF communication has been successfully tested. The video feed is shown on the web application using the Node MCU's IP address. GPS data is also used to show the fishermen's location on the LCD screen. The specific latitude and longitude of the boat are displayed on the LCD display thanks to a connection to the node MCU.**(Refer fig A.2.1)**

INTEGRATING NODE MCU

NODE MCU has grown weary of writing requirements-compliant embedded C code. Join the Wi-Fi network to the Node MCU board: With the help of its integrated Wi-Fi module, the Node MCU board may join a Wi-Fi network. Use the Arduino IDE or the Node MCU firmware to configure the Wi-Fi network credentials on the Node MCU board.

Connect the GPS module to the Node MCU board: Connect the GPS moduleto the Node MCU board using the serial communication protocol. The Node MCUboard has multiple hardware serial ports, which can be used to communicate withthe GPS module.

Connect the buzzer to the Node MCU board: Connect the buzzer to one of thedigital pins of the Node MCU board. The buzzer can be triggered by setting thecorresponding digital pin to high or low.

Write the code for the Node MCU board: Using the Arduino IDE or the Lua programming language, create the code for the Node MCU board. When the fisherman reach the predetermined boundary point, the buzzer should be activated by the code, which should also communicate the GPS data to the web application via the Wi-Fi module.

Integrate the Node MCU board with the web application: Integrate the NodeMCU board with the web application using a communication protocol such asMQTT or HTTP. The Node MCU board should be able to send GPS data to the webapplication in real-time.**(Refer fig2.2.2)**

INTEGRATING GPS

Latitude and longitude information for the boat can be obtained using the Global Positioning System (GPS). Select a GPS that satisfies the module's specifications. affix the GPS module: Use the proper wiring to connect the GPS module to the Node MCU microcontroller. You must connect the GPS module's TX pin to the microcontroller's RX pin and vice versa since the majority of GPS modules communicate using a serial interface, such as UART.

Configure the GPS module: Set the GPS module to output the required information, including latitude, longitude, and altitude. The NMEA 0183 protocol, which comprises of sentences carrying data on the GPS position, time, and other characteristics, is used by the majority of GPS modules to communicate data. To parse NMEA words and retrieve the necessary data, libraries are utilized.

Integrate the web application with the GPS data: Integrate the GPS data with the web application once it has been retrieved. Using a mapping tool like Google Maps or Leaflet to show where the fisherman are. The fishermen will receive alerts via GPS data if they depart from a predetermined area or become in distress. **(Refer fig 2.2.3)**

INTEGRATING ESP32 CAMERA

Live streaming from a specific place to a web application may be connected using an ESP32 camera. Pick an ESP32 camera that satisfies the specifications, including the picture quality, resolution, and price. Incorporate the ESP32 camera module: Utilise the proper wiring to join the microcontroller and ESP32 camera module. The majority of ESP32 camera modules communicate using a serial interface, such as UART or I2C, thus you must connect the camera module's TX and RX pins to the microcontroller's RX and TX pins..

Set up the ESP32 camera module: Configure the ESP32 camera module to take the required pictures or videos. Most ESP32 camera modules

include integrated libraries that allow for image or video capture and network transmission.

Integrate the camera data with the web application: Integrate the camera data with the online application once it has been configured. Streaming library such as WebRTCor RTSP is used to stream the video data to the web application. Cloud-basedservice such as AWS or Google Cloud can be used to store the video data andprovide access to authorized users.

INTEGRATING BUZZER

Buzzer can be used to alert the fishermen when he crossed the border. Thereare many types of buzzers available in the market with different features andspecifications. Choose a buzzer that meets the requirements such as the soundintensity, power consumption, and cost.

Connect the buzzer to the microcontroller: Connect the buzzer to the microcontroller using the appropriate cable. Most buzzers have both a positive pin and a negative pin. Connect the microcontroller's negative pin to ground and its positive pin to a digital pin.

Program the microcontroller to trigger the buzzer: By programming the microcontroller, you can cause the buzzer to sound when the fishermen reach the border. The comparison between the fishermen's GPS position and the predetermined boundary location should be the conditional statement. The buzzer should be activated by the microcontroller to warn the fisherman if they cross the border. **(Refer fig 2.2.4)**

Integrating All Components With Web Application

Integrating all the hardware components with the web application forfishermen border security application requires the following steps:

Develop a web application: Develop a web application that can interface withthe hardware components. The web application should be capable of receiving datafrom the hardware components, processing it, and displaying it to the user in ameaningful way.

Configure the microcontroller: Configure the microcontroller to send data tothe web application. This can be achieved using the microcontroller's built-in Wi-Fior Ethernet module. Configure the microcontroller to connect to the web applicationusing the appropriate network credentials.

Stream video data: Use a streaming protocol such as RTSP or WebRTC tostream video data from the ESP32 camera module to the web application. This willenable authorized users to monitor the activities of the fishermen in real-time.

Transmit GPS data: Use the GPS module to transmit GPS data to themicrocontroller, which can then be sent to the web application. Real-time position tracking of the fishermen is possible using GPS data.

Trigger the buzzer: The buzzer should be activated by a conditional statement in the microcontroller code when the fishermen pass the predetermined border spot. The buzzer can notify both the coast guards and the fishermen of the boundary crossing.

Store data in the cloud: Use a cloud-based service such as AWS or GoogleCloud to store the data transmitted by the hardware components. This will provideauthorized users with access to historical data, allowing them to analyse trends andidentify potential issues. **(Refer fig 2.2.5)**

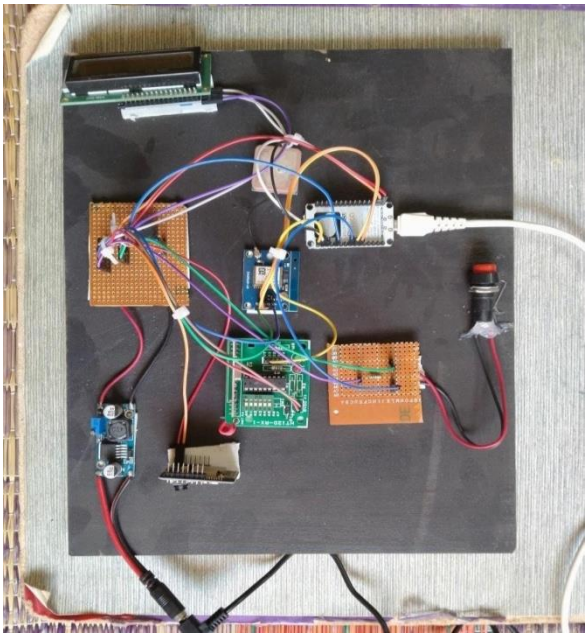


Fig :A.2.1Connectingdevice

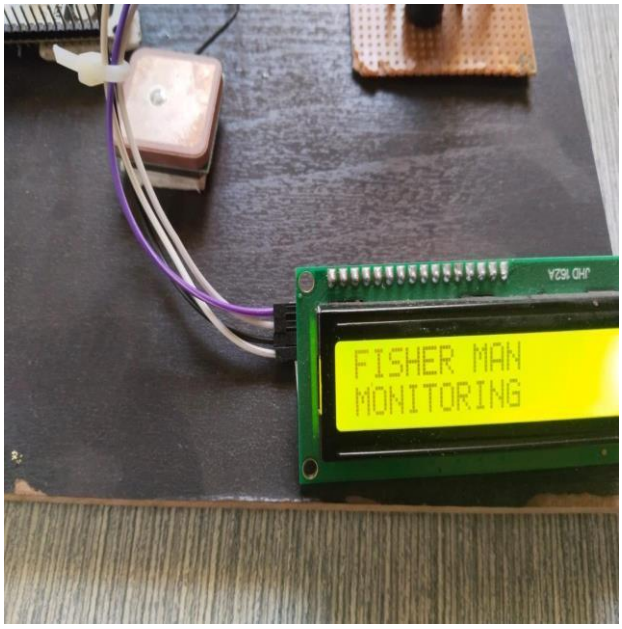


Fig:A.2.2Monitoringfishermen

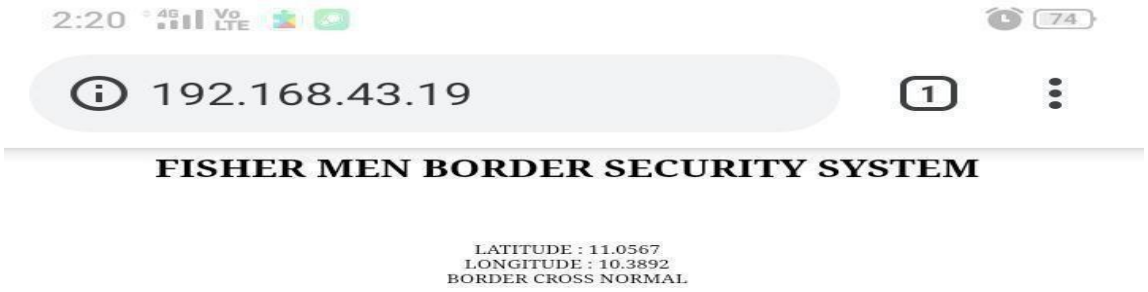
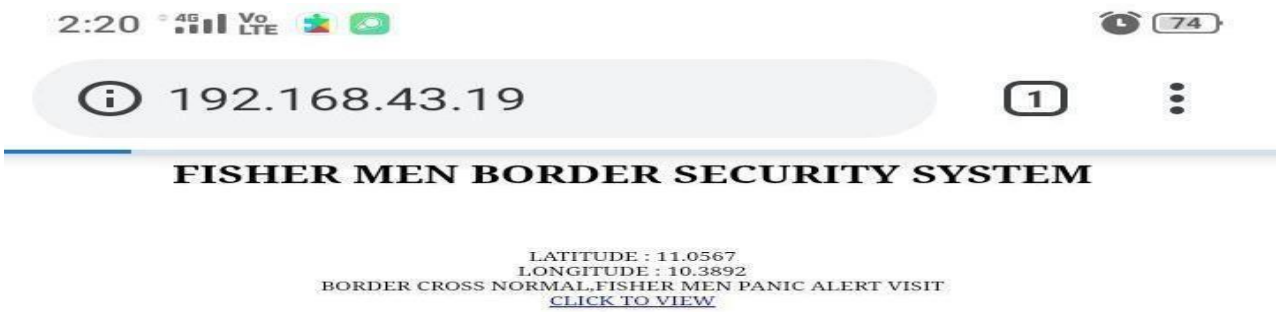


Fig :A.2.3Viewlatitudeandlongitudevalue



FigureA.2.4DisplayofPanicAlert

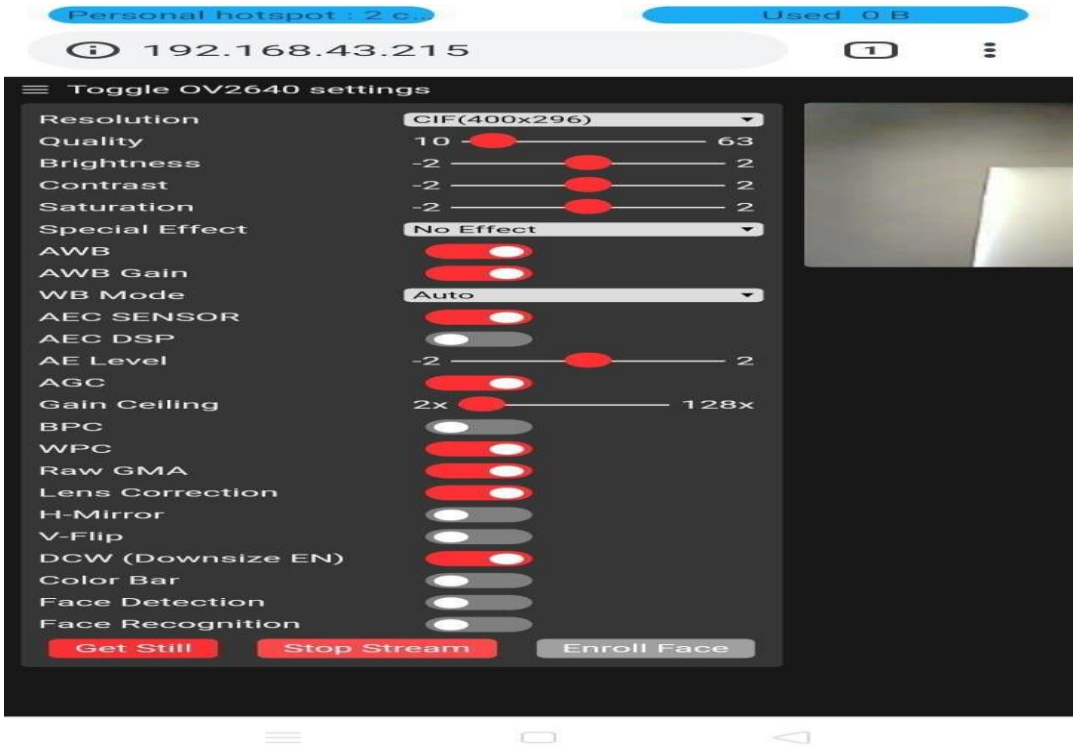


Fig :A.2.5ViewLivestreaming

Iv Conclusion

The launch of a border alert system for fisherman driven by a 20-pin Node MCU microcontroller that has the ability to burn one program while executing another. The system is dependable, adaptable, and requires little upkeep. The proposed alert system will effectively address the issue of fishermen and stop them from crossing international borders. Numerous fishermen's lives could be saved by the program. The program functions as an automatic incident management tool that alerts the user whenever a border crossing takes place. The alarm is used to identify the fisherman if the sailor crosses the boundary, and the coast guard is alerted. The proposed solution makes use of GPS technology to maintain fisherman safety. The evaluation found that the system locates users with 99% accuracy and transmits data in just a few seconds, enabling fishermen to immediately inform rescue teams to their location in the event of an emergency. Because fishermen will be able to contact the coast guard using the suggested system in case of an emergency, it will help to save many fishermen's lives. The project's major goal is to keep the relations between the two nations cordial.

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