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Alert system of fisherman for secure navigation

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Alert system of fisherman for secure navigation

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Abstract. In day-to-day life we hear news about fisherman caught and even kill by naval infantry forces of other country for crossing the international borders. The proposed system can be used by the fisherman to safeguard them with the help of Global Positioning System (GPS) module based alerting system. The system uses the GPS device to get the current location i.e., latitude and longitude values of the boat and is continuously compared with the pre-set values in controller unit. As a result of this, the system alerts by buzzer sound before five hundred meter range and when the boat is near to international borders the speed of the boat is reduced. If the shipper refused to stop the boat and continues further the system alerts the fisheries by voice alarm. At the same time the control unit stops the boat from moving further and the present location is transmitted to the coastguards with the help of RF Transceiver. This is achieved when the boat is before 200 hundred meter range to of the international borders. If the boat tries to cross the international border or the boat is taken over by other countryman naval forces, the location of the boat is transmitted to coastguard port office continuously. This system also has hijack switch and when the switch is pressed it convey the hijack information and the current location to the coastguards continuously.

1. Introduction

The international border issues are considered the major problem rose over many countries. The Indian, Sri Lankan border complications are highlighted more in maritime borders [1]. The distance between India and Sri Lanka is just 18 nautical miles. However, in India many picadors (fisher) reside close to the international borders like Dhanushkodi, Ramanathapuram and their lives is based on fishing and maritime. In times of fishing, in an unknown aspect they tend to cross the international borders. For their lost ways they further killed and arrested or abducted by the foreign countryman troops. To uplift the above concern, in India, The Indian Armed Force compresses of mainly three divisions- Indian army, Indian navy, and the Indian air force, under the Ministry of Defence. The Indian Coastguard is fourth armed force, which was officially inaugurated on 1987. It deals with fisher, marine safety and security. The Indian Coastguard has duties and responsibility functions which is explored in the Coastguard act 1978, which is related to maritime protection and preventions [2]. In a specific view of fisherman's safety, it's the act of Assistance to fisherman in distress at sea. The fisherman gets assisted with the source of security from the Coastguard. But still the fishermen suffer in border crossing issue of International boundaries. To overcome these aspects of issues, we have designed an alert system for fisherman to avoid border crossing dilemma and in added preformation note of fisher and the boat to Coastguard. The entire system is done with the help of GPS and RF Module.



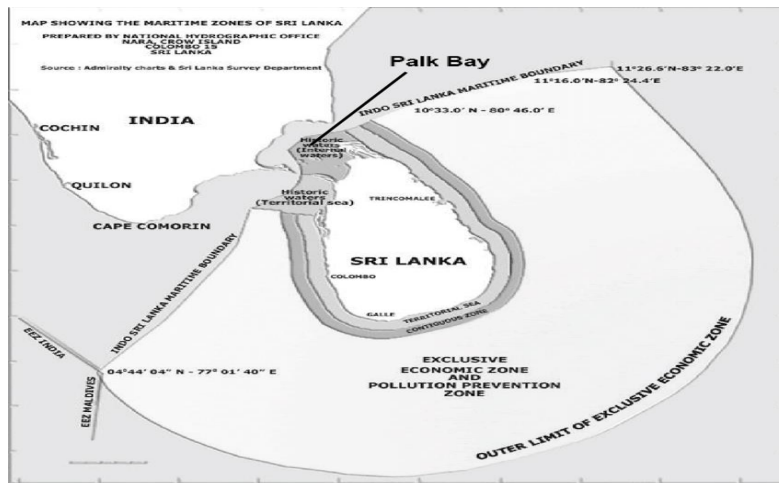


Figure 1. India – Sri Lankan marine border

2. Block diagram

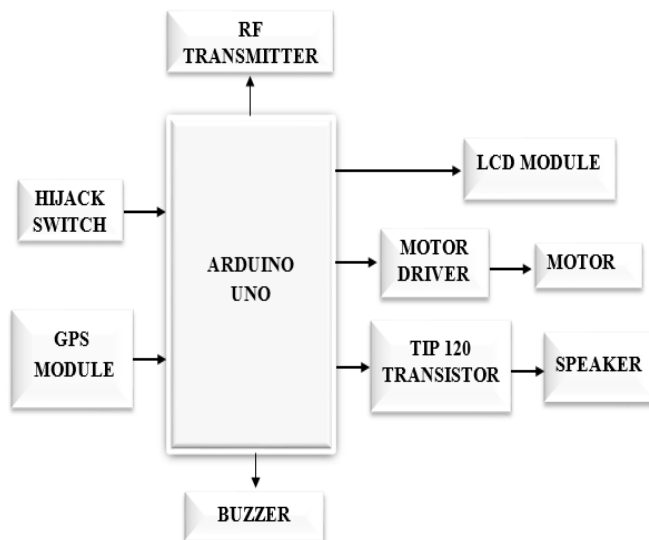


Figure 2. Transmitter block

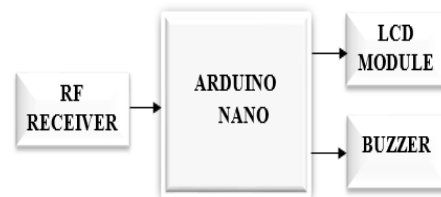


Figure 3. Receiver block

3. Hardware specification

3.1. Arduino uno

Arduino UNO is a microcontroller board inbuilt with a Microchip AT mega328P microcontroller IC, which is the main MCU on controlling and receiving sensor data and taking necessary actions based on intended program [3]. It is an open source microcontroller used in many projects. Its operating voltage is 5volts with 7 - 20 volts input voltage. It has a number of communicating facilities with other device and boards. In this system it acts as a controller and are used to control the receiving and processing of data. The controller receives the data from different sensor and modules which process the data as per the system design. Here the controller receives GPS module signal which is in the form of NMEA sentence then the received signal is processed as per the users programming design of the system.

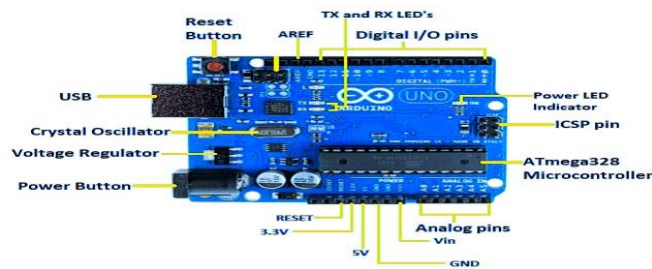


Figure 4. Arduino UNO as Transmitter hardware.

3.2. Arduino nano

Arduino Nano is compact in size used for in places of Arduino Uno they differ only difference is their package with different cable configuration. It is a microcontroller board inbuilt with Microchip ATmega3248P microcontroller IC [4], which is the main MCU for controlling and receiving sensor data and proceeding necessary actions based on intended program. In this system it is used for receiving the transmitted data from different controller of RF Receiver Module. As per the controller the output will be send to the relevant device. GPS Module the Global Positioning System (GPS) is a global navigation satellite systems (GNSS) which is a satellite-based radio navigation system. It provides time and the geolocation to the receiver. It uses ground station and satellite to measure and compute its exact position of the object. It is also famous as NAVSTAR GPS (Navigation System with TIME and Ranging). Each time the GPS receiver needs at least 4 satellites to receive the accurate data. The GPS receiver receives the data through the radio frequency in the range of 1.1 to 1.5 GHz, the received information with GPS module helps to compute the accurate time and location. In this system we uses NEO-6M series GPS module with antenna attached. Here the GPS receiver receives the location of the boat in NMEA sentences which includes different data information for computing process. The received data of the boat location with latitude and longitude values send to the controller unit for further process of the system.

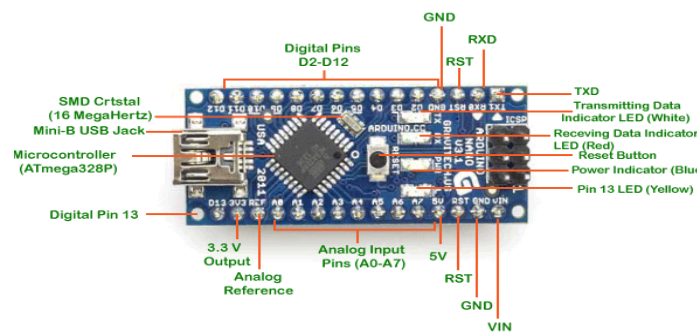


Figure 5. Arduino nano as receiver hardware.

3.3. GPS module

The Global Positioning System (GPS) is a global navigation satellite system (GNSS) which is a satellite-based radio navigation system [5]. It provides time and the geolocation to the receiver. It uses ground station and satellite to measure and compute its exact position of the object. It is also famous as NAVSTAR GPS (Navigation System with TIME and Ranging). At every time a GPS receiver needs at least 4 satellites to receive the data accurately. The GPS receiver receives the data through the radio frequency in the range of 1.1 to 1.5 GHz, the received information with GPS module helps to compute the accurate time and location. In this system we uses NEO-6M series GPS module with antenna attached. Here the GPS receiver receives the boat location data in NMEA sentences which includes different data information for computing process. The received data of the boat location with latitude and longitude values send to the controller unit to do the further process of the system.

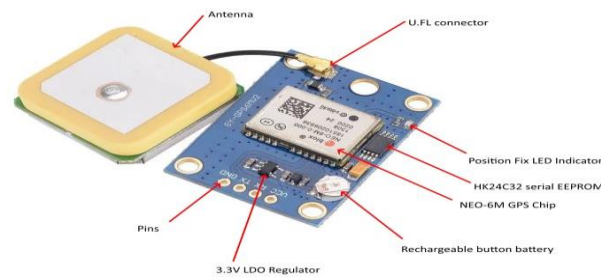


Figure 6. GPS module.

3.4. RF module

It is a 433 MHz wireless simple and separate Transmitter Receiver module, which is used in transmitting and receiving data at a particular distance [6]. These can be achieved with the help of inbuilt encoder and decoder data unit of the microcontroller. The RF module has an antenna for a required range communication, in absence of antenna the data is transmitted with only few centimetres. While choosing an antenna, it should be one quarter half of the frequency wave. It will be working with technique called Amplitude Shift Keying (ASK) like all forms of data transmission this is a method of modulating carrier wave, in this case the carrier wave is 433 MHz signal [7]. It is similar to an analog amplitude modulation (AM Radio) and also called binary shift keying because we consider only two levels of on/off slip for carrier and the digital one turns the carrier ON and digital zero turns OFF. In this system we use two controllers (Arduino) one for transmitter and other for receiver. The controller transmits the data through RF transmitter with the 433 MHz carrier frequency. The RF receiver receives the same data in same carrier frequency. Here the RF module transmit and receives the boat location, when the boat crosses the international border the hijack message is sent by the fisher.

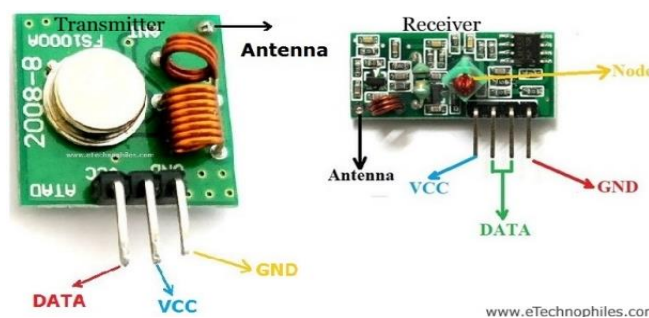


Figure 7. 433 MHz RF transmitter and receiver module.

3.5. Motor

The DC Motor is a rotatory electric motor that converts direct current electrical energy to mechanical energy. Their speed can be controlled widely by changing the strength of field current or by varying a supply voltage. It is used in number of fields in automotive, lathing, compressor, trolley car, crane, etc. In this system the motor is configure as boat's motor when the boat is close to the border its speed is reduced to moderate level., if its crosses the border limit the motor should be in off condition. Thus the motor works in three condition on, medium, off based on its speed. The control of the speed is achieved by using the motor driver l293d.

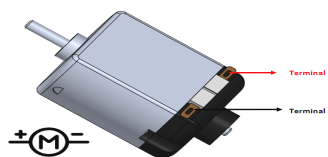


Figure 8. Motor

3.6. Motor driver

It is 16 pin motor driver IC, used to drive the motor. It's capable to run a couple of DC motor at a same time in single IC. Both the motor is independent for direction and speed control. If the motor is interfaced with the controller the motor driver is needed for satisfying power consumption, thus the controller works in lower-current signal whereas the output motor requires higher current signal, the motor driver take input as the lower current signal from the controller and gives an higher current signal as output to the motor as its need [8].

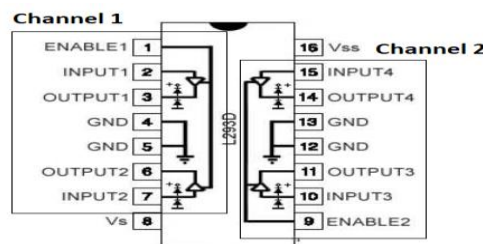


Figure 9. L293D Motor driver IC.

3.7. Speaker

The speaker is an electroacoustic transducer, which converts an electrical audio signal into relevant sound signal. If the speaker is less than 3 watt, it can be connected to the controller where if the speaker more than 3 watt it should be interfaced via TIP120 transistor to the controller. In this system it is used here as an output voice signal to indicate border crossing dilemma, when the boat crosses the international border.



Figure 10. Speaker

3.8. LCD module

An LCD module is an electronic display module that produces a visual image of data with use of liquid crystal. In this system the JHD162A LCD Module is used in displaying the output data of the boat position and alerting messages for human reference view point. It is a 16*2 matrix display, it can display 2 rows and 16 columns data in this module [9].

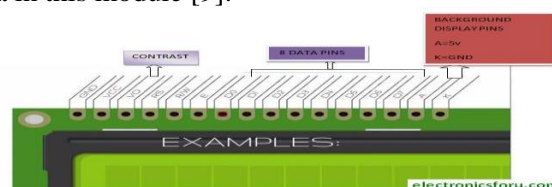


Figure 11. LCD Module.

3.9. Buzzer

The active buzzer is a sounding device which will generate a tone using internal oscillator with DC voltage. Here we uses a buzzer for alerting purpose in the border crossing dilemma and it used to indicate the hijack message when received [10].

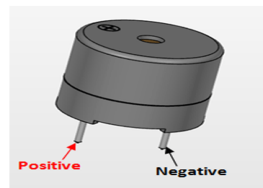


Figure 11. Buzzer

4. Project outcome

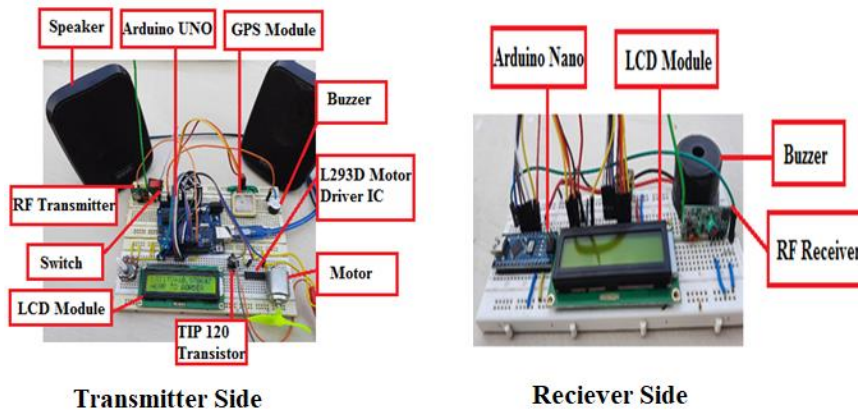


Figure 12. Implementation of the system

4.1. Working

The system perfectly suits the fisher who fishes near the international borders. Not all time the fishers are aware of the border lines, due to their invisible border areas, perfectly the border crossing dilemma happens. Here we designed a system to alert the fisher every time as per their movements. The working of the project is based on GPS and RF Module. First the GPS module is fixed on the top outside the boat to receive the signals, for an each and every second the GPS device receives the longitude and latitude values of the boat location. Based on the location values the controller will perform as per the conditions designed. Where the GPS receiver receives the location continuously, the received location data of the boat has longitude and latitude values is send to the microcontroller unit, the controller compares the current latitude and longitude values to the predefined latitude and longitude values as a correct path location. The output of the controller to the boat is concluded in to three aspect conditions.

4.2. Right path

If the boat goes in the right path there is no restriction to the boat's speed and no alerting is present, then the LCD displays data "right path" with latitude and longitude values.



Figure 13. Boat going in right path.

4.3. Near to border

When the boat is near to the international border location, the controller unit reduces the speed of the boat by controlling the motor speed and alerts the fishers by small buzzer sound. It also conveys the message to LCD module as "near to border" with the current latitude and longitude values.



Figure 14. Boat is near to border

4.4. Crossing border

When the boat reaches the predefined international border location, the controller unit stops the boat by reducing the motor speed to low value and it alerts as “border alert” via speaker. If the boat crosses the international border, the RF transmitter transmits the present the location of the boat with latitude and longitude value to the coast guard office to know the current status of the fishing boat. Even though when the fisher had not crossed the border, if the boat is taken across the border by other countryman troops, the location of the boat is send to the coastal guard office. The RF receiver with the controller is placed at the coastal guard port office. Once when the data or message is received at receiver side, the message is displayed in LCD module and also sounds the buzzer to help the coast guard for awareness.



Figure 15. Boat crosses the border.



Figure 16. Boat’s location received at coast guard port office.

4.5. Hijack switch

The hijack switch is placed in transmitter side, it is pressed when the hijack happens for fisheries. The RF transmitter transmits the hijack message to the port office. The RF receiver receives the message transmitted and displayed in LCD module and also sounds the buzzer to help the coast guard to aware of hijack. This is very useful for both coast guard and fisheries. Once the message is received, it helps for coast guard to rescue the fisheries as soon as possible.



Figure 17. Hijack message received at coast guard port office



Figure 18. Boat’s location received at coast guard port office.

5. Conclusion

An alert system for fisherman is introduced which is controlled by Arduino UNO and Nano micro-controllers with the help of GPS and RF modules. It is an effective system for the fishers for fishing nearby international border. Though the entire project is GPS based security system, it helps for fisherman to differentiate alert zone and normal zone easily in international border regions. Also with the help of RF module, the additional safety is increased for fishers by sending their present note to coast guard. Majorly it helps to save the life of each fisherman and also maintains good relationship between neighbouring countries.

6. Future scope

Implementation in real time application for fisherman. The system can also be included with LoRa band for long-range transmission with low power consumption. The enhanced system will give good source of action at maritime international borders.

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