SMART MARINE BORDER MONITORING AND FISHERMAN SAFETY ALERT SYSTEM

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Abstract: *Fishermen operating near the International Maritime Boundary Line (IMBL) often face serious security threats due to unintentional border crossings, especially in countries like India where coastal communities largely depend on fishing for their livelihood. Due to a lack of awareness or clear demarcation of marine boundaries, fishermen may unknowingly cross into neighboring territorial waters, leading to life-threatening consequences. To address this critical issue, our project introduces a device named Weather Predictor and Land Locator for Fishers. This device aims to alert fishermen when they approach or cross maritime borders using RSSI (Received Signal Strength Indicator) technology. The system continuously monitors the boat's position and transmits border-crossing alerts to a control room, where the data is visualized using terminal software and also sent as SMS alerts through platforms like Thing Speak. Additionally, the project incorporates a DHT11 sensor to monitor temperature and humidity, and an ADXL sensor to detect abnormal wave activity. If the wave conditions become hazardous, a buzzer is activated to warn the fishermen in real time. All information is displayed on an onboard LCD screen, ensuring fishermen stay informed of their surrounding weather conditions. The entire system is powered by a solar panel, with energy stored in a rechargeable battery, making it suitable for marine environments.*

Key Word*: IoT, Maritime Boundary Alert, RSSI, ESP8266, DHT11 Sensor, ADXL Sensor, Thing Speak, LCD Display, Buzzer Alert, Solar Power, Real-Time Monitoring, Weather Detection, IMBL (International Maritime Boundary Line)*

I.INTRODUCTION

India has a vast coastline and a large community of fishermen who rely on marine resources for their livelihood. However, traditional fishing practices often lack modern safety and monitoring mechanisms, putting fishermen at risk of unknowingly crossing international maritime boundaries or encountering hazardous weather conditions. These challenges necessitate the adoption of advanced technologies to ensure safety, efficiency, and compliance in marine operations.

Recent developments in the Internet of Things (IoT) have enabled real-time tracking, environmental monitoring, and communication in remote maritime regions. Traditional safety methods often fail to provide timely alerts or location-based information, leaving fishermen vulnerable. To address this, we propose an IoT-based safety system integrated with sensors and alert mechanisms to enhance maritime safety and monitoring.

The key contributions of this project can be summarized as follows:

1.Development of an IoT-enabled alert system for monitoring fishermen location and environmental conditions in real time.

2.Integration of RSSI-based signal tracking, DHT11 for weather monitoring, and ADXL for motion detection to ensure multi-level safety.

3.Provision of a user-friendly interface using LCD display and buzzer alerts to notify fishermen when nearing the International Maritime Boundary Line (IMBL).

4.By leveraging smart sensors, solar power, and real-time data visualization through Thing Speak, this project aims to improve marine navigation, reduce risks, and promote safer fishing practices.

II.LITERATURE REVIEW

[1] Ramesh, K.; Balan, S. IoT-Based Maritime Boundary Alert System for Fishermen. This study presents an IoT system using GPS and GSM modules to alert fishermen near restricted zones. The system enhances marine safety by transmitting real-time location and sending SMS alerts when the vessel approaches the international boundary.

[2] Priya, D.; Kumar, R. Smart Alert System for Fishermen Using IoT. This paper proposes an IoT-based alert mechanism using GPS, GSM, and sensors. The approach focuses on real-time tracking, boundary alerts, and remote monitoring, demonstrating improved response time and enhanced awareness of maritime zones.

[3] Sharma, P.; Anand, R. Implementation of Sensor-Based Safety Measures in Fishing Boats. This research integrates sensors like DHT11 for weather and ADXL for motion detection in fishing boats. The study emphasizes real-time data collection and alert systems, promoting safer navigation and reducing risks at sea.

III.EXISTING SYSTEM

Conv Traditional fishermen safety systems largely rely on manual methods, limited communication technologies, or standalone GPS devices. These systems often fail to provide real-time alerts or tracking, leading to delayed responses during emergencies or maritime boundary violations. Communication gaps and lack of automation reduce overall effectiveness.

Manual Monitoring: In many regions, fishermen depend on printed maps or radio signals to detect boundaries, which are outdated and prone to errors in navigation or decision-making.

GPS Only Devices: Basic GPS tools are used to determine location but lack integration with communication modules or alert mechanisms, providing no proactive warnings or automated updates.

Lack of Sensor Integration: Existing methods typically do not use sensors to monitor weather conditions or boat movement, limiting the system's ability to detect danger or abnormal events in real-time.

IV.DISADVANTAGES

1.Limited Communication Range
Traditional RF-based systems have a restricted coverage area, making them ineffective for long-distance maritime applications. Fishermen operating far from shore may not receive timely alerts.

2.Lack of Real-Time Alerts
Existing systems do not provide immediate notifications for boundary violations or hazardous weather conditions, delaying response times and increasing risks at sea.

3.Inaccuracy in Border Detection
RF signals are prone to interference and may not accurately determine precise locations near maritime borders, leading to potential false alerts or missed warnings.

4.No Integrated Weather Monitoring
Current systems do not analyze environmental conditions such as wave intensity, temperature, and humidity, leaving fishermen vulnerable to unexpected storms and rough sea conditions.

V.PROPOSED METHODOLOGY

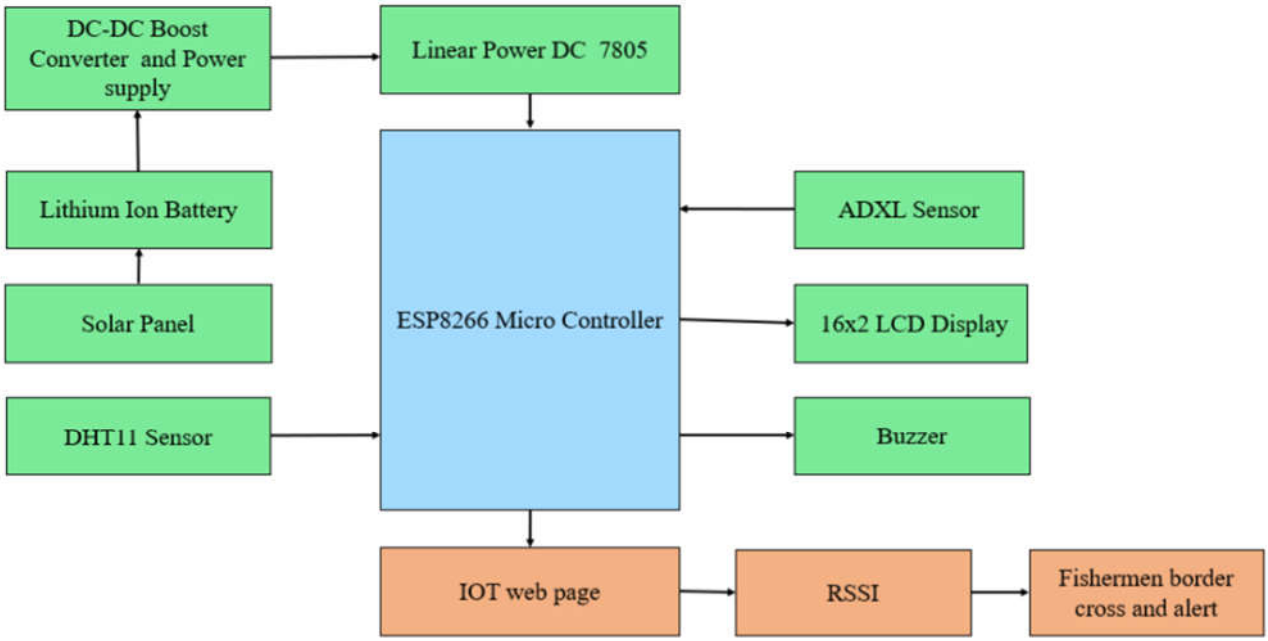
The proposed system is a compact, solar-powered safety device designed to assist fishermen by integrating border detection and environmental monitoring technologies.

• The core components of the system include an RSSI module for detecting proximity to the International Maritime Boundary Line (IMBL), a DHT11 sensor for measuring temperature and humidity, and an ADXL accelerometer to monitor wave intensity and detect rough sea conditions.

• When a fisherman approaches or crosses the maritime border, the RSSI signal strength drops below a predefined threshold, triggering an alert that is displayed on an LCD screen and accompanied by a buzzer warning.
• Simultaneously, real-time data including sensor readings are transmitted via an IoT platform like Thing Speak, and an SMS alert is sent to a central control room for monitoring and response.

• The system ensures continuous operation using a solar panel that charges a battery, making it suitable for long fishing trips without dependency on external power sources.

• By combining location awareness with weather forecasting and sea condition alerts, the proposed system aims to significantly reduce the risks faced by fishermen, promoting safer navigation and improved communication with coastal authorities.



BLOCK DIAGRAM

Alert Generation
1.Fishermen Notification: in mobile and Thing Speak Website
LCD displays real-time warnings.
A buzzer is activated if danger is detected.

Result Display
Fishermen View: LCD shows boundary alerts and weather updates.
Control Room Monitoring: Terminal software displays received alerts for immediate action.

This methodology ensures enhanced maritime safety, reduces border violations, and provides real-time environmental awareness, ultimately protecting fishermen from potential threats at sea.

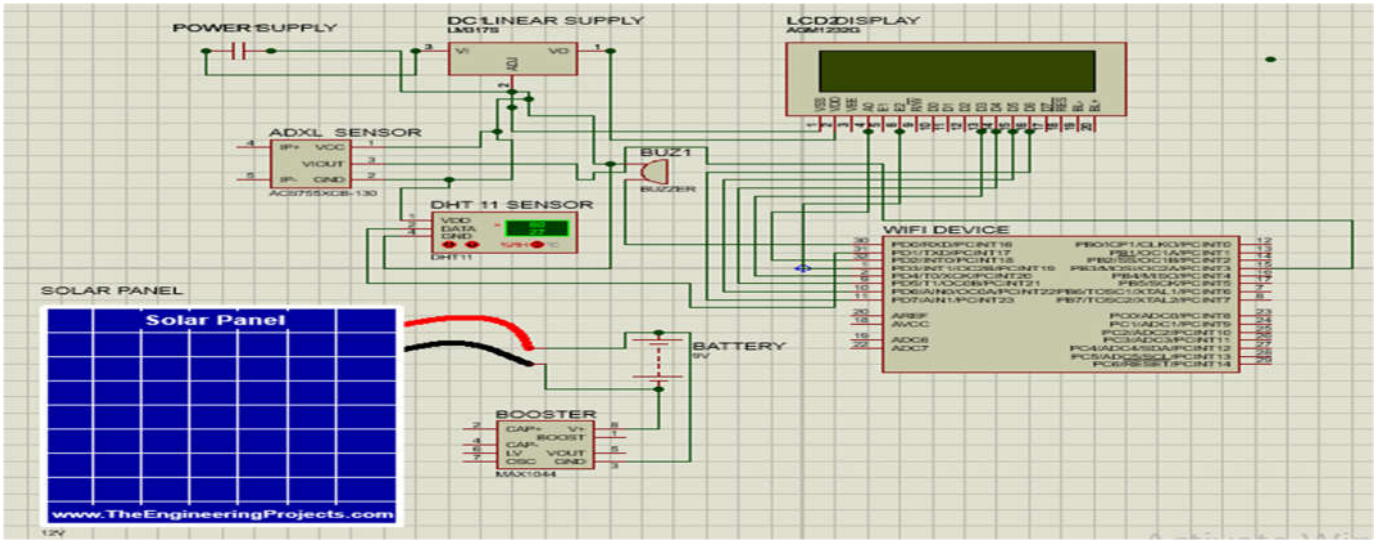
VI.ADVANTAGES

The system continuously monitors temperature and humidity using the DHT11 sensor, providing real-time weather updates to fishermen. This helps them make informed decisions, ensuring safety while fishing.

• The ADXL sensor tracks water wave conditions and alerts fishermen with a buzzer if the waves become uneven. This early warning enhances safety by preventing accidents caused by rough seas.

• Virtual boundaries are set using RSSI data to detect border crossing. If a fisherman crosses the boundary, the system triggers an alarm and alerts the control room to prevent accidental violations.
• The system operates on solar energy, making it eco-friendly and sustainable. This eliminates the need for external power sources and ensures reliable operation while out at sea.

VII.CIRCUIT DIAGRAM



VIII.APPLICATION

1.Border Alert Mechanism: Warns fishermen when nearing international maritime boundaries using RSSI signals, preventing accidental border crossings.

2.Safety Monitoring: Monitors sea conditions like wave activity and alerts fishermen during emergencies, enhancing safety at sea.

3.IoT-Based Remote Surveillance: Sends real-time location and safety data to authorities via platforms like ThingSpeak for timely monitoring.

4.Solar-Powered Operation: Ensures uninterrupted performance in remote marine areas through renewable energy support.

5.Easy-to-Use Alert Interface: Provides instant alerts via buzzer and LCD display, enabling fishermen to act quickly and effectively.

IX.RESULT AND CONCLUSION

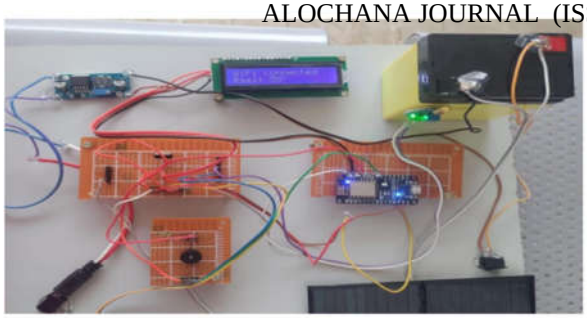


Fig1.LCD Displaying WIFI Connectivity and RSSI Value

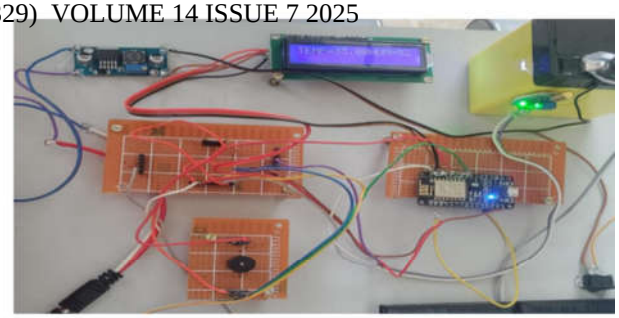


Fig2.LCD Displaying Temperature and Humidity Value

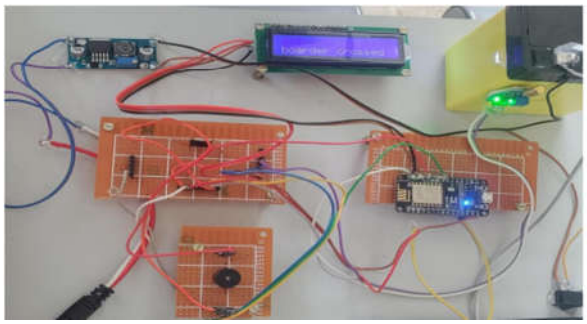


Fig3.LCD Displaying The Message "Border Crossed"

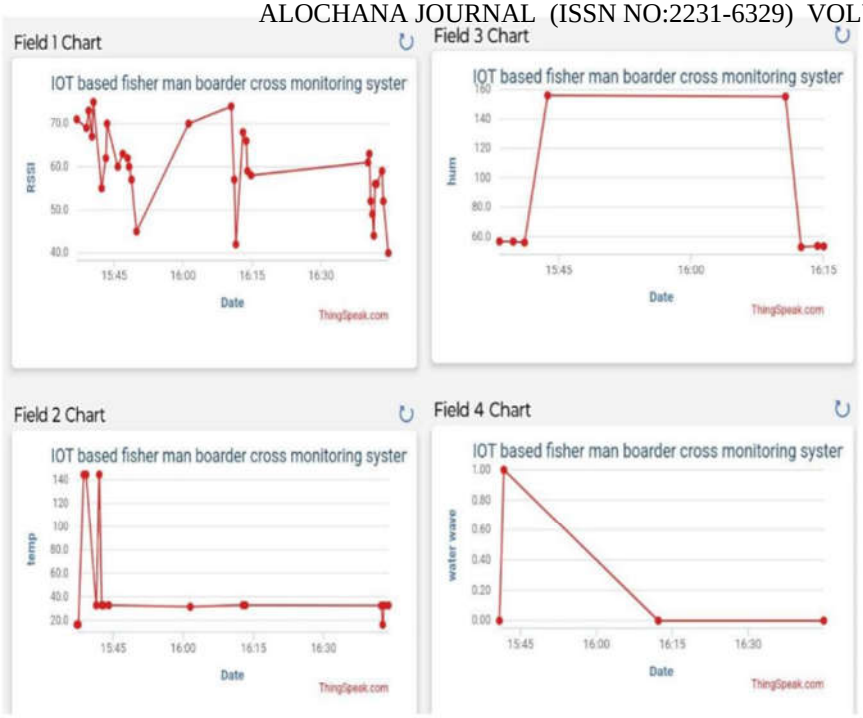
In conclusion, the proposed system offers a comprehensive solution to enhance the safety and security of fishermen operating near the International Maritime Boundary Line (IMBL).

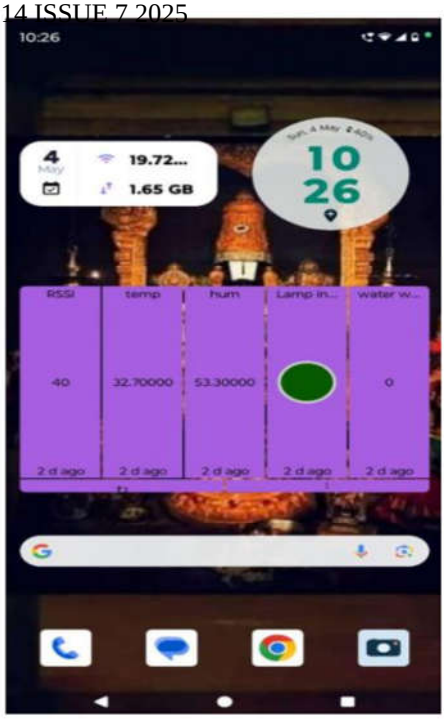
• By integrating advanced technologies such as ADXL sensors, and real-time weather monitoring, the system effectively addresses border crossing violations and hazardous water conditions.

• The continuous monitoring and instant communication with the control room ensure that fishermen are alerted and supported in a timely manner.

• The solar-powered, sustainable design further ensures that the system remains operational in remote areas without the need for external power sources.

• Overall, this system significantly improves the safety of fishermen, reduces the risk of accidents, and contributes to the protection of their lives and livelihoods.





Real Time Notification in Mobile

NOTIFICATION IN THING SPEAK IOT WEBSITE

X.FUTURE SCOPE

IoT-Based Real-Time Monitoring: Future enhancements can involve integrating IoT sensors to monitor real-time maritime conditions such as tides, wind speed, and water currents, offering improved safety alerts.

AI-Powered Threat Detection: Artificial Intelligence can be incorporated to detect patterns in route deviations or dangerous zones, enabling early warnings and automatic alert generation.

User-Friendly Mobile Application: A mobile app can be developed to display real-time data, boundary alerts, and emergency notifications, making the system more accessible to fishermen even in remote areas.

Multi-Language and Voice Assistance: The system can be upgraded to support regional languages and voice-based alerts to ensure clear communication for all users, regardless of literacy levels.

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