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Methodical Review on Marine Tracking and Communication

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ABSTRACT

Boats can send real-time location updates and emergency alerts to a shore-based monitoring station using LoRa technology, which is intended for locations lacking mobile coverage. Every boat has an ESP32, a GPS module, and a LoRa transceiver for wireless long-range communication. This project offers an Internet of Things (IoT) solution that uses GPS to follow and communicate with fisherman during emergencies or geofence breaches. Alerts are provided quickly to support rescue efforts. In addition, this mechanism makes sure that nearby vessels can communicate. The LoRa module is essential because it offers long-range data transmission, which makes it possible to reliably transmit the location and status of the vessel to a shore-based gateway or control center even when it is far from the coast and cellular coverage is not available. The device is scalable, affordable, and improves fishermen's safety in deep-sea and coastal areas. The microcontroller unit stores a predetermined geofenced marine border. The microcontroller initiates real-time notifications, such as lights, auditory buzzers, or display messages to the fisherman, when the vessel gets close to a warning zone.

INTRODUCTION

Due to unreliable cell network coverage, fishermen working in deep-sea and offshore environments frequently encounter serious communication and safety issues. Even though they work well, conventional maritime communication systems like satellite-based solutions or VHF radios can be costly, power-intensive, or have a restricted range for small-scale fishing vessels. Because of this, emergency reaction times are often delayed, and it becomes challenging to track boats in real time, which raises the possibility of collisions, unauthorized border crossings, and fatalities under unfavorable circumstances. The development of low-cost, energy-efficient, long- range communication networks appropriate for distant areas has been made possible in recent years by the progress of Internet of Things (IoT) technology. LoRa (Long Range) is one of these technologies that has shown promise since it can send little data packets over many kilometers while using very little power. Even in locations well beyond the reach of cellular infrastructure, LoRa-based networks may establish dependable communication linkages between vessels and shore stations when combined with microcontrollers and GPS devices.

Studies already conducted demonstrate the increasing demand for maritime surveillance systems with geo-fencing capabilities, continuous tracking, and quick emergency alarm mechanisms. However, a lot of conventional tracking systems rely on expensive satellite services or GSM connectivity, which makes them unsuitable for fishing communities in rural areas or those with little financial resources. This disparity highlights the need for a more reliable and approachable system designed for small and medium-sized fishermen. By utilizing ESP32, GPS, and LoRa connectivity to create an Internet of Things-enabled boat monitoring and alert system, the project described in this article tackles these issues. The system guarantees boat-to-boat communication, real-time location monitoring, and automated geo-fence notifications to inform fishermen to possible boundary breaches. By leveraging low-cost hardware and long-range wireless communication, the proposed solution offers a scalable, reliable, and cost-effective approach to enhancing maritime safety and supporting efficient rescue operations.

LITERATURE SURVEY

1. GPS assistive communication tool for fisherman community using internet of things. (2023)

Every field in this technologically advanced world is effectively developing with new technologies. Due to financial constraints, the fishing community is becoming less adept at employing technological tools. Here, a significant issue

that fishermen encounter while fishing is examined. Many fishers are unable to communicate with the outside world once they enter the sea or ocean. In order to combat this circumstance, the suggested model is made so that the fisherman can communicate to his family members whether he is safe or in danger anytime he encounters an issue in the water. They can use their mobile device, which they have been given, to track the whereabouts of fishermen using latitude and longitude. In this manner, family members can assist the fishermen. Fishing is recognized to be the hardest and riskiest job. Fishermen occasionally go fishing and get home late, which worries the family. Two modes—the SAFE MODE and the DANGER MODE—are taken into consideration in this case. When he is in safe mode, they can follow his whereabouts and he can communicate that he is safe. When in danger mode, he can communicate that he is in danger, and his whereabouts is monitored.

2. An Improved GPS Assisted Fishermen Tracking System Using Internet of Things with Smart Sensors Association (2024)

It suggests an Internet of Things-based border warning system for fishermen. Fishermen frequently unintentionally cross international borders as a result of their survival strategies, increasing their risk of being apprehended or murdered. The fundamental cause of this issue is the unable to accurately establish international maritime borders. By using state-of-the-art GPS and GSM technology in conjunction with Internet of Things (IoT) monitoring, this system seeks to prevent such events and provide fishermen advance notice about border regions. An implanted device that uses GPS to alert fisherman to the nation's borders protects them from danger. This study presents a new method for tracking fishermen using the Internet of Things (IoT); the efficacy of the proposed system is evaluated by cross-validating the IoT GPSTM model with the conventional AGPST model. The acquired GPS position data is sent to the Internet of Things cloud via the ESP8266 Wi-Fi module. The data may then be tracked by the navy. The motor speed will be reduced to 25% and a buzzer will sound if the boat's GPS coordinates fall inside the danger zone. The core idea behind this issue is to combine a GPS receiver module and a WiFi-enabled Node MCU microcontroller to alert fishermen when they are near international maritime borders.

3. IoT Assisted Fisherman Aid to Detect Borders and Alert System by using Intelligent GPS Technology

Technology like Wireless Sensor Networks (WSN) and the Global Positioning System (GPS), which will be used in this project, will increase fishermen's safety. The boat's precise location can be tracked at any moment using the GPS. The alarm will ring if the fisherman goes outside the area that is allowed. Through the use of the vessel's own electrical equipment and software designed expressly for this purpose, the user or owner can keep track of the vessel's location in relation to established dimensions (latitude and longitude).A person using a GPS receiver can use a digital map to determine their precise location. The boat's relay circuit will enable it to turn around. Communication between the fisherman and the Internet of Things device could be transmitted using wireless sensor network technology. When the fisherman approach the first two borders, a siren-like loudspeaker and an LCD-equipped indication inform them. There is a fallback in case the warning system fails. As the boat approaches the third border, its engine will automatically shut down. Now, the Indian and the government of Sri Lanka would have access to identical data on the fishermen.

4. IoT based Fishermen Tracking and Communication Using Wireless Water Communication (2023):

Underwater communication is the most challenging medium. Its qualities are to blame. Acoustic waves and optical signals are two of the current modes of communication in water media. In order to get around this, this project transmits data in a water medium using an EM method. Data transmission is accomplished by means of magnetic transmitter sources. In addition to being more effective and less expensive than the other current techniques, this will guarantee the highest possible transmission rate. This project also has GPS tracking capabilities for automation. The goal of our suggested solution is to provide a mobile computing device that is easy to use and comprehend. In order to prevent them from crossing the maritime boundary at all costs, IMBL should be supported and adequately informed. and ensure the lives of Indian fishermen are completely secure and dependable. In order to do this assignment, a few contemporary mobile computing principles must be applied. WWSNs, which use submerged sensors as part of their components to communicate through water. Most uses of WWSNs include intelligent communication, water monitoring, and environmental monitoring. This suggested system receives emergency messages and transmits them to a centralized server or a fishing boat via water in case of an emergency. A Review to do Fishermen Boat Automation with Artificial Intelligence for Sustainable Fishing Experience(2023)

One of the Sultanate of Oman's biggest resources is fishing. It is regarded as one of the most significant economic advancements on which the country depends. The Sultanate of Oman is distinguished by having a sizable fishing fleet in terms of the quantity of boats and fishing vessels inside it. To improve the quality of fishing by giving fisherman a safe and secure fishing experience, good research with the use of contemporary technology in fishing boats is necessary. For Oman's fishing industry, artificial intelligence (AI) in boat automation technology is a new and necessary requirement. There are numerous issues that fishers deal with while fishing, including as weather changes, border tracking, navigation, illegal fishing, pirate attack, oil spill, technical fault in boats, etc" Thus, the use of AI and similar methods in boat automation, information exchange, and documentation resource development is crucial in this industry. The primary prerequisite for a fisherman is a top-notch fishing vessel equipped with the necessary communication tools to give the control room and other fishermen all the necessary information. In order to provide

Omani fisherman with a sustainable fishing experience that includes safety, security, navigation, and information sharing, this study reviews boats equipped with artificial intelligence.

PAPER COMPARISON

RESEARCH PAPERS	COMPARTATIVE STUDY
1.GPS assistive communication tool for fisherman community using internet of things. (2023)Josephine Selle Jeyanathan; K Naresh Kumar; P Viswanath Reddy; C Vishnu Chaithanya; Naveen Kumar; P Manikandan	Wireless water communication offers advantages over old methods and some current technologies in terms of cost- effectiveness, dependability offshore, and data transmission capabilities for fishermen tracking and communication. The suggested method overcomes the drawbacks of costly satellite systems and air-based communication by using low-cost components and electromagnetic waves or modified acoustic signals under water for real- time tracking, alerts, and emergency communication.
2.An Improved GPS Assisted Fishermen Tracking System Using Internet of Things with Smart Sensors Association (2024) G.M. Karthik; Samuthira Pandi V; Gayathri S; Anni Princy B; Kiran Kumar Bhadavath; S. Sujatha	It enhance the safety, security, and efficiency of fishing operations. The authors propose a GPS-based tracking and safety system for fishermen that integrates a standard GPS module with Internet of Things (IoT) connectivity and one or more “smart sensors,” forming a more comprehensive vessel-monitoring solution than pure GPS trackers. In their method, the vessel’s real-time latitude and longitude are captured by the GPS unit, While other sensors gather contextual data (such as environmental or boat-status information), the GPS data is sent to a distant monitoring station or server via an Internet of Things link. Thus, the system allows for ongoing tracking, remote monitoring, and prompt notifications or alerts in the event of an emergency or dangerous situation.
3.IoT Assisted Fisherman Aid to Detect Borders and Alert System by using Intelligent GPS Technology. A P. Ramesh; R. Nithya Paranthaman; M. Porkodi; V. Aruna; S. Rohini	By identifying maritime borders and sending out timely alerts, it is an Internet of Things- assisted technology intended to improve fishermen's safety. The device continuously monitors the vessel's location using a GPS module and compares it with pre-established
	geo-fenced maritime borders that are kept in a microcontroller. The device warns the fisherman by using buzzers, lights, or display messages when the vessel approaches or passes a restricted area. The technique combines geofencing algorithms, GPS-based positioning, and IoT-enabled alarm systems to enhance maritime safety and stop unintentional border infractions. All things considered, the system is an affordable, useful solution that guarantees real-time monitoring and warning, lowering the possibility of legal or safety problems for fisherman.
4.Fishermen Tracking and Communication UsingWireless Water Communication (2022):S.Sasikala ,D.Selvamuthukumaran R.Thirunavukkarasu , M.Saran , and S.Chandru	By fusing GPS positioning and Internet of Things concepts with underwater wirelesswater communication (using electromagnetic transmission through water), the research suggests a unique tracking and communication solution for fisherman working at sea. In contrast to traditional acoustic or optical underwater communications, the technique uses a magnetic transmitter-based underwater communication channel to transfer data through water, allowing communication between fishing boats and shore (or other vessels) even in the event that cellular or radio communication fails. Every boat has a microcontroller (such a PIC) that interfacesincludes sensors, a GPS module, and a magnetic-water transmitter; sent signals are gathered by a waterdata receiver at the receiving end (central station or

	shore). GPS- based tracking is also integrated into the system so that the location of the vessel may be tracked. The technology enables the transmission and receiving of emergency messages via the water channel to a centralized server or other boats in the event of crisis, border approaches, or dangerous conditions.
5.A Review to do Fishermen Boat Automation with Artificial Intelligence for Sustainable fishing Experience(2023)	In order to address safety, navigation, border tracking, piracy, environmental hazards, and communication deficiencies in traditional fisheries, the author applies artificial intelligence (AI), machine learning, IoT, and automation technologies to fishermen's boats. The author analyzes previous research that integrates GPS-based navigation, sensor networks, environmental monitoring, surveillance, and data-sharing systems. They describe a potential "boat automation" design that incorporates live location tracking, geofencing (radius monitoring), environmental sensors (temperature, humidity, pressure, oil spill detection, fire, wind speed), 360° vision systems for detecting nearby objects or vessels, data communication (radio, RF, even in the absence of internet), cloud-based monitoring, and mobile/web applications for real-time alerts and control.

CONCLUSION

The system marks a significant turning point in the development of affordable, open marine telemetry. It provides an adaptable framework for ocean monitoring that lessens reliance on pricey satellite equipment by fusing IoT, LoRa, and GPS technologies. In marine research communities, its open-source design promotes cooperation, adaptability, and broad acceptance. In conclusion, small and medium-sized fishing vessels operating in offshore and deep-sea conditions confront communication and safety difficulties that are successfully addressed by the suggested IoT-based fisherman tracking and alarm system. Even in places without cellular service, the system's integration of an ESP32 microcontroller, GPS module, and LoRa transceiver allows for low- power, long-range whenever a ship gets close to restricted areas, avoiding unintentional border infractions. Boat-to-boat communication also guarantees situational awareness among neighboring vessels, improving overall safety. This strategy is a workable and dependable way to improve maritime safety and operational efficiency in coastal and deep-sea fisheries by utilizing affordable, scalable IoT technology to provide continuous location monitoring, quick emergency notifications, and enhanced rescue response capabilities.

REFERENCES

[1]. M. Radeta et al., “TRITON—Open Telemetry and Location Estimation for Marine Monitoring Based on IoT and LoRa,” IEEE Journal of Oceanic Engineering, vol. 50, no. 2, pp.1244–1256, Apr. 2025. 2. A.J .Read, “Biotelemetry, ”Encyclopedia of MarineMammals,2018.
[2]. R. Harcourt et al., “Animal-borne telemetry: An integral component of the ocean observing toolkit,” Frontiers in Marine Science, 2019.
[3]. G.C.Haysetal.,“Translating marine animal tracking data in to conservation policy,” Trends in Ecology & Evolution, 2019.
[4]. G. Xu, Y. Shi, X. Sun, and W. Shen, “Internet of Things in marine environment monitoring: A review,” Sensors, 2019.
[5]. M. C.Domingo,“An overview of the Internet of Underwater Things,” Journal of Network and Computer Applications, 2012.
[6]. J.J. Lahoz-Monfort and M.J. Magrath, “Technologies for species and habitat monitoring,” BioScience, 2021.
[7]. M.Radetaetal.,“LoRaquatica:Studying range and location estimation using LoRa and IoT in aquatic sensing,” IEEE PerCom Workshops, 2020.
[8]. F. Dar et al., “Upscaling fog computing in oceans for underwater data science,” ACM
[9]. Transactions on Internet of Things, 2022
[10]. H. Choi, J. Woo, and N. Kim, “Localization of an underwater acoustic source,” IEEE Underwater Technology, 2017.