

DEVELOPMENT OF PRE-ALARMING SYSTEM FOR FISHERMAN SECURITY



Venkateswara Rao Tumati^{1*}, Swathi Nallagachu²,
Srinivas Yendra³, Sumalatha Madugula⁴

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Abstract

With the evolution of the technology over the various sectors communication is possible at ease. However, due to lack of awareness about ocean frontiers and advanced alert instruments, fishermen are facing trouble in knowing weather updates and border limits. In order to protect the fishermen and to assist them about the sea/ocean frontiers and weather updates during fishing, we are proposing vessel monitoring system, in which automatic identification is done using a GPS module and a communication established is between ship-ship, ship-shore using a Very High Frequency (VHF) equipment. This marine VHF set is a Two-way radio transceiver on ships and watercraft used for two way/bidirectional voice communication. [The VHF radio band operates at frequencies ranging from 156 to 174 MHz. Its transmitter power is limited to 25 watts, and with the range of 100 kilometers (62 mi).] A panic switch is also installed to call out for help during emergency situations. Thus, this provides an effective navigation by preventing the fishermen from the border crossing and taking necessary actions during severe weather conditions and panic situations.

Keywords: Fishing Vessels, Boarder Security, DHT11 sensor, GPS module.

^{1*,2}Department of Electronics and Communication Engineering Sir C R Reddy College of Engineering, Eluru, West Godavari District-534007, Andhrpradesh, India

³Department of Electronics and Communication Engineering Vishnu Institute of Technology, Bhimavaram, West Godavari District-534201, Andhrpradesh, India

⁴Department of Electronics and Communication Engineering Sri Vishnu Engineering College for Women, Bhimavaram, West Godavari District-534201, Andhrpradesh, India

Email: ^{1*}tumati01@gmail.com, ²swathiprasad549@gmail.com, ³srinivas.y@vishnu.edu.in, ⁴sumalathamece@svcew.edu.in,

Corresponding Author:

Venkateswara Rao Tumati

^{1*}Department of Electronics and Communication Engineering Sir C R Reddy College of Engineering, Eluru, West Godavari District-534007,

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1. Introduction

Fishing is one of the world's most dangerous professions since it is vulnerable to a variety of oceanographic and climatic circumstances [1]. The issues that most fishermen face are being imprisoned or shot by the neighboring country's officials and perishing due to storms or cyclones. Indian fishermen too face these problems/cases quite often with our neighboring countries like Sri Lanka. The India-Sri Lanka border

stretches approximately 288km (155nm) from the Maldives tripoint in the west, i.e., the Gulf of Mannar, to approximately 200nm (370km) in the east, i.e., Palk Strait. The regions of the Gulf of Mannar and Palk Strait have been the regions of dispute for over a long time, despite the discussions between the two nations. So, it requires providing a proper navigation system to the fishermen in order to have an idea or alert about frontiers and also feed them with frequent weather updates.

Table 1: Table.1: Difference in Weather conditions

Conditions	Temperature	Atmospheric Pressure
Normal	20 C About (68 F)	800 millibars
Cyclone	26 C About (79 F)	1013.2 millibars

To address these problems, we are proposing a system that keeps track of the fishermen's location while also establishing communication between the fishermen and coast guards to provide weather updates and request assistance in case of an emergency or a panic situation [2]. In the proposed system, we use the Global Positioning System (GPS) module for keeping track of the location of the fishing vessel and providing these location coordinates to the coast guards at regular intervals, so that the kit can give out an alert if the fishermen are crossing or close to crossing the positions [1-3].

1. Position: 09° 13'.0 North, 79° 32'.4 East.
2. Position: 08° 53'.8 North, 79° 29'.3 East.
3. Position: 08° 31'.2 North, 79° 04'.7 East.
4. Position: 08° 12'.2 North, 78° 53'.7 East.

On the other hand, the weather monitoring sensors are used in the kit to provide real-

time weather updates, and the coast guards feed the alerts regarding cyclones or storms in advance so that the fishermen can reach a safer location [4]. It is a very high frequency (VHF) set, which is used for communication purposes. This VHF set supports about 16 commercial channels with an operating frequency range of 156-174MHz. In these 16 channels we are using 3 channels those are channel 9 is primary channel with operating frequency 156.450 MHz, channel 13 is bridge to bridge communication between vessels with operating frequency 156.650MHz, channel 16 is emergency and distress call with operating frequency 156.80MHz. Through these dedicated channels the information regarding the weather, cyclones and storms information is fed to the fishermen in critical situations. In case of critical emergencies like health issues or unexpected accidents there exist a panic switch that helps in sending out a message to coast guards about the emergency so that the nearby officials can reach them in time to provide assistance to them.

1. Materials And Methods

This proposed paper is an embedded system is implemented using the Raspberry Pi 3 micro-controller. The Raspberry Pi 3 has different components where the interfacing across sensors and actuators can be connected. The Raspberry Pi 3 is interfaced with GPS module, VHF module, temperature and humidity sensors and others.

If the boat crosses the sea borders and is apprehended by the coast guard, or if they lose their way within the nautical borders, the GPS module allows them to be identified.

For this, an algorithm is written so that the vessel can be monitored continuously and tracked down efficiently. The algorithm is based on the threshold values set before the boat reaches the borders, and thus an alarming signal is sent.

The system comprises of weather forecasting sensors to notify the changes in weather at stipulated time intervals.

Raspberry Pi 3 Model B+

This is a micro-controller device whose operation is similar to that of a CPU in a computer. This device consists of 40 GPIO pins to connect to external components and in-built memory capacity. To facilitate efficient connectivity, the device also contains HDMI and Ethernet ports.

VHF communication module

A VHF communication module is a two-way communication device used to transfer and receive messages between the coastal authorities and fishing vessels. This marine VHF module works by operating on MHz that fall anywhere between 156 and 172, which is a small fragment of the MHz used in high frequency radios that work with radio waves between 30 to 300. Here we use three channels, 9, 13, and 16. For the primary communication channel, we tune to channel 9. For distress calls and emergencies, tune into channel 16. Tune into channel 13 for communication

between boats.

GPS module

In this system, we are using the NEO-6M GPS module that can track up to 24 satellites on 50 channels with the highest level of sensitivity, i.e., -161dB and identifies locations anywhere in the world. These are low-power and inexpensive modules. The module supports a baud rate from 4800bps to 230400bps with a default baud of 9600. They're pre-programmed to know exactly where the GPS satellites are at all times. Satellites send radio signals to the Earth that contain information about their location and current time. These signals identify satellites and provide information about their locations to the receiver. By calculating the time, it takes for the signals to arrive, the receiver may determine how far away each satellite is. It can pinpoint your location on Earth once it has information on how far away you are and where at least three satellites are in space. This process is known as trilateration.

DHT11 sensor

The DHT11 is a part of the DHTXX series of humidity sensors that measure both humidity and temperature. There are three primary parts to the DHT11 Humidity and Temperature Sensor. A resistive humidity sensor, an NTC (negative temperature coefficient) thermistor (for temperature measurement), and an 8-bit microprocessor that translates the analogue outputs from both sensors into a single digital signal. Any microcontroller or microprocessor may read this digital signal and analyze it further.

Voice recorder and playback module APR33A3

In this system, we are using the APR33A3 voice record and playback module that senses and reads out pre-recorded voice notes through the speaker to alert the fishermen. This is a powerful audio processor along with high-performance audio analog-to-digital converters (ADC) and digital-to-analog converters (DAC).

This is a high-quality analogue to digital and PWM module which averagely uses up to eight voice messages per recording and playback.

LCD display:

In LCD 16×2, the term LCD stands for Liquid Crystal Display that uses a plane panel display technology. This is a 16-pin electronic device used to display data and messages. It includes 16 Columns & 2 Rows so it can display 32 characters (16×2=32) in total. The role of this LCD

display is to display the messages/alerts from coastal authorities and to view humidity and temperature values.

Methodology

The automatic identification system of fishing vessels for Indian fishermen is an embedded system device which is interfaced with a physical tracking device, a communication device and some sensors. In this system, physical tracking is done by using the global positioning system



Figure 1. Proposed system for automatic identification of fishing vessels

(GPS) module. The latitude and longitude coordinates of the location is received from the GPS receiver and is compared to the previously defined threshold coordinates from the algorithm. There are two threshold values set one at 5km from the border line and the other at 2km from the border line. Using the GPS module, the current location coordinates of the fishing vessel are considered and compared to the threshold values set at the 5km. If the boat is near the threshold limit of 5km, then the system sends out an alert message to the fishermen. Now if the boat enters the critical area i.e., the threshold limit of 2km, another alarm is set, and an SMS is sent out to the coast guards. After receiving the message, the coast guard makes a communication with the fishermen to manually alert them.

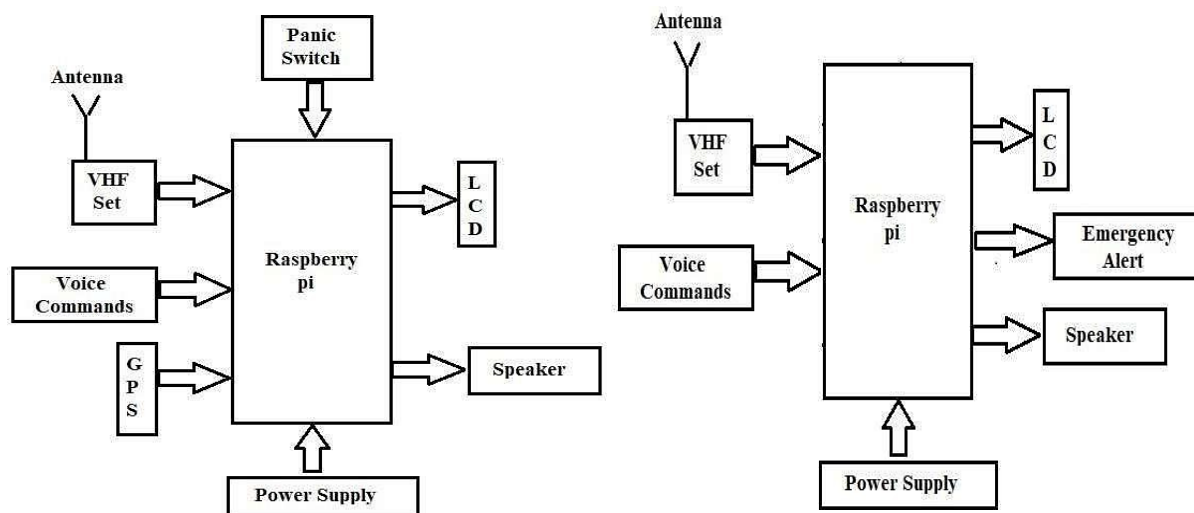


Figure 2: Basic Block Diagram of Transmitter-Receiver in proposed System

The fishermen need to be aware of the changing weather conditions in order to make best use of the conditions and have good yield so we can use the DHT11 sensor which gives humidity and temperature levels at stipulated time intervals, but it is still not possible for the sensors to detect cyclones or tsunamis in real time, so we make use of a VHF communication set to feed this information to the fishermen in real time. The coast guard is made available with a VHF set to transmit and receive messages and same is the case with the fishermen. The coast guard's duty is to send out the alerts regarding the cyclones or tsunamis or any other natural calamities through a dedicated channel i.e., channel 16. The basic block diagram of Transmitter and receiver modules are shown in Figure 2. In case of any medical emergencies like heart stroke or any other serious injuries during fishing, the fishermen require a quick medical assistance. So, we can make use of the channel 13 to send out a message to the fishing boats and coast guards nearby for medical help. Due to unforeseen circumstances if the boat is met with an accident, there exist a panic switch which when turned on sends out a message to the

coast guards to quickly reach and help them so that there wouldn't be loss of life. This panic switch can also be used for medical emergencies well.

2. Results & Discussions

Present paper is designed using Raspberry Pi 3 microcontroller. It is proposed to design an embedded system which is used for automatic identification of fishing vessels where the Raspberry Pi 3 is interfaced to various hardware peripherals as shown in fig. The Raspberry Pi 3 microcontroller is interfaced serially to a GPS transceiver. There will be a reference GPS location. When the current location exceeds reference location of the first threshold(5km), the fishermen are intimated as shown in the fig 4 and when reference location of second threshold(2km) is exceeded, then the intimation is sent to both the fishermen and the coast guard as shown in the fig 4 and fig 5. This intimation is be using a buzzer for first threshold and for second threshold we will be using a VHF communication set and also the buzzer.



Figure 4. Visible message to fishermen

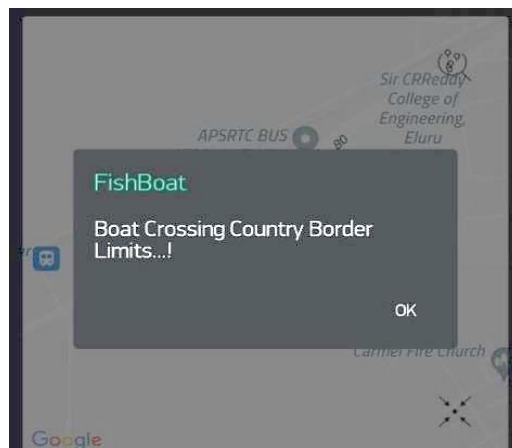


Figure 5: Message sent to coast guard

The fishermen will also be requiring weather updates for a safe hunt. So, by interfacing a DHT11 sensor to the microcontroller we are giving humidity and temperature values regularly as shown in the below fig 6 and 7. The intimation for natural calamities like cyclone is given using the VHF communication set. In this communication set the common channel 16 is used by the coast guard to send an alert to all the fishing vessels that had gone to the hunt.

When there is an emergency situation during the hunt, we use a panic switch. This panic switch when pushed on sends out a message to the coast guards when the fishing boat met with an accident as shown in the fig 8. In case of any medical emergency like heart stroke or attack, the fishermen can make use of the VHF communication set to communicate with the coast guards or other fishing boats for emergency assistance.



Figure 6: Weather Update to fishermen



Figure 7: Temperature and Humidity

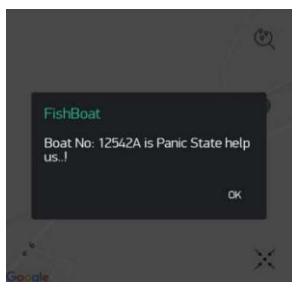


Figure 8. Emergency message to coast guard from fishermen

When the communication process used in the proposed system is compared to other communication techniques like LoRa, GSM, the VHF communication module provided better results in terms of

bandwidth usage, wavelength and data rate as shown in Table2. So, it would be more effective and efficient when VHF communication is used for communication.

Table 2: Delay variation in different technologies [7-10]

Technologies	LoRa	GSM	VHF
Bandwidth	500KHz	45MHz	270MHz
Wavelength	16 Cm	33 Cm	1 M
Data rate	22.7 Kbps	21.6 Kbps	31.4Kbps

3. Conclusion

The proposed system assists the fishermen from not crossing the international maritime borders by giving alerts when they are close to the border and weather updates/alerts regarding rains/cyclones/storms are also provided by the coast guards directly using flexible processes as discussed in the above sections. The panic switch comes handy during emergency situations in providing suitable assistance thereby preventing the loss of life. By this the fishermen caught/shot/arrested by neighboring countries navy forces can be controlled and the lives of the Indian fishermen will also be saved.

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