International Journal of Engineering and Advanced Technology (IJEAT)
ISSN: 2249-8958 (Online), Volume-8 Issue-4, April 2019

Low Cost Border Alert System for Indian Fishermen using RFID in Microwave Range

A. Jayakumar, S. Sundaresan, S. Vetrivel

Abstract*: One of the serious issue faced by South-East Indian fishermen is ambush attack of neighboring countries due to unaware crossing of the border while fishing. In aim of overcoming this fussy scenario a prototype is modeled with Atmega 328controller and other modern electronics to alert the fishermen. Radio Frequency IDentification (RFID) technology operating in microwave frequency range with high coverage area plays a vital role in alert system. Two levels of boundaries with active RFID tags are erected within the nation's boundary limit. Global Positioning System (GPS) and Global System for Mobiles (GSM) modules gives hand for location tracking of boats and information transmission respectively. Boats with RFID nearing the first active tag gets alert through via controller through Liquid Crystal Display (LCD) and audio output (speaker) and simultaneously information is conveyed to coastal officials. If the RFID reader detects second active tag, controller autonomously turns off the boat engine. Thus providing safe and secure fishing with low cost and reduces fishermen's fatal rate

***Index Terms*: RFID, active tags, microwave range, GPS, GSM.**

I. INTRODUCTION

Nowadays fishermen faces many risks for his day-to-day bread and survival is being a challenging task. In specific, fishermen's of South-East Tamilnadu are being arrested and shot to dead by other countries navy. To address this serious issue faced by fishermen's, in this paper, a cost efficient solution is suggested using microcontroller and RFID. Initially, two boundaries are installed at different distances within the nation's limit using RFID active tags for wider coverage area and operating at microwave frequency range.

In previous method, Bluetooth and Wi-Fi technology are adopted which lags due to poor coverage and blind spot region [1,2]. Monitoring of fishermen's boat inside ocean is complex with individual GSM [3], [5,6] and separate device is needed for location tracking, which makes system design expensive and inefficient [9][11]. Also, the alert is given only through coastal guards to fishermen's for crossing of boundary and there is no defined boundary marks in existing methods [4]. General Packet Radio System (GPRS) for security can send information only is text format and real time tracing is not possible [10-12]. In few countries, sensor networks are made to use for monitoring system to reduce false alarm and wide coverage [2]. But sensor networks need more power utilization and maintenance is tedious for sensors deployed under water [4], [7]. Optimized protocols and recent algorithms need to be updated regularly for efficient working of sensor networks [14]. The proposed system overcomes the above difficulties with RFID technology (reader and active tags) and atmega 328 controller. For location tracing of fishermen's boat and transmission of information to coastal guards, integrated GPS and GSM modules interfaced with controller is used, which ensures safety to fishermen's job. This paper is organized as follows: Section II discusses about the modeling of the system, the hardware components utilized is briefed in Section III. Section IV explains the working of prototype for alert system and Section V put forth the results and discussions followed by conclusions in Section VI.

Manuscript published on 30 April 2019.
* Correspondence Author (s)
A. Jayakumar, Department of ECE, IFET College of Engineering, Villupuram, India.
S. Sundaresan, Department of ECE, SRM TRP Engineering College, Trichy, India.
S. Vetrivel, Department of ECE, IFET College of Engineering, Villupuram, India.

II. MODELING OF THE SYSTEM

The monitoring and alert system for fishermen is implemented with atmega 328, which serves as heart of the system. RFID reader and GSM are installed in boats and interfaced with controller using UART for asynchronous serial communication. For alerting purpose LCD and speaker are interfaced to controller and entire setup is fixed in boat. RFID tags are deployed at two different distances within the nation's boundary. Figure 1 shows the sketch of RFID boundary tags that are erected within the limit of nation's boundary. During fishing, boats nearing the first active tag boundary, an alert message is given to fishermen via output devices controlled by atmega 328 and simultaneously the latitude and longitude position of the boat is sent to coastal guards through GPS and GSM modules. Figure 2 displays the block diagram of the proposed system with atmega 328 controller and other interfacing components. If the boat continues its movement and sails further distance, second tag is detected by reader and this time controller turns off the engine autonomously via relay drive interfaced with it.

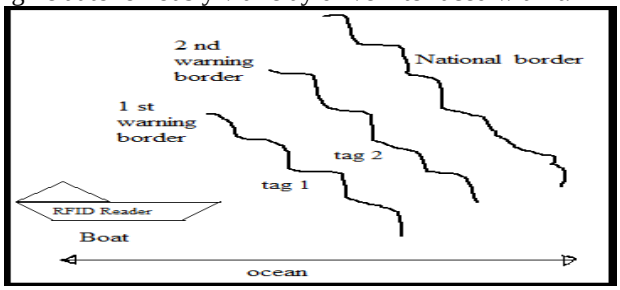

Figure 1 Sketch of Two Level RFID Boundary Tags

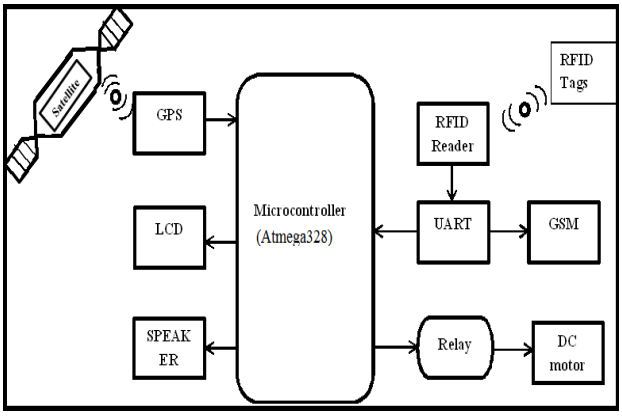

Figure 2 Block Diagram of Proposed System

III. HARDWARE REQUIREMENTS

3.1 Atmega 328

Controller plays a key role in monitoring and gets data from other equipment's for taking necessary actions according to program loaded. Atmega 328 is 8 bit processor capable of performing read and write operations simultaneously with 23 general purpose I/O lines, 32 general registers, thus enhancing the computational speed with operating frequency of 20MHz. It also has programmable watchdog timer with internal oscillator, 5 software selectable power saving modes and achieves throughput approaching 1 MIPS per MHz. Interfacing other devices with atmega 328 is easier and supports high speed data transmission build up with AVR RISC based microcontroller.

3.2 RFID Reader and Tags

Radio Frequency IDentification (RFID) technology provides easy and cost effective way of electromagnetic signal tracking and identification which as electronically stored information. For border alert system, boundaries are formed using RFID active tags and reader is fixed in boats. RFID-RC522 module operating in 13.56 MHz frequency which consumes low power, low cost and compact size read write chip is utilized and is been interfaced with controller using UART. Figure 3 displays the RFID module casted in prototype. Module utilizes 3.3V power supply, data rate of 10Mbits/s, reading distance of 60mm with SPI protocol.

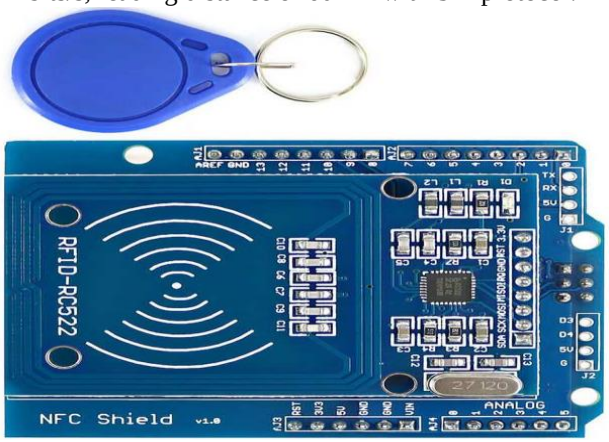

Figure 3 RFID-RC522 Module with Tag

3.2 GPS and GSM Modules

The information obtained from RFID tags is conveyed to coastal officials with latitude and longitude positions through GPS and GSM technologies. NEO-6M GPS and SIM 900A GSM/GPRS modules are made to use due to effective transmission of data. NEO 6M GPS features UART interface, compact size, onboard RTC crystal for faster warm and hot starts. Integrated ceramic antenna helps in precise point positioning with Ublox 6 position engine and have Assist Now autonomous offline and online services for faster communication. Figure 4 shows the NEO-6M GPS module. SIM 900A GSM/GPRS operates at 900/1800 MHz and can be connected to controller via RS232 chip. Baud rate is configurable from 9600-115200 via AT command and has slide SIM card tray with stub antenna, Bluetooth modem and SMA connector. Consumes input voltage of 12V DC with high quality PCB FR4 grade. Figure 5 displays the SIM 900A GSM/GPRS module.

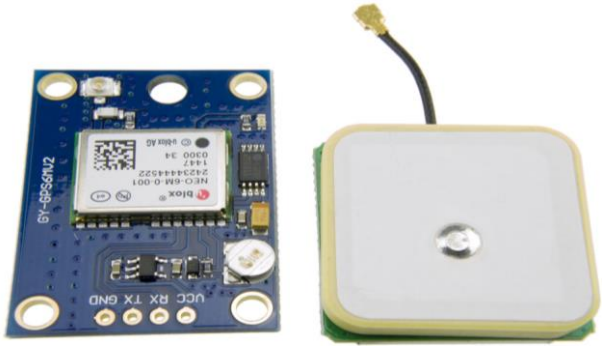

Figure 4 NEO-6M GPS Module with Ceramic Antenna

Figure 5 SIM 900A GSM/GPRS module

IV. SYSTEM WORKING

The border alert system for fishermen is replicated through prototype and made as a real time working model. Atmega 328 controller with RFID reader, active tags, display device, motor drive, GPS and GSM modules are casted. In the fishermen vessel RFID reader is fixed and interfaced with controller. Active tags forms two boundaries for identification of neighbouring country intrusion. Figure 6 shows the real time working prototype of the border alert system. If the fishermen gets near to active tag 1, RFID reader detects it and formation is casted via LCD and speaker for alerting the fishermen. Simultaneously, controller sends the exact location of boat through GPS to coastal officials.

Once the alert is given, fishermen need to change direction or sail towards the shore. If the fishermen proceeds further more towards the neighbouring country, active tag 2 gets detected and as a result controller stops the engine through motor drive automatically.

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication (BEIESP)

Instead of boat engine, DC motor with relay is interfaced to controller in the prototype. Thus boat is arrested from further movement and again latitude and longitude position is transmitted to navy officials by the controller for taking necessary actions.

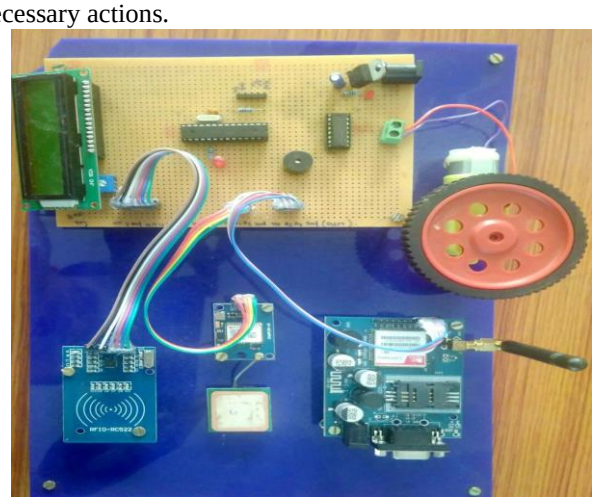

Figure 6 Real Time Working Prototype of Alert System

V. RESULTS AND DISCUSSIONS

The RFID reader placed in the vessel of the boat detects the active tag 1, when boat gets near and this information is sent to controller. Controller warns the fishermen via output devices present in the boat and GSM/GPS modules sends the information to coastal officials. Figure 7 shows the LCD status for tag 1 detection and Figure 8 displays the GSM message sent to officials via GSM module through controller.

Figure 7 LCD Status for Tag 1 Detection

Figure 8 GSM Message Sent to Officials

If tag 2 is detected by RFID reader, DC motor is turned off automatically by controller through relay unit which resembles boat engine. Hence movement of the boat is restricted and precise position is transmitted to navy peoples thereby fishermen boat is arrested within the nation's border. Figure 9 sketches the exact position of the boat through Google map.

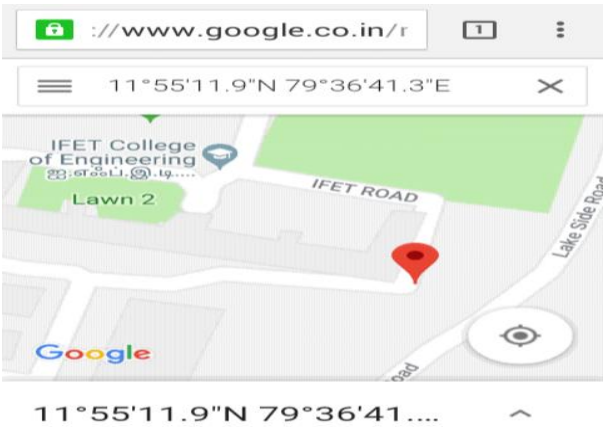

Figure 9 Location Tracking Through GPS

VI. CONCLUSIONS

Huge funding, precautionary steps, political suggestions and coastal area alerts are been made for safe guarding the fishermen's of South-East India. Many ideas have been put forth for solving this serious issue both in technical and non-technical ways. Overcoming the previous system issues, in this proposed model an efficient and simple way of alerting the fishermen is been developed with low cost modern electronic equipment's. Atmega 328 microcontroller with RFID technology functioning at microwave frequency range having wider coverage, precise location tracking and faster data communication is utilized for alert system. Active RFID tags forms two level of boundary scenario within the nation's boundary limit and helps in clear identification of safe fishing zone. NEO-6M GPS and SIM 900A GSM/GPRS module paves the way for precise location identification and information transmission. Open source software for programming atmega 328 and less maintenance of equipment's ensures low cost of the system, providing safe job for fishermen's, thereby reducing the fatal ratio. Future scope can be utilization of controller with even more high computational speed and memory, live telecasting of fishermen movements and installation of repeaters for overcoming the signal power issues in mid of the ocean.

REFERENCES

1. K. Aruli, M. Malathi, "A Review on GPS Tracking and Border Alert System for Fishermen", *IJSTE -International Journal of Science Technology & Engineering*, Volume 2, Issue 5, November 2015.
2. Sowmiya Ma, Sabeenian R.Sb, "Security and Monitoring System by using RFID Tags and multiple sensors", *International Conference on Electrical, Instrumentation and Communication Engineering (ICEICE2017).*
3. B.Kamalakannan, K.Naresh, P.Sakthivel, PROTECTING "Fishermen's by Detecting and Warning Them While Crossing Sea Borders Using GSM and RFID Technologies", 2016 *Online International Conference on Green Engineering and Technologies (IC-GET).*
4. Friedrich Samuel, R. Gomathi Bhavani, "GPS Based System for Detection and Control of Maritime Boundary Intruding Boats", *IEEE 59th International Midwest Symposium on Circuits and Systems (MWSCAS)*, 16-19 October 2016, Abu Dhabi, UAE.
5. Francis Enejo Idachaba "Design of a GPS/GSM based tracker for the location of stolen items and kidnapped or missing persons in Nigeria" *ARPN JEAS*, Vol. 6, No. 10. 2011.

6. Guoqiang Mao, Barıs Fidan and Brian D.O. Anderson, “Wireless sensor network localization techniques”, *Computer Networks*, Vol.51, Issue 10, Elsevier, 2007.
7. D. Arunvijay, E. Yuvaraj “Design of border alert system for fishermen using GPS”, *International Journal of students Research in Technology & Management*, Vol 2 (02), March-April 2014, ISSN 23212543.
8. M. Sivaramganesh, M. Ramya, V. Gowtham, T. Bharathi, G. Jeevitha, “Implementation of Maritime border alert system”, *International journal of innovative research in electrical, electronics, instrumentation and control engineering*, vol. 2, Issue 3, March 2014.
9. Hu Jian-ming; Li Jie; Li Guang-Hui, "Automobile Anti-theft System Based on GSM and GPS Module," *Fifth International Conference on Intelligent Networks and Intelligent Systems (ICINIS)*, 1-3 Nov. 2012.
10. Fleischer, P.B.; Nelson, A.Y.; Sowah, R.A.; Bremang, A., "Design and development of GPS/GSM based vehicle tracking and alert system for commercial inter-city buses," *IEEE 4th International Conference on* Adaptive Science & Technology, 25-27 Oct. 2012.
11. El-Medany, W.M.; Alomary, A.; Al-Hakim, R.; Al-Irhayim, S.; Nousif, M., "Implementation of GPRS Based Positioning System Using PICMicrocontroller," *Second International Conference on* Computational Intelligence, Communication Systems and Networks, 28-30 July 2010.
12. Parvez, M.Z, Ahmed, K.Z.; Mahfuz, Q.R.; Rahman, M.S., "A theoretical model of GSM network based vehicle tracking system, *" International Conference on Electrical and Computer Engineering (ICECE)*, 18-20 Dec. 2010.
13. Le-Tien, T.; Vu Phung-The, "Routing and Tracking System for Mobile Vehicles in Large Area,*" Fifth IEEE International Symposium on Electronic Design, Test and Application, 2010. DELTA, Jan. 2010.*
14. Hyunsung Kim, “RFID Mutual Authentication Protocol based on Synchronized Secret” *International Journal of Security and Its Applications*, Vol. 7, No. 4, July, 2013.
15. Sadagopan, V.K.; Rajendran, U.; Francis, A.J., "Anti-theft control system design using embedded system," *IEEE International Conference on* Vehicular Electronics and Safety (ICVES), 10-12 July 2011.

AUTHORS PROFILE

Jayakumar A completed his undergraduate from M.S University, Tirunelveli and M.E from Anna University, Chennai. Currently working as a Associate Professor in IFET College of Engineering. He has published several papers in International Journals and Conferences. His research areas are Communication Systems, Signal and Systems, Digital Signal Processing . He is a life time member in ISTE and IAENG. .

Sundaresan S completed his undergraduate from Pondicherry University and M.Tech from Amrita Vishwa Vidyapeetham, Coimbatore. He has published several papers in International Journals and Conferences. His research areas are Wireless Communication, Software Defined Radio and Embedded Systems. He is a life time member in ISTE, IAENG, SDIWC, ISRD, IAOE and IASTER. He has obtained best paper award and has been a resource person for various workshops and seminars.