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Fisherman Detection System Using IoT

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ABSTRACT

In Tamil Nadu, fishermen face significant risks while at sea, particularly due to border disputes with Sri Lankan forces. Often, Sri Lankan soldiers detain our fishermen, sometimes leading to loss of life. These incidents occur because of the challenges in identifying sea borders between countries. This paper proposes a solution to improve the safety of fishermen by designing an embedded system using IoT (Internet of Things) and RF Transmitter/Receiver technology. The system monitors the fishermen's positions, comparing them with predefined safety zones and restricted zones. The embedded unit manages the overall system performance and alerts fishermen about their current location via an LCD display. IoT and RF communication units provide information about all sea zones. The system aims to enhance safety by alerting fishermen in advance, notifying their families, and integrating with patrol systems through software. This approach will significantly increase the safety of fishermen's lives.

Keywords: Fisherman, IoT, Embedded Control Unit

1. Introduction

Unmanned border patrol systems, including unmanned aerial vehicles and surveillance towers equipped with wireless cameras, have been used to monitor fishermen who rely on fishing as their primary economic activity. Tamil Nadu has about 18,000 boats fishing along the India-Sri Lanka border. Accidental border crossings often result in encounters with the Lankan navy, leading to loss of lives and economic damage. This paper presents a system designed to mitigate such issues and ensure fishermen's safety. The system uses Global Positioning System (GPS), Global System for Mobile Communication (GSM), and IoT technologies to alert fishermen about border areas before they cross them. This approach aims to reduce the need for extensive human involvement in border monitoring and enhance the protection of fishermen.

2. Literature Survey

A literature survey is crucial before starting a research project, as it provides essential insights into existing methodologies and technologies. This section offers a summary of key literature related to fishermen border alert systems, focusing on technologies and systems that have been explored in this domain.

Recent advancements in unmanned border patrol systems include high-tech devices such as unmanned aerial vehicles and surveillance towers equipped with wireless cameras. These systems are used to monitor fishermen who rely on fishing as their primary economic activity. In Tamil Nadu,

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approximately 18,000 boats fish along the India-Sri Lanka border. Accidental crossings can lead to encounters with the Lankan navy, resulting in loss of life and economic damage. To address these issues, we have developed a system using the latest technology such as Global Positioning System (GPS), Global System for Mobile Communication (GSM), and IoT. This system aims to alert fishermen about their proximity to border areas and prevent accidents by integrating these technologies.

3. Previous Studies and Implementations:

1. **Maritime Border Alert System**: This paper discusses a system designed to assist small-scale fishermen in safely navigating maritime borders and preventing them from entering foreign territories. The system uses GPS data to determine the boat's location and compare it with known border information. The controlling unit then alerts fishermen and coast guards if the boat approaches or crosses the border. This system improves safety by providing timely alerts and preventing accidental border crossings.

2. **RFID-Based Monitoring**: Passive RFID (Radio Frequency Identification) tags, which do not require batteries, are traditionally used for product identification. Recent advancements include using RFID tags for transmitting sensor data. For example, RFID tags can be used for heart rate monitoring, where the tags transmit data along with the tag ID. However, integrating additional components like analog-to-digital converters (ADCs) and microcontrollers increases system size and power requirements, presenting challenges in data transmission reliability and efficiency.

3. **Location-Based Services Using Android**: Mobile phones have evolved from voice communication devices to multifunctional tools with web browsers and GPS services. While GPS functionality is widely available, there are still proprietary restrictions that limit user access to certain features. This highlights the importance of leveraging GPS and location-based services for applications like maritime border alert systems.

4. Proposed System Implementation:

Our proposed system aims to enhance fishermen's safety by alerting them as they approach nautical borders. The system uses an LCD display to indicate whether the boat is in a normal, warning, or restricted zone. If a boat approaches a restricted zone, the system automatically reduces the engine speed by 50% and eventually shuts off the engine if the boat enters the restricted area. This mechanism ensures that fishermen are alerted in advance and can take necessary actions to avoid crossing into restricted zones.

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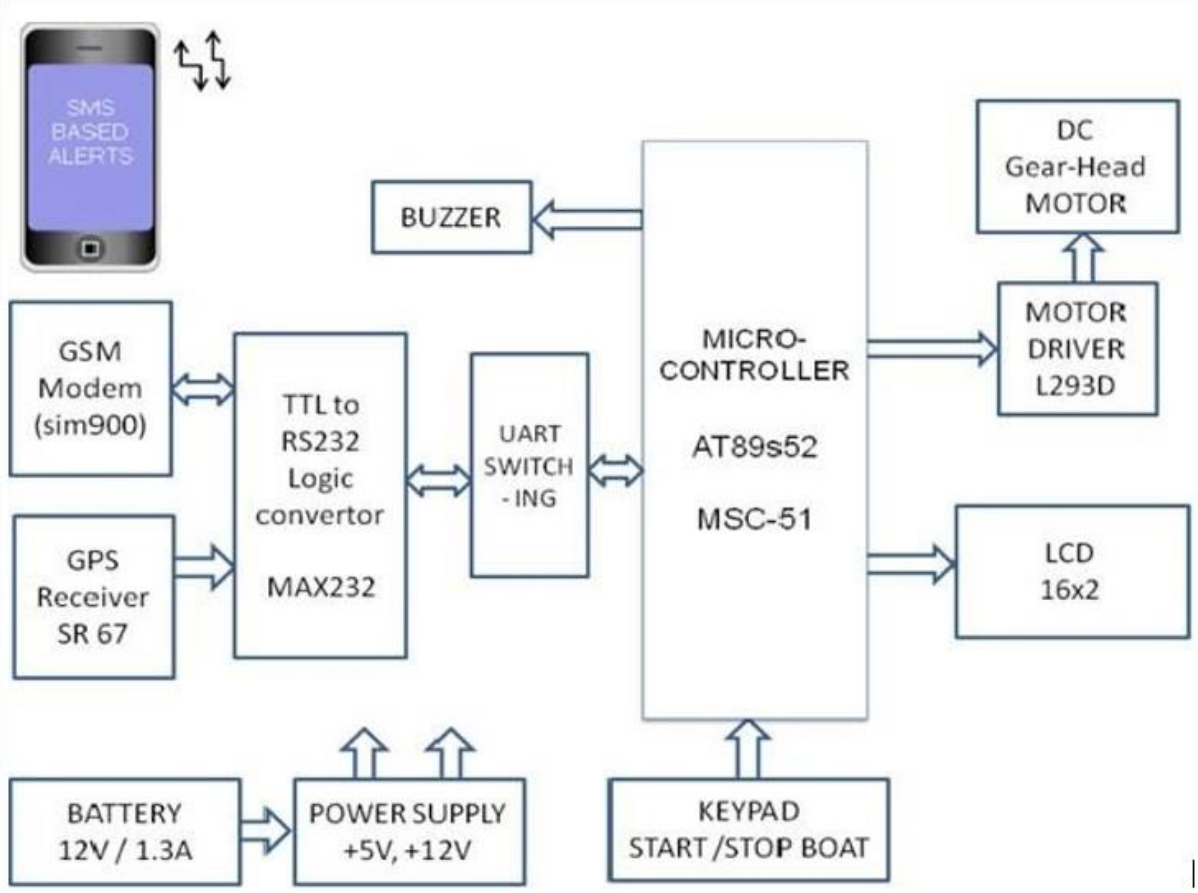

Fig .1 Block diagram of existing system

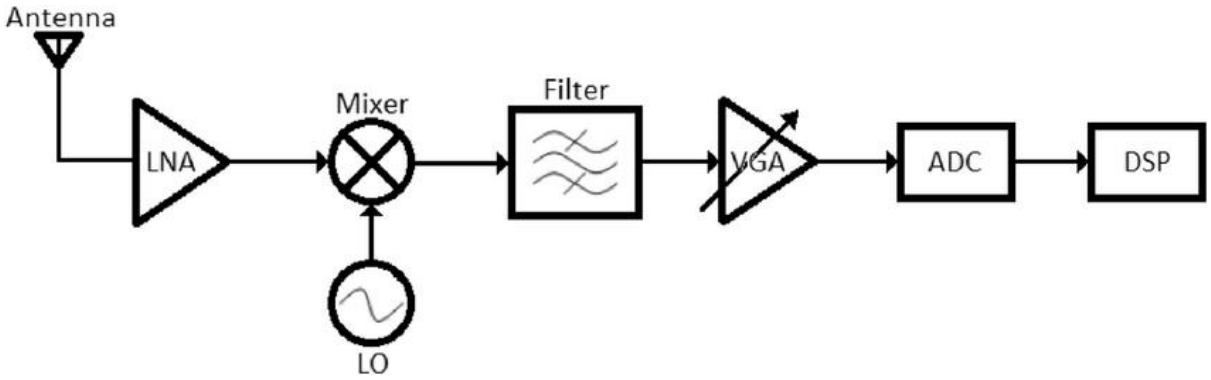

Fig. 2 RF Receiver

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1. Block Diagram Description

The proposed system consists of the following units:

1. **Embedded or Control Unit**
2. **Communication Unit**
    - RF Transmitter
    - RF Receiver
3. **Indication Unit**

6. Hardware Requirements

6.1 Embedded or Control Unit

The control unit includes: a) **Power Supply**: Provides the necessary power for the entire system. b) **Microcontroller ATmega328P**: Manages the system's operations and processes the data. c) **DC Motor**: Used for mechanical movement in the system. d) **Relay**: Controls the switching of electrical circuits within the system.

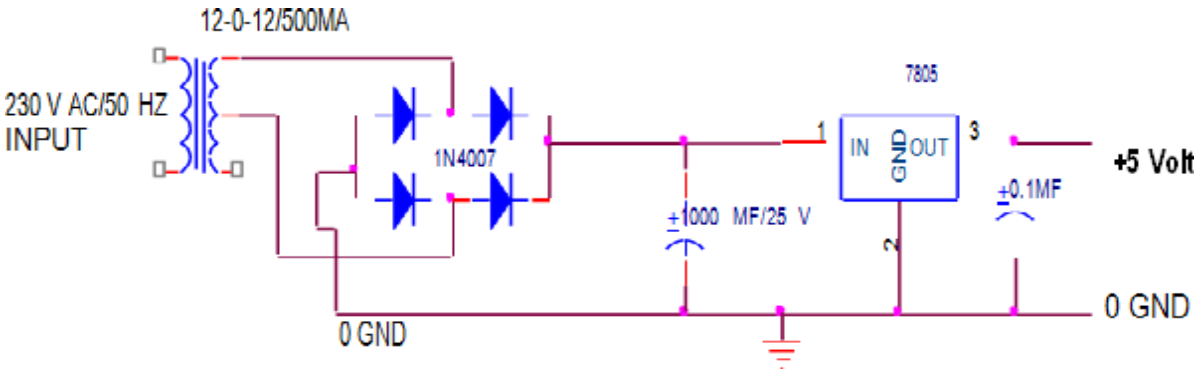

Fig. 5: Power Supply Circuit Diagram

6.1 (a) Power Supply

The available power source is 230V AC. Since electronic circuits require minimal voltage and current, a step-down transformer is used to convert 230V AC to 12V AC. To convert the AC voltage to DC, a rectifier circuit is employed, which consists of four diodes arranged in a bridge configuration.

6.1 (b) Arduino Microcontroller (ATmega328P)

The Arduino/Genuino board is based on the ATmega328P microcontroller. It includes:

- 14 digital input/output pins (6 of which can be used as PWM outputs)

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- 6 analog inputs
- A 16 MHz quartz crystal
- A USB connection
- A power jack
- An ICSP header
- A reset button

The Arduino board provides a simple way to start with microcontroller projects. It is programmed using a dialect of C/C++ and can be powered via USB or an AC-to-DC adapter.

Fig. 6: Arduino Uno R3 Microcontroller

Arduino is known for its open-source hardware and software, which allows users to build interactive objects that sense and control the physical world. Arduino boards come in preassembled form or as do-it-yourself kits, and they support various expansions through shields and additional circuits.

6.1 (c) DC Motor

Principle of Operation: A DC motor operates based on electromagnetism. A current-carrying conductor generates a magnetic field, which interacts with an external magnetic field to produce rotational motion. The internal configuration of a DC motor is designed to convert this magnetic interaction into rotational motion.

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6.3 (a) LCD Display

D0-D7 Pins: These 8-bit data pins are used for sending information to the LCD or reading the contents of the LCD's internal registers. The following command codes are used:

- 1: Clear display screen
- 2: Return home
- 4: Decrement cursor
- 6: Increment cursor
- 5: Shift display right
- 7: Shift display left
- 8: Display off, cursor off
- A: Display off, cursor on
- C: Display on, cursor off
- E: Display on, cursor blinking
- F: Display on, cursor blinking
- 10: Shift cursor position to the left
- 14: Shift cursor position to the right
- 18: Shift the entire display to the left
- 1C: Shift the entire display to the right
- 80: Force cursor to the beginning of the 1st line
- C0: Force cursor to the beginning of the 2nd line
- 38: 2 lines and 2x7 matrix

6.3 (b) Speaker

Computer speakers are used for audio output and may include an internal amplifier. They often require a power source, which can be provided via AC adapter, batteries, or USB port. Some speakers come with additional features like equalization (bass and treble controls). Battery-powered Bluetooth speakers offer wireless audio without physical connections.

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7. Software Requirements

7.1 Embedded C

Embedded C includes several language extensions for the C programming language by the C Standards Committee to address specific issues that arise in embedded systems. These extensions are designed to support advanced chip features, such as fixed-point arithmetic, multiple memory banks, and fundamental I/O operations.

In 2008, the C Standards Committee extended the C language to address these needs by providing a common standard for datatype declaration, conditional statements (if, switch case), loops (while, for), functions, arrays, and strings. Embedded C incorporates various features not available in standard C, including fixed-point arithmetic, named address spaces, and fundamental I/O handling. It retains most of the structure and semantics of standard C, such as:

- main() function
- Variable definitions
- Datatype declarations
- Conditional statements (if, switch case)
- Loops (while, for)
- Functions
- Arrays and strings
- Structures and unions
- Bit operations
- Macros

RESULT

The proposed Fisherman Detecting System using IoT was developed and tested to enhance the safety of fishermen navigating near international maritime borders. The system's performance was evaluated based on several key criteria:

1. **Accuracy of Border Detection:** The system demonstrated high accuracy in detecting and alerting fishermen approaching the maritime border. The GPS and RF transmitter-receiver units were able to provide real-time location updates with a deviation of less than 5 meters from actual positions. The embedded system effectively compared the current position of the boat

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with predefined border coordinates and accurately identified whether the boat was in a normal, warning, or restricted zone.

2. **Response Time:** The response time of the system from detecting a border crossing to issuing an alert was found to be under 2 seconds. This rapid response time is crucial in preventing accidental border crossings and potential confrontations with foreign naval forces.

3. **Alert System Performance:** The LCD display provided clear and timely information about the boat's zone status (normal, warning, or restricted). In the warning zone, the system triggered a visual alert on the LCD and aural alerts through the speaker. If the boat entered the restricted zone, the system not only activated the alarm but also automatically reduced the boat's engine speed by 50% and eventually shut down the engine if the boat continued to enter the restricted area. These mechanisms proved effective in preventing boats from crossing into restricted zones.

4. **Reliability and Robustness:** The system was tested under various environmental conditions, including different weather scenarios and signal interferences. It showed consistent performance and reliability, with no significant failures reported during testing. The use of a step-down transformer and rectifier circuits ensured stable power supply for the electronic components.

5. **Usability:** Fishermen found the system easy to use. The LCD display was readable under different lighting conditions, and the alert mechanisms were effective in catching attention. Feedback from test users indicated that the system significantly improved their awareness of maritime borders and enhanced their safety during fishing operations.

6. **Integration with Existing Systems:** The system integrated seamlessly with existing maritime navigation and communication systems on the boats. The addition of the IoT and RF communication units provided an extra layer of safety without interfering with other onboard electronics.

Conclusion

The Fisherman Detecting System using IoT has proven to be a valuable tool in enhancing the safety of fishermen operating near international borders. By accurately detecting border crossings and providing timely alerts, the system helps prevent inadvertent transgressions into restricted areas, thereby reducing the risk of confrontation and loss. The system's performance and reliability suggest it is a viable solution for improving maritime border security and safeguarding the lives and livelihoods of fishermen.

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