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Implementation of Smart and Safe Navigation System for Fisherman

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Abstract: The concept of digital world into physical world has changed human lifestyle to be much secure, comfortable and happier. India is called a peninsula because much of the country is surrounded on three sides by water. Due to the vast area of coast line, India is more prone to security threats. The people livelihoods in coastal areas purely depend on fishing occupation in the sea. Inadvertent crossing of the maritime boundary, safety, security and intrusion by fishing boats are the issues that has resulted in deep problems. The aim of the proposed work is to design an embedded system for fisherman with safe and smart navigation facility. The system consists of a float station and a receiver setup. The float station transmits RF signals. The receiver setup in the boat receives the signals when they come near the border line. If the fisherman ignores the warning, their boat engine is automatically stopped using the relays when they cross the border. Unpredictable climatic changes in the seas and oceans are intimated to the fisherman. Also alerts are sent to the coastal guards as well as the base station or the family member using RF transmitter and receivers in case of any emergency. Thus, this system safe guards the fisherman from any potential dangers by giving them pre-warning. It also helps to meet their economical needs and reduces the risks and damages even when they are lost in the sea.

Keywords: Alarm system, Arduino, Border Alert, IoT, RF communication.

I. INTRODUCTION

The importance of the ocean to life on land is fishing. The oceans have been fished for thousands of years and are an integral part of human society [1]. Marine fishing is a key contributor to the economy of the countries with a long coastline. There are numerous communities of fishermen living along the coastal regions whose livelihood has depended on fishing for generations together. Each fishing trip lasts 5-7 days typically, sometimes even longer, in order to catch enough fish to make it profitable to the boat owners. During these fishing trips, these fishermen are totally isolated from their families and friends. Also**,** they are not able to communicate with the relief and rescue agencies in the case of any emergencies. The fishermen use hand-held radios for communication which have a limited range within the line of sight and do not work reliably under adverse conditions when the sea state is rough [2].

Many fisherman and people are travelling in sea are punished by other country due to crossing border. While considering both Indian and Sri Lankan fishermen, they have been known for entering into each other's waters. However, cases of arrest of Sri Lankan fishermen by Indian authorities are comparatively less since they mostly fish in the high seas by using multi-day crafts. On the other hand, due to the dearth of multi-day fishing capability, Indian fishermen cannot shift their fishing effort from the Palk Bay area to the offshore areas of the Indian waters or way beyond the continental shelf. Therefore, Indian fishermen have no other option but to fish into the Sri Lankan waters. While for the Sri Lankan authorities protecting their maritime boundary is important, for the Indian fishermen the priority is of securing their livelihood [4].

Maritime Collision is also one of the common problems faced by these fishermen that lead to loss of lives and damage to boats. Carelessness or simply errors on the part of crew members can lead to collisions at sea. The collision occurs due to presence of any ice bergs or any obstacles that can damage the boat and risk the human lives [5].

Weather conditions also have the biggest impact on maritime accidents. Fog obstructing vision, high winds exerting force on vessels, ice flows colliding with vessels all fall under this category. In many cases, weather is only a contributing factor in a collision. Fishermans take a trip for more than 3 days in the seas to fish to catch enough fish to make it profitable. In such situations, any emergency regarding the climatic changes that was unpredictable becomes a threat to their lives. Any information relating their existence becomes fraught of danger.

This project aims at a possible application of RF module which can aid small scale fishermen from accidentally crossing over into international waters. This system provides a cost effective system which can be used by fishermen and other people to find out their position. Further the people at the ground especially the family and friends of the fishermen can be updated with latest position of the fishermen by the concerned authorities. This brings a huge sigh of relief to the family waiting on the shores and also it is easy for illiterate people to operate.

II. RELATED WORK

A system to aware the fisherman when they are about to reach the nautical border is designed. The system saves the life of the fishermen by making an alarm system and a motor controlled device, which is mounted in the boat/ship [6] [12]. For this, the sea area is divided into three zones namely; safe, intermediate and danger. The boat is allowed to roam anywhere within the safety zone. If the boat reaches the intermediate zone, a buzzer alert is given to the fisherman. If the boat reaches the danger zone, intimation is given to the fisherman where he is supposed to reach the intermediate zone

within the specified time. Else the engine gets stopped automatically and the control of the boat goes to the control room [4] [8] [15]. The authors in paper [7] used the buoys in the marine waters with the laser beams along with relay for border identification. On other hand, the authors have kept the SMD LED, buzzer and PIR sensor on another buoy. Chains of buoy separated by a distance linked together and the sensors will detect the foreign body. The system generates alarm if the boundary has been crossed. The authors [9] [11] [13] have used PIC microcontroller and Zigbee technology for data analysis and data transmission. RF communication system and Wireless Networks can be the best choice for addressing the maritime border crossing issue [10].

III. PROPOSED SYSTEM

In Figure 1 and 2, the block diagram of the receiver setup in the boa and a transmitting station. Here there are floating stations in the marine waters that transmit RF signals continuously at different levels. On the other hand the boat consists of the RF receiver that receives those signals. The system is a combination of RF transmitters and receivers that uses the radio waves that travel with the speed of light. Also sensors such as temperature and humidity sensors, IR sensors and MEMS sensors are used.

The transmitter in the float station transmits the signals by means of antenna that the receiver setup at the boat receives. At Level 1, as the boat crosses the level a warning message is shown to the registered boat that holds the receiver by receiving the signal from the float station. As the boat ignores the warning and continues to sail and crosses the border, then the float station at the level 2 transmits a signal that when received displays the boat as crossed the border and stops the boat engine using the relays. Also the message about the boat with its ship no is sent to the coastal guards by which it reduces the risk of lives of the fisherman.

With the usage of the temperature and humidity sensors unpredictable changes in the environment are sensed and intimated to the fisherman. At times boats are damaged because of any unnoticed obstacles that are also sensed using the IR sensors. This makes it more cost efficient method. In case of any unbalanced situation where the boat is in danger to tilt, then the MEMS sensor measure the X, Y and Z coordinates of the boat and sends a message to the coastal guards for help.

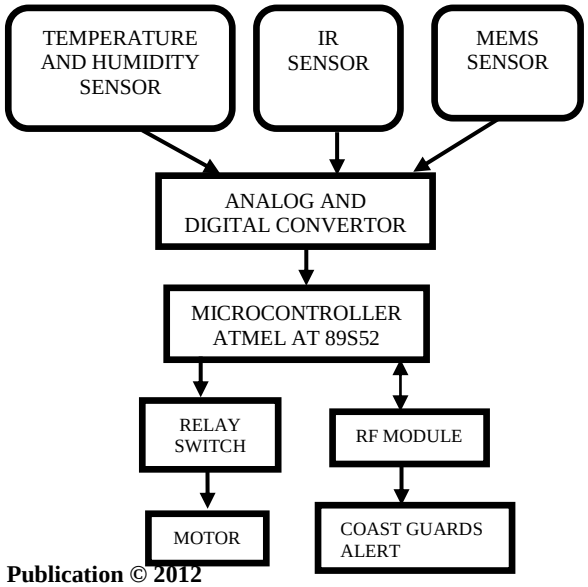

Figure 1: Block diagram of Receiver setup in the boat

Figure 2: Block diagram of Transmitting float station.

IV. HARDWARE COMPONENTS

A. Arduino Uno

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

B. Temperature and Humidity Sensor

DHT11 (Fig 4) is a Humidity and Temperature Sensor, which generates calibrated digital output. DHT11 can be interface with any microcontroller like Arduino, Raspberry Pi, etc. and get instantaneous results. DHT11 is a low cost humidity and temperature sensor which provides high reliability and long term stability. The DHT11 is a basic, ultra low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed). It's fairly simple to use, but requires careful timing to grab data.

Figure 3: DHT 11

C. Infrared Sensors

An infrared sensor (Fig 5) is an electronic device that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, the resistances and these output voltages, change in proportion to the magnitude of the IR light received.

Figure 4: IR Sensor

D. MEMS Sensor

A MEMS (Fig 6) magnetic field sensor is a small-scale micro electromechanical systems (MEMS) device for detecting and measuring magnetic fields. A MEMS-based magnetic field sensor is small, so it can be placed close to the measurement

location and thereby achieves higher spatial resolution than other magnetic field sensors.

Figure 5: MEMS Sensor

E. NRF 24LO1 (RF Module)

NRF24L01 (Fig 7) is a single chip radio transceiver for the world wide 2.4 - 2.5 GHz ISM band. The transceiver consists of a fully integrated frequency synthesizer, a power amplifier, a crystal oscillator, a demodulator, modulator and protocol engine. Current consumption is very low, only 9.0mA at an output power of -6dBm and 12.3mA in RX mode. Built-in Power Down and Standby modes makes power saving easily realizable.

Figure 6: NRF 24L01

V. RESULTS AND DISCUSSION

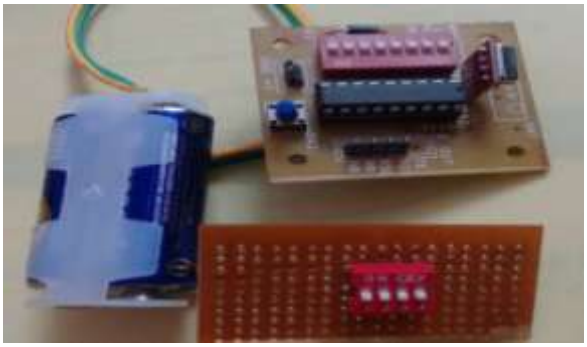

Figure 7: The floating station with RF transmitter.

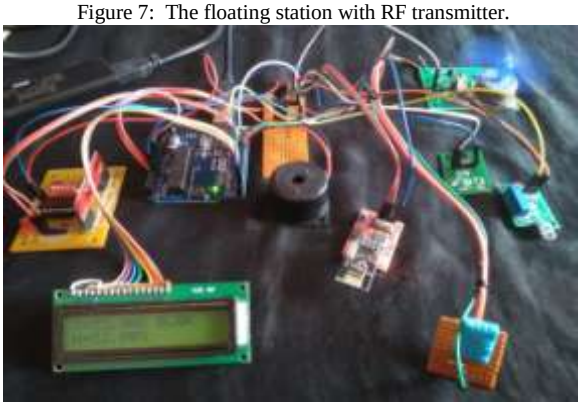

Figure 8: The boat/ship sailing within the border limits.

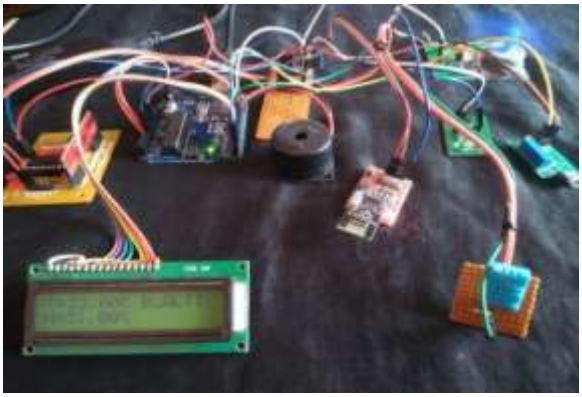

Figure 9: The 2x16 LCD that displays alert message to the boat as the boat is near to the nautical border.

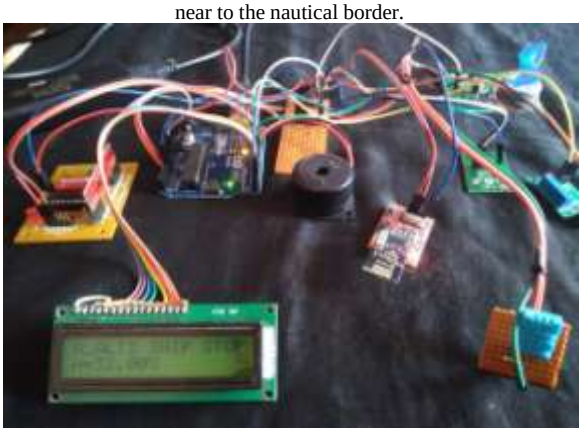

Figure 10: The 2x16 LCD that displays the boat has crossed the nautical border and the engine is stopped

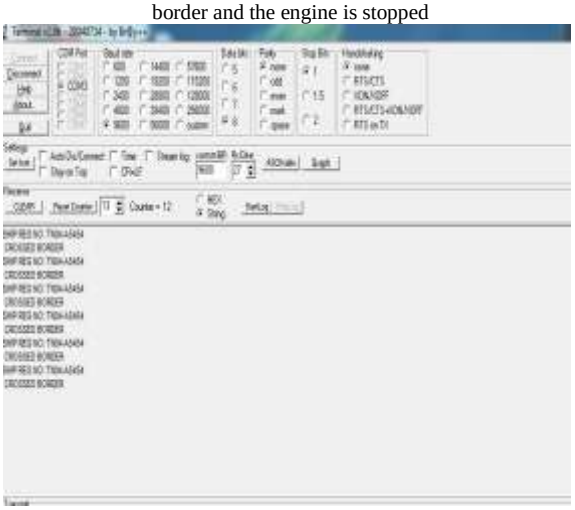

Figure 11: The terminal application in the base station that indicates the boat has crossed the nautical border along with the ship register number.

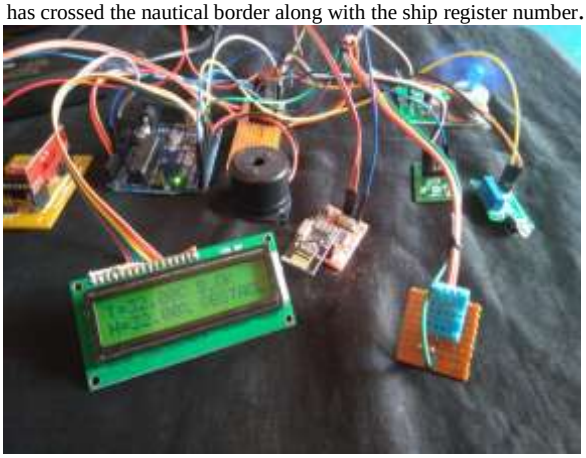

Figure 12: The2x16 LCD shows that an obstacle is found using IR sensors.

Figure 13: The2x16 LCD shows that a rain alert using DHT11 sensors.

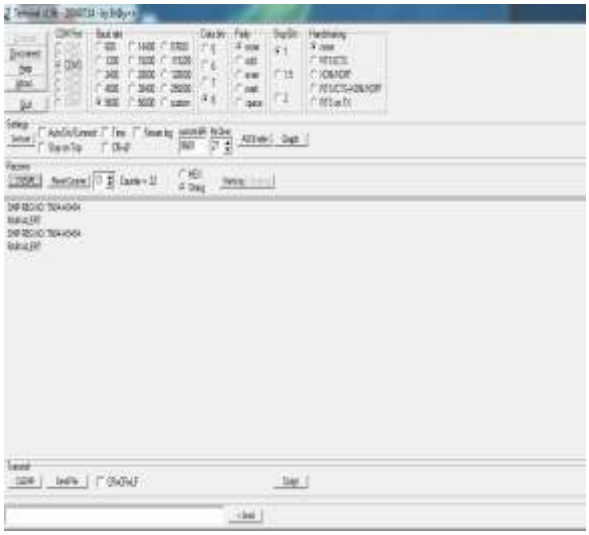

Figure 14: The terminal in the base station that indicates the rain alert.

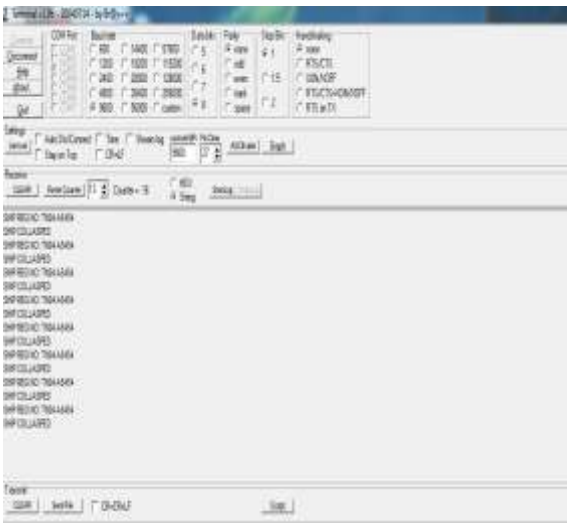

Figure 15: The terminal in the base station that indicates the rain alert.

VI. CONCLUSION

Thus with an advanced technology of an embedded system, a safe navigation system is designed which provides an effective solution for fishermen's problem and prevent them from crossing country's nautical border. The system has good data transmission rate. It is reliable, flexible and of low cost. The application works as an automatic incident management application that intimates the user if border crossing occurs. If the sailor crosses the border the buzzer is on and boat engine is off and alert message is given to base station. The high range of data transmission helps for the protection of fishermen and also helps them retain in safe zone. This has the potential to substantially improve the quality of life of the marine fishermen community and also provide them with better safety and security. Also it establishes a good relationship with the neighboring country and piracy of the ship is controlled.

REFERENCES

[1] Shravankumar Kalbhor , Sadanand Bhujbal , Akash Jadhav , Kuldip Mahajan , Mrs. P.D.Wadkar , "Safety system for fisher man to prevent border crossing", IJARIIE-ISSN(O)-2395-4396, Vol-3 Issue-2 2017.

[2] http://marinebio.org/oceans/ocean-resources/

[3] Sethuraman N Rao, Maneesha Vinodhini Ramesh, Venkat Rangan, "Mobile Infrastructure for Coastal Region Offshore Communication and Networks", IEEE Global Humanitarian Technology Conference, 2016.

[4]https://idsa.in/askanexpert/Indianfishermanoftenrunintoproblems withtheSriLankan

[5]http://timesofindia.indiatimes.com/articleshow/61908847.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst

[6] Preethi J, Lidya K, Reka M,Ramya Kiran S, Venugopal G, "Portable Life Protection System for Fisherman", International Journal of Scientific Research in Computer Science Engineering and Information technology, 2016.

[7] Nilanjit Mitra, Abhyuday Maji, Prativa Agarwalla, "Integrated Maritime Security & Surveillance", Devices for Integrated Circuit (Dev-IC), 2017.

[8] Kishore Kumar Reddy N.G, Ramakrishnan.G, Rajeshwari.K, "Ensuring Fisherman Safety through a Range Based System by Trizonal Localization using Low Power RSSI", International Conference on Signal Processing, Communication and Networking, 2017.

[9] G. Lavanya, Sneha Susan Abraham, "Modeling of Maritime vehicle using Gold Coin Coding Technique and GPS", International Journal of Engineering Research and Applications 2014.

[10] D.Arunvijay, E.Yuvaraj, "Design of Border alert system for fisherman using GPS", International Journal of Students Research in Technology & Management, 2014

[11] B.Kamalakannan, K.Naresh, P.Sakthivel, "Protecting Fisherman's by detecting and warning them while crossing sea borders using GSM and RFID Technologies", International Conference on Green Engineering and Technologies, 2016.

[12] Aishwarya Dalvi, Ridhee Borad, Nidhi Dawda, Niraj Bangera, "Fisherman Nautical Border Alert System", International Journal of Advanced Research in Computer Engineering &Technology, 2016

[13] Preethi J, Lidya K, Reka M,Ramya Kiran S, Venugopal G, "Portable Life Protection System for Fisherman", International Journal of Scientific Research in Computer Science Engineering and Information technology, 2016

[14] Nilanjit Mitra, Abhyuday Maji, Prativa Agarwalla, "Integrated Maritime Security & Surveillance", Devices for Integrated Circuit (Dev-IC), 2017.

[15] Syeda Muzammil, R.S .Prasanna Kumar, "Submarine Navigation and Disaster Management System using WSN", International Research Journal of Engineering and Technology, 2018.

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