IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

ISO 3297:2007 Certified ⁜ Impact Factor 8.102 ⁜ Peer-reviewed / Refereed journal ⁜ Vol. 12, Issue 5, May 2023

DOI: 10.17148/IJARCCE.2023.125179

SATELLITE AND RF ENABLED ASSISTANCE FOR MARINE NAVIGATION

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Abstract-The paper discusses the implementation of satellite and Radio Frequency (RF) technologies for providing assistance in marine navigation. The authors outline the challenges and limitations of traditional navigation methods and highlight the advantages of using satellite and RF technologies, such as increased accuracy, coverage, and reliability. The paper also covers the various types of satellite systems and their applications in marine navigation, including the Global Navigation Satellite System (GNSS) and Automatic Identification System (AIS). Additionally, the authors discuss the use of RF technologies for navigation, including radio beacons and radar systems. The paper concludes with a discussion of the potential future developments in satellite and RF technologies for marine navigation.

I.INTRODUCTION

Unlike on land, visually distinguishing the border of a country at sea is impossible. We have seen many cases wherein the fishermen are found “trespassing” into other country’s border and as a result are jailed. Unfortunately, these fishermen fail to realize they are in the other country’s border and thus get caught. This is one of the most tragic phenomena seen (for example: between India and Sri Lanka & India and Pakistan).

As of today, there is no system available (that is affordable and portable) for the fishermen that can help him in alerting him if he is venturing out of the country’s border at sea. [1] GPS navigators are the best solution to determine one’s position. But, due to their high price, our fishermen cannot afford them. Other option includes using buoys along the entire Indian water boundary. This is a costly process and ocean current and waves can easily disturb their positions. Another instance is that coast guards roam around the border and alert the fishermen whenever they tread near the border. [2]

Fishing is one of the most important occupations of the people living in the coastal area. Considering the problem faced by our fishermen and to provide a cost-effective solution, we designed SEAMAN (SEAMAN stands for Satellite and RF Enabled assistance for Marine Navigation) to meet the three basic problems faced by them. They are: [1]

1. Border determination
2. Distress message communication
3. Sudden weather change alerting

Many embedded systems have substantially different designs according to their functions and utilities. In this project design, structured modular design concept is adopted and the system is mainly composed of a single microcontroller, LCD, GSM, RF transmitter, RF receiver, RFID, GPS, emergency switch, mp3 module and android application (base station). The microcontroller located at the centre of the block diagram forms the control unit of the entire project.

II.LITERATURE SURVEY

In paper by QIAO Weihua1 [1], Submarine Target Recognition Based on Gps Positioning System, In this paper, image points of active target image features are calculated by image processing to achieve positioning of the target. The neural network is used to establish the coordinate correspondence of the target from the image space to the GPS

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positioning system space to locate the submarine space moving target. The results show that the multi-target recognition and positioning system based on GPS positioning system combined with sonar image design, the target recognition accuracy rate is over 93%, which meets the technical requirements of the detection system. Improving the identification of submarine targets is important.

In paper by Yukiko Muller1 [2], Underwater GPS System for Autonomous Underwater Wireless Drone Control, This research describes an underwater positioning system for swarming multiple AUVs. The existing Global Positioning System satellite (GPS) constellation provides limited availability and reliability. Thus, it is of interest to examine GPS using the integrated GNSS advantage. The purpose is to explore the usage underwater and subsurface monitoring, drone-based monitoring, digital forensic environment, and other defense-related applications. This is a cutting-edge technique for technical application that will allow the drone to inspect the ship and detect any damage by scanning the submerged surface of marine ships and receiving accurate damage position information.

In paper by A.D.Sarma, Navigational Electronics Present Status, Future Demands and Strategies to Enhance Quality, This paper briefly discusses history of navigation followed by operating principles of various satellite based navigations systems. The limitations as well as performance enhancement techniques are mentioned. The present status of satellite-based navigation systems is discussed. The importance of latest techniques including indoor navigation and source localization are highlighted. The major future demands and strategies to enhance quality are given.

In paper by S. Garg, Autonomous Ship Navigation System, the project aims at developing a prototype boat that is capable of autonomously sailing and navigating its way through obstacles present around it. Apart from moving on a pre-defined path the boat can intelligently avoid obstacles in the path through its ability of decision making using fuzzy logic. Calculations of fuzzy logic as well as deciding inputs for the path direction to be sent to the micro controller are done at the MATLAB workstation. The electronic system designed for the boat has excellent scalability and can be used for larger ships as well, but with some modifications. The project also includes the in-house fabrication of the BLDC motor controller and the wireless communication board using various TI chips.

In paper by H. Su, Ship detection in navigation based on broad learning system, based on the broad learning system (BLS), this paper carries out the detection of ships in navigation. Firstly, grayscale, and histogram equalization are used to preprocess the image to enhance the detail of the image and improve the training accuracy. Secondly, randomly select a part of the photo set as the test set. Finally, BLS is introduced to train and test the data set. Two training methods, back propagation neural network (BPNN) and support vector machine (SVM), are used to compare the proposed method with the navigation ship data set. From the experimental results, it can be seen that the BLS in this paper has a better detection effect in ship detection.

III.BLOCK DIAGRAM AND WORKING OF THE SYSTEM

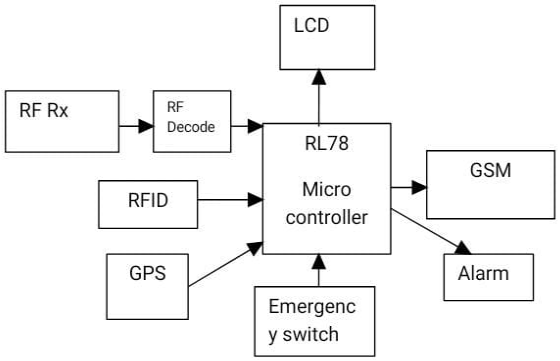

Fig 1. Block Diagram Of Satellite And Rf Enabled Assistance For Marine Navigation

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The heart of project is microcontroller Renesas (RL78), the ship unit consist of RFID reader for fisher man identification, GPS to get location, GSM to send and receive emergency alerts, emergency switch to indicate risk situation, alarm to get alerts while boundary crossing and weather changes, RF transmitter to indicate boundaries. Android application referred as base station. RF transmitter will be placed at other country boundary, RF receiver will be in ship unit ,when the ship tries to enter the other boundaries alert will be given to fisherman through voice alert via ,mp3 module and fisher man information is sent to base station when he enters ship through RFID ,if any emergency occurs at the mid of sea ,it is informed to base station using emergency switch, when emergency switch is pressed the present GPS location is fetched using GPS receiver and sent to base station and if any sudden changes in weather happens ,it is informed to fisher man from base station through voice alert via alarm.

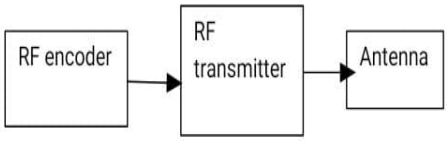

Fig 2. Ship/Intruder

Rf transmitter will be placed at other country boundary, RF receiver will be in ship unit ,when the ship tries to enter the other boundaries alert will be given to fisherman through voice alert via ,mp3 module and fisher man information is sent to base station when he enters ship through RFID ,if any emergency occurs at the mid of sea ,it is informed to base station using emergency switch, when emergency switch is pressed the present gps location is fetched using gps receiver and sent to base station and if any sudden changes in weather happens ,it is informed to fisher man from base station through voice alert via alarm.

IV. COMPONENTS USED FOR HARDWARE

1.RENESAS (RL78)

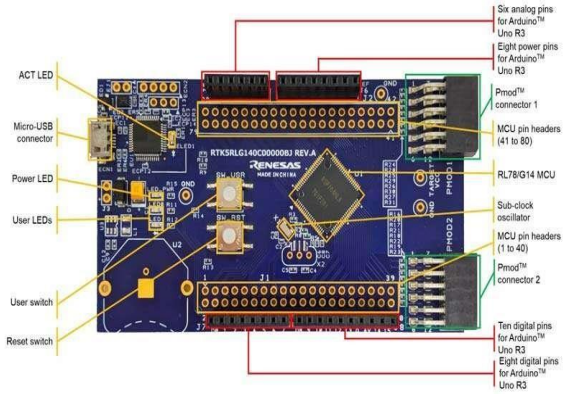

Fig 3.Renesas (RL78)

The figure shows the Renesas (**RL78**) is 16-bit architecture, it has 64 I/O pin (**R5F100LE**). It has 11 I/O ports, 64kB ROM, 4kB RAM, 1 watch dog timer, I2C protocol, 3 UART's, 10-bit ADC, 8 Timers, on chip debug function, high speed on-chip oscillator.

2.LCD DISPLAY

Fig 4. LCD display

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A liquid crystal display (**LCD)** is a flat panel display, electronic visual display, based on Liquid Crystal Technology liquid crystal display consists of an array of tiny segments (called pixels) that can be manipulated to present information. LCDs are used in a wide range of applications, including computer monitors, television, instrument panels, aircraft cockpit displays, signage, etc. They are common in consumer devices such as video players, gaming devices, clocks, watches, calculators, and telephones.

3. GSM

Fig 5. GSM

AT Commands are used to get information in SIM card. The SIM interface supports the functionality of the GSM Phase 1 specification and also supports the functionality of the new GSM Phase 2+ specification for FAST 64 kbps SIM (intended for use with a SIM application Tool-kit). Both 1.8V and 3.0V SIM Cards are supported. The SIM interface is powered from an internal regulator in the module having nominal voltage 2.8V. All pins reset as outputs driving low.

5.GPS

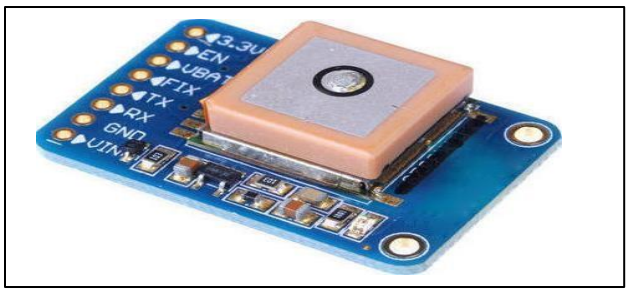

Fig 6. GPS

The Global Positioning System (GPS) is a space-based navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites. The system provides critical capabilities to military, civil, and commercial users around the world.

Radio-frequency identification (RFID) is the wireless use of electromagnetic fields to transfer data, for the purposes of automatically identifying and tracking tags attached to objects. The tags contain electronically stored information. Some tags are powered by electromagnetic induction from magnetic fields produced near the reader. Some types collect energy from the interrogating radio waves and act as a passive transponder. Other types have a local power source such as a battery and may operate at hundreds of meters from the reader. Unlike a barcode, the tag does not necessarily need to be within line of sight of the reader and may be embedded in the tracked object. RFID is one method for Automatic Identification and Data Capture (AIDC).

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6.RFID

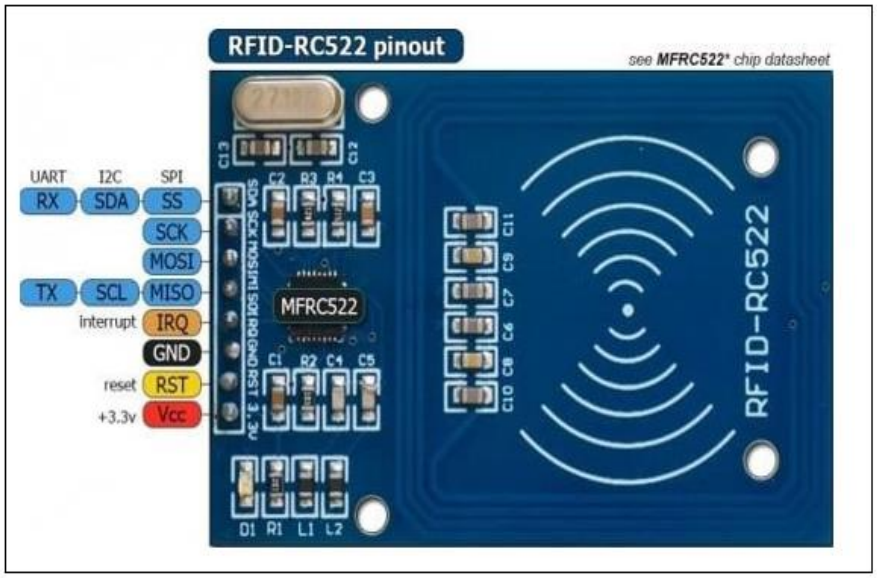

Fig 7. RFID

7. LED

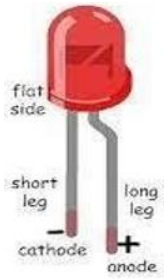

Fig 8. LED

An LED (Light Emitting Diode) emits light when an electric current passes through it. The simplest circuit to power an LED is a voltage source with a resistor and an LED in series. Such a resistor is often called a ballast resistor. LEDs work on the principle of Electroluminescence. On passing a current through the diode, minority charge carriers and majority charge carriers recombine at the junction. On recombination, energy is released in the form of photons.

V. RESULTS

The "border determination" system was implemented successfully using three RF transmitter towers, an RF receiver and decoder, an ARM (LPC2148) controller and three LED's and a buzzer as follows: the three RF towers were placed in three different areas to illustrate three boundary regions. Whenever the boat setup was near tower-A, a green LED was switched ON indicating that the boat was inside the Indian border. Whenever the boat setup was placed near tower-B, the green LED was switched off and a yellow LED was switched ON, indicating that the boat was near the international water border. When the boat setup came near tower-C, yellow LED was OFF and a red

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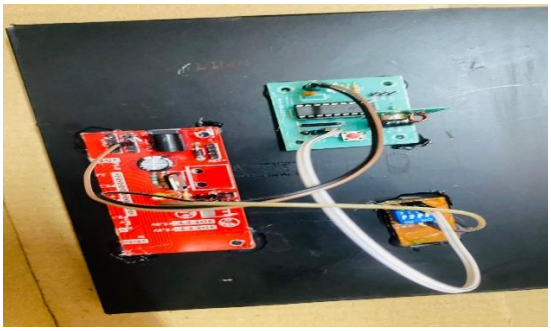
LED was switched ON and a buzzer was sounded indicating that the boat was near the other country's border i.e. danger area.

Coming to the "distress messaging" system, we were successfully able to implement it using an ARM (LPC1768) controller, a GPS receiver, a switch and a Zigbee module. When the switch was turned on, the "distress messaging" system was activated. The boat's current GPS coordinates were obtained from the GPS receiver and was sent out to a nearby boat and the base station along with a predefined message using GPS.

As soon as the message was delivered, the success message was displayed on a16x2 LCD on the boat. Also, the SOS message was displayed on LCD modules placed on the base station as well as that in boat

Finally, the "sudden weather change alerting" system was successfully implemented using 8051 (P89V51RD2) controller, an RF transmitter and receiver pair and a hex-keypad input as follows: at the base station, the designated key on the keypad (say key3 = tsunami alert) is pressed. This message is transmitted to the boat setup and is received and decoded by the RF receiver and the message is displayed on a 16x2 LCD module. Thus the fisherman is alert of the sudden weather changes so that he can come back to the shore safely.



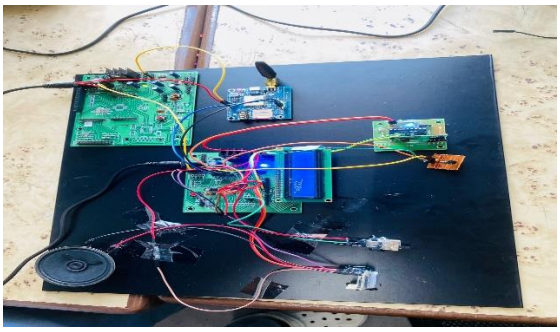


Fig 9. Marine navigation system

VI. CONCLUSION

We conclude that we were capable to successfully incorporate all the three features mentioned into our project. Main application is for our fishermen who unknowingly thread into international borders and get arrested by authorities of the other country for trespassing. The system guides them such that they are aware of the nation's boundary and when they have crossed it. Also, with the incorporation of the alert / warning & distress systems, the fishermen can be assisted at times of disaster. Thus an overall robust and cost effective system is them when they venture into the sea every day to meet their livelihood.

REFERENCES

[1] Qiao Weihua1, 3, Li Shoujun2,3, Submarine Target Recognition Based On Gps Positioning System , Iop Conf. Series: Materials Science And Engineering 740 (2020) 012207.

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[2] Yukiko Muller1), Shiho Oshiro1), Shigeo Nakagawa2), And Tomohisa Wada3), Underwater Gps System For Autonomous Underwater Wireless Drone Control , Ijcsns International Journal Of Computer Science And Network Security, Vol22 No.4, April 2022.

[3] A.D.Sarma , J.Ind. Geophys, Navigational Electronics Present Status, Future Demands And Strategies To Enhance Quality, Union (April 2015) V.19, No.2, Pp:210-214.

[4] S. Garg, R. K. Singh And R. Kapoor, "Autonomous Ship Navigation System," 2013 Texas Instruments India Educators' Conference, Bangalore, India, 2013, Pp. 300-305.

[5] H. Su, Y. Zuo And T. Li, "Ship Detection In Navigation Based On Broad Learning System," 2021 International Conference On Security, Pattern Analysis, And Cybernetics（Spac), Chengdu, China, 2021, Pp. 318-322.

[6] C. Vinothkumar1 And B. Arun Kumaran, “Implementation Of Gps Based Security System For Safe Navigation Of Fisherman Auto Boat”, International Journal For Research And Development In Engineering (Ijrde) 2014.

[7] G.W. Challen, J. Waterman, And M. Welsh, “Idea: Integrated Distributed Energy Awareness For Wireless Sensor Networks,” Proc. Eighth Int’l Conf. Mobile Systems, Applications, And Services (Mobi Sys ’10), 2015.

[8] B. Hubbard And F. Meyer, The World According To Wavelets: The Story Of A Mathematical Technique In The Making. Ak Peters Wellesley, 2015.

[9] V. Katiyar, P. Kumar, And N. Chand, “An Intelligent Transportation Systems Architecture Using Wireless Sensor Networks,” Int’l J. Computer Applications, Vol. 14, No. 2, Pp. 22-26, 2014.

[10] M. Arik And O.B. Akan, “Collaborative Mobile Target Imaging In Uwb Wireless Radar Sensor Networks,” Ieee J. Selected Areas In Comm., Vol. 28, No. 6, Pp. 950-961, Aug. 2016.