YACHT GEOFENCING

A PROJECT REPORT

Submitted by

R.PUSHPAGANESH (1614027)

S.ARAVIND (1614005)

G.SAKTHIKUMARAN (1714L10)

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KARAIKUDI - 630 003.

ANNA UNIVERSITY, CHENNAI-600025

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BONAFIDE CERTIFICATE

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Signature of the HOD

Dr.A.SIVANANTHARAJA M.E., Ph.D

HEAD OF THE DEPARTMENT

Department of Electronics And Communication Engineering

A.C.Government College Of Engineering and Technology,

Karaikudi-630 003.

Signature of the Supervisor

Mr.T.MARIDASS M.E.,

ASSISTANT PROFESSOR

Department of Electronics And Communication Engineering

A.C.Government College of Engineering and Technology,

Karaikudi-630 003.

Submitted for Viva-Voce examination held at A.C. government college of engineerinng and technology,karaikudi on ……

INTERNAL EXAMINER **EXTERNAL EXAMINER**

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We are very much grateful to THE GOD who helped us the way throughout project and who has modeled us into what we are today.

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ABSTRACT

One of the major issues, that news channel daily telecast is that the rameshwaram fisheries were attacked or arrested by srilankan navy. This occurs mainly due to our fisheries cross the border for fishing or sailing nearby srilankan border. One way to overcome this issue is that we should alert the fisheries while sailing near the border. Some fisheries will cross the border in spite of danger alert. To overcome this problem we could send the message to our coastal guards that this boat tends to cross the border before them reaching the limit. In that message we could send the location parameters such as latitude and longitude, along with that the direction of the boat sailing to cross the border is sent. Why we send direction because the boat can sail in any direction to cross the border. It's like tracking a car while travelling on road using Google map, but sea is widely spread it is difficult to locate the exact location. For the transmission purpose we use radio frequency signals ,antenna in the boat transmit the data, GSM cannot be used in the sea to send the message because there is no signal for GSM in the sea. There is a digital compass attached in the boat to know which direction they heading to. For this purpose we use MPU-9250 to construct the digital compass. . RF module is used for the transmission purpose. Arduino acts as the microcontroller which controls all this process. In the boat there will be the speaker to announce the danger alert to the crew and emergency button is implemented in case of emergency they can inform the coastal guards by pressing the emergency button. Overall concept of this project is to safeguard our fisheries from crossing the border or geofencing.

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CHAPTER 1

INTRODUCTION

Navigation in transportation is one of the most important application mostly used by the drivers in both roadways and seaways transportation. Marine transportation is not an easy task as road transportation since its spread widely and lack of path. For the safe navigation purpose of fisherman inside the country border and thereby preventing them from crossing the border limits. GPS and Magnetometer module based alerting system provide effective real time boat tracking in which the location of the boat was found and reported to the coastal guards. This system informs where the boat is exactly located, since the geographical data is being fetched with the help of this system. The real time parameters such as exact latitude, longitude, directions, distance are reported by RF transmission. Then the coastal guards will receive the exact location and direction of the yacht, meanwhile there will be a alert system in the boat which will indicate with the help of the speaker and danger LED.

AIM

The goal was to build a device that could

- Read the location from the GPS.
- Match it with the border co-ordinates.
- Read the direction of the boat with the help of the Magnetometer.
- First level of indication is in the boat, through speaker they are alerted.
- Second level they are indicated by the Danger LED and then the information about the boat is transmitted to coastal guards.
- The parameters such as latitude, longitude, direction is transmitted via RF transmitter
- In the receiver side there will be danger siren buzzer and LED which indicates someone sailing near the border.

CHAPTER 2

LITERATURE SURVEY:

2.1 Intelligent boundary alert system using GPS:

In this paper, An Intelligent Boundary Alert System (IBAS) is proposed. This system helps the fishermen in maritime navigation. The system uses a GPS which continuously receiving signals from the satellite and provide the current position of the boat based on the latitude and longitude data. ARM processor is already fetched details of the latitude and longitude of the maritime boundary between India and Sri Lankan. Comparison is done by the processor with stored data and current position of the boat, and it generates the alarm signal whenever the boat crosses the border. They used wireless sensor network to transmit the message to the base station, there they monitors the boat in the sea. This system provides an indication to both fisherman and to coastal guard. Thereby fishermen lifespan will be saved.

2.2 Implementation of GPS based security system for safe Navigation of Fisherman Auto Boat:

This system also uses GPS technology for navigation and vessel tracking purposes. Using microcontroller, the stored border data between India and Srilanka is being compared with the current location details of the boat, and then alarm signal is being generated when the vessels near(appox:1.5km)to the border. Simply the message will be transmitted to the base station.

2.3 Implementation of GPS based Surveillance Navigation system for Fisherman:

This paper aims at surveillance System for fisherman from preventing them from border crossing. With the help of GPS, the current position of boats/vessels with latitude and Longitude data is continuously being extracted. The microcontroller compares the stored value and alert the fisherman when crosses the border line. Then the message is transmitted to coast guards through the RF signals. The RF module is the low cost and preferable solution for wireless communication while wired communication is not feasible in marine. RF module can be used for both transmission and reception purpose. Wireless communication I marine use VHF band range provides long way transmission.

2.4 Implementation of Maritime Border Alert System:

This paper proposed to help the small scale fishermen for safe navigation in maritime and then preventing them from entering other country border line. Data collection unit consists of GPS thus provided the information of location based on the position of the boat and transmitter. The processing unit fetched with already known details of border between the countries, and comparison is being done with known data and current position data. The controlling unit will make decision in order to alert the fishermen and coast guards.

2.5 Arm Based Fishing Boat Security System:

In this paper, the idea is to help the fishing boat for safe navigation using GPS. When the fishermen boat getting near the border limit, the controller units generates the alarm signal. ARM processor is used in controller unit. In addition to it, voice alert is also generated. If so the boat is further moving towards the border, DC motors will be steering opposite to the border. Thus the system provides the maritime security for fishermen.

2.6 Proposed Work:

Problem Definition and Objectives

Indian fishermen have been habitually transgressing the International Maritime Boundary Line (IMBL), the imaginary line in the waters between India and Sri Lanka, in their struggle for survival. On February 19, seven fishermen from Tamil Nadu were arrested by the Sri Lankan Navy for allegedly straying into their waters.

What is the problem?

Indian boats have been fishing in the troubled waters for centuries and had a free run of the Bay of Bengal, the Palk Bay and the Gulf of Mannar until 1974 and 1976 when treaties were signed between the two countries to demarcate the maritime boundary — the IMBL. However, the treaties failed to factor in the hardship of thousands of traditional fishermen who were forced to restrict themselves toa meager area in their fishing forays. The small islet of Katchatheevu, hitherto used by them for sorting their catch and drying their nets, fell on the other side of the IMBL. Fishermen often risk their lives and cross the IMBL rather than return empty-handed, but

the Sri Lankan Navy is on alert, and have either arrested or destroyed fishing nets and vessels of those who have crossed the line.

How many have been hit?

The 4,000-odd fishermen in Rameswaram have borne the brunt as they hit the IMBL at the 12th nautical mile from the jetty. They set out for fishing in 800-odd mechanized boats thrice a week, but every voyage is a nightmare. The distance between the shore and the IMBL in the Palk Bay is 15 nautical miles from Point Calimerein Nagapattinam district, 29 nautical miles from Adirampatinam and 27 nautical miles from Mallipattinamin Thanjavur district, it is only 12 nautical miles from Rameswaram and just 9 nautical miles from Danushkodiin Ramanathapuram district. The Nagapattinam fishermen could well set out to the Bay of Bengal and sail down south to enter into Sri Lankan waters and get arrested.

At present, 120 fishermen from these districts are detained in Sri Lankan prisons with their boats — 177 in all — confiscated after they were arrested on the charge of trespassing into that country's waters. On any fishing day, 3,343 mechanized boats, including 1,581 from Ramanathapuram and 953 from Nagapattinam, get into the Palk Bay with an eye on Sri Lankan waters for the high-value giant prawns.

The IMBL is imaginary, but it was geo-tagged and is visible to the fishermen, thanks to Global Positioning System (GPS) sets. The latest 'Garmin 585' GPS sets can flash the boundary line on the screens and fishermen have the option to view the line in the colour of their choice. Close to 200 boat owners in Rameswaram have already switched to modern GPS sets for precision fishing.

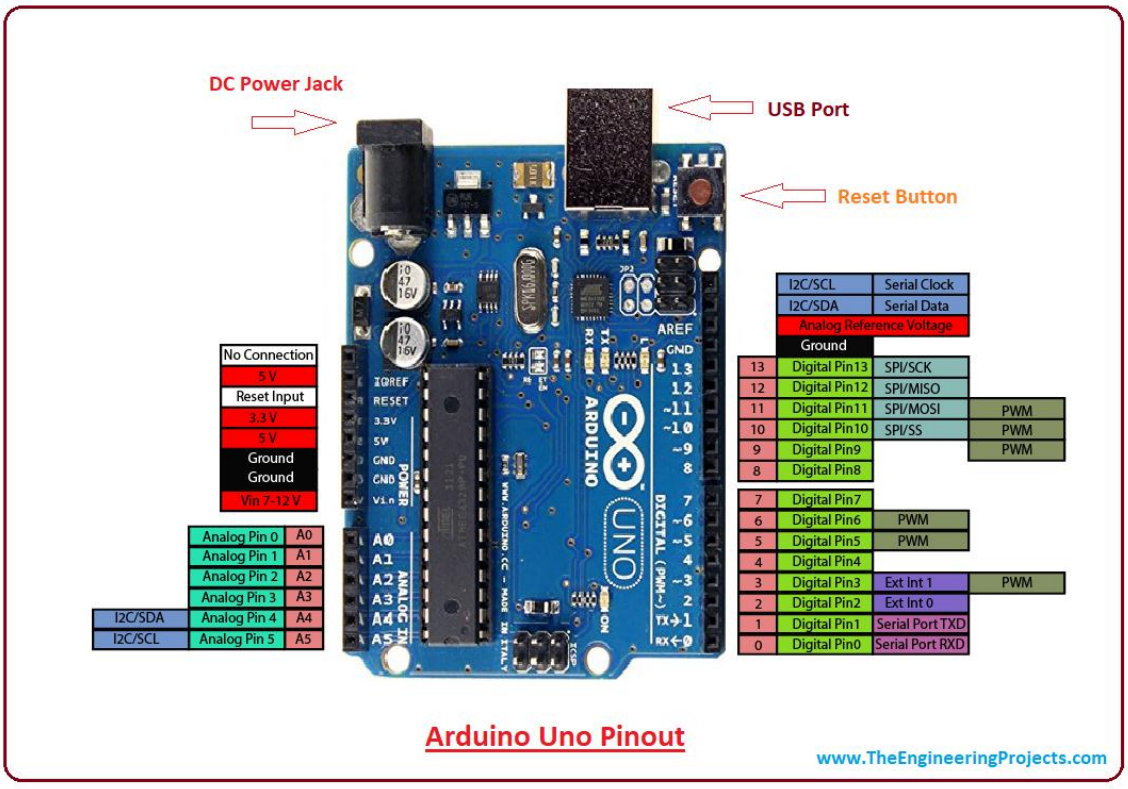
Initially, the Sri Lankan Navy used to release the arrested fishermen along with their vessels but has now started detaining the trawlers, each worth about □50 lakh. With Sri Lankan naval patrol vessels keeping strict vigil along the IMBL, the fishermen take turns to get into their waters. If they get caught, the Navy usually targets a couple of boats and others hurry back to the Indian waters, sometimes leaving their expensive fishing nets behind. Thanks to the buoys, they retrieve the nets later but not all fishermen are lucky. Of late, the Sri Lankan Navy have begun destroying the nets also. But the fishermen take the risk as the returns are high.

CHAPTER 3

ARDIUNO

3.1 Technical specifications

- Microcontroller: MicrochipAtmega328P
- Operating Voltage: 5Volts
- Input Voltage: 7 to 20Volts
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- Analog Input Pins:6
- DC Current per I/O Pin: 20mA
- DC Current for 3.3V Pin: 50mA
- Flash Memory: 32 KB of which 0.5 KB used by boot loader
- SRAM: 2KB
- EEPROM: 1KB
- Clock Speed: 16MHz



ARDUINO UNO **FIGURE 3.1**

3.2 General Pin functions:

- **LED:** There is a built-in LED driven by digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.
- **VIN**: The input voltage to the Arduino/Genuino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
- **5V**: This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 – 20V), the USB connector (5V), or the VIN pin of the board (7-20V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage the board.
- **3V3**: A 3.3-volt supply generated by the on-board regulator. Maximum current draw is 50mA.
- **GND**: Ground pins.
- **IOREF**: This pin on the Arduino/Genuino board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source or enable voltage translators on the outputs to work with the 5V or3.3V.
- **Reset**: Typically used to add a reset button to shields which block the one on the board.

3.3 Special Pin Functions

Each of the 14 digital pins and 6 Analog pins on the Uno can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive 20mA as recommended operating condition and has an internal pull- up resistor (disconnected by default) of 20-50k ohm. A maximum of 40mA is the value that must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller. The Uno has 6 analog inputs, labeled A0 through A5, each of which provide 10 bits of resolution (i.e. 1024 different values). By default, they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analogReference() function.

In addition, some pins have specialized functions:

- **Serial** / UART: pins 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the Atmega8U2 USB-to-TTL Serial chip.
- **External Interrupts**: pins 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.
- **PWM** (**P**ulse **W**idth **M**odulation): 3, 5, 6, 9, 10, and 11 Can provide 8-bit PWM output with the analogWrite() function.
- **SPI** (**S**erial **P**eripheral **I**nterface): 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK).These pins support SPI communication using the SPI library.
- **TWI** (**T**wo **W**ire **I**nterface) / I²C: A4 or SDA pin and A5 or SCL pin. Support TWI communication using the Wire library.
- **AREF** (**A**nalog **REF**erence): Reference voltage for the analog inputs.

3.4 Communication

The Arduino/Genuino Uno has a number of facilities for communicating with a computer, another Arduino/Genuino board, or other microcontrollers. The Atmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An Atmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The 16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, a .inf file is required. The Arduino Software (IDE) includes a serial monitor which allows simple textual data to be sent to and from the board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial communication on pins 0 and 1). A SoftwareSerial library allows serial communication on any of the Uno's digital pins.

3.5 Automatic (Software) Reset

Rather than requiring a physical press of the reset button before an upload, the Arduino/Genuino Uno board is designed in a way that allows it to be reset by software running on a connected computer. One of the hardware flow control lines (DTR) of the Atmega8U2/16U2 is connected to the reset line of the Atmega328 via a 100 nano-farad capacitor. When this line is asserted

(taken low), the reset line drops long enough to reset the chip.

This setup has other implications. When the Uno is connected to a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half-second or so, the boot loader is running on the Uno. While it is programmed to ignore malformed data (i.e. anything besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened.

3.6 Steps to upload the code

1. Open the arduino IDE software and write the code in the blank space.
2. Compile the code to check errors in that code. So the code can be easy to debug.
3. Before uploading the code to the arduino, you'll need to select the entry in the **Tools > Board menu** that corresponds to your Arduino board.
4. Select the serial device of the board from the **Tools | Serial Port** menu. This is likely to be **COM3** or higher (**COM1** and **COM2** are usually reserved for hardware serial ports). To find out, you can disconnect your board and re-open the menu; the entry that disappears should be the Arduino board. Reconnect the board and select that serial port.
5. Now, simply click the "Upload" button in the environment. Wait a few seconds – you should see the RX and TX LEDs on the board flashing. If the upload is successful, the message "Done uploading." Will appear in the status bar.

CHAPTER 4

GPS

The NEO-6MV2 is a GPS (Global Positioning System) module and is used for navigation. The module simply checks its location on earth and provides output data which is longitude and latitude fits position. It is from a family of stand-alone GPS receivers featuring the high performance u-blox 6 positioning engine. These flexible and cost-effective receivers offer numerous connectivity options in a miniature (16 x 12.2 x 2.4 mm) package. The compact architecture, power and memory options make NEO-6 modules ideal for battery operated mobile devices with very strict cost and space constraints. Its Innovative design gives NEO-6MV2 excellent navigation performance even in the most challenging environments.

4.1 NEO-6MV2 GPS Module Pin Configuration

The module has four output pins and we will describe the function each pin of them below. The powering of module and communication interface is done through these four pins.

Table 4.1

Pin Name	**Description**
VCC	Positive power pin
RX	UART receive pin
TX	UART transmit pin
GND	Ground

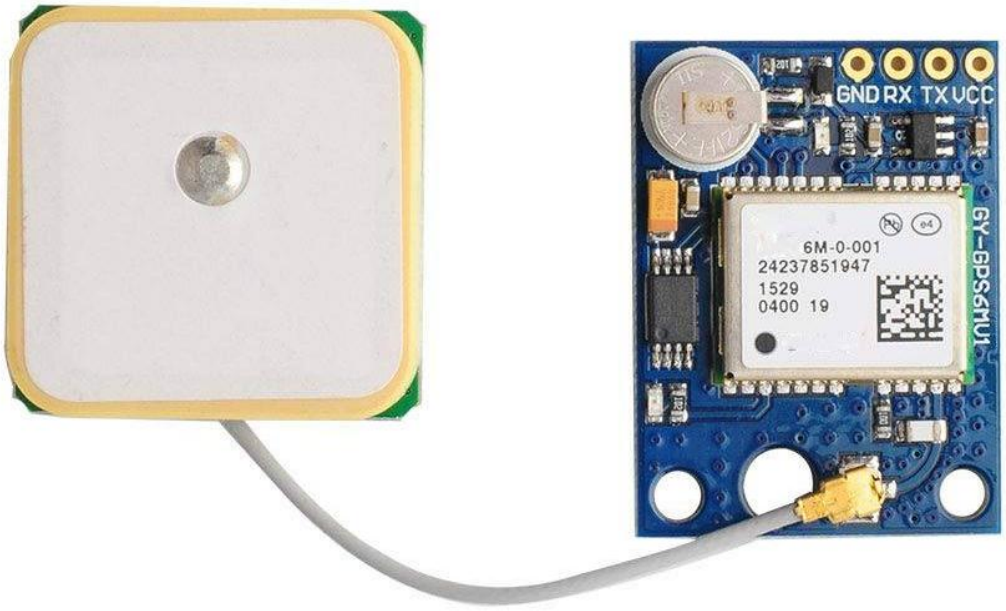
4.2 Features and Electrical Characteristics

- Standalone GPS receiver
- Anti-jamming technology
- UART Interface at the output pins (Can use SPI ,I2C and USB by soldering pins to the chip core)
- Under 1 second time-to-first-fix for hot and aided starts
- Receiver type: 50 Channels - GPS L1 frequency - SBAS (WAAS, EGNOS, MSAS, GAGAN)
- Time-To-First-fix: For Cold Start 32s, For Warm Start 23s, For Hot Start<1s

- Maximum navigation update rate:5Hz
- Default baud rate:9600bps
- EEPROM with battery backup
- Sensitivity:-160dBm
- Supply voltage:3.6V
- Maximum DC current at any output:10mA
- Operation limits: Gravity-4g, Altitude-50000m,Velocity-500m/s
- Operating temperature range: -40ºC TO85°C

4.3 Overview of the NEO-6MV2 GPS Module

This module is one of popular GPS modules on the market and is also cheap to buy. The location data provided by it is accurate enough to satisfy most applications. And for it to be included in smart phones and tablets design points out its efficiency. This module is famous among hobbyist and engineer's altogether who want to work on applications involving navigation.



GPS MODULE **FIGURE 4.3**

CHAPTER 5

MAGNETOMETER

A magnetometer is a device that measures magnetism—the direction, strength, or relative change of a magnetic field at a particular location. The measurement of the magnetization of a magnetic material (like a ferromagnet) is an example. A compass is one such device, one that measures the direction of an ambient magnetic field, in this case, the Earth's magnetic field.

5.1 MPU9250 overview

MPU-9250 is a multi-chip module (MCM) consisting of two dies integrated into a single QFN package. One die houses the 3-Axis gyroscope and the 3-Axis accelerometer. The other die houses the AK8963 3-Axis magnetometer from Asahi Kasei Microdevices Corporation. Hence, the MPU-9250 is a 9-axis Motion Tracking device that combines a 3-axis gyroscope, 3-axis accelerometer, 3-axis magnetometer and a Digital Motion Processor™ (DMP) all in a small 3x3x1mm package available as a pin-compatible upgrade from the MPU6515. With its dedicated I^2C sensor bus, the MPU-9250 directly provides complete 9-axis MotionFusion™ output. The MPU-9250 Motion Tracking device, with its 9-axis integration, on-chip MotionFusion™, and runtime calibration firmware, enables manufacturers to eliminate the costly and complex selection, qualification, and system level integration of discrete devices, guaranteeing optimal motion performance for consumers. MPU-9250 is also designed to interface with multiple non-inertial digital sensors, such as pressure sensors, on its auxiliary I^2C port. MPU-9250 features three 16-bit analog-to-digital converters (ADCs) for digitizing the gyroscope outputs, three 16-bit ADCs for digitizing the accelerometer outputs, and three 16-bit ADCs for digitizing the magnetometer outputs. For precision tracking of both fast and slow motions, the parts feature a user-programmable gyroscope full-scale range of ±250, ±500, ±1000, and ±2000°/sec (dps), a user-programmable accelerometer full-scale range of ±2g, ±4g, ±8g, and ±16g, and a magnetometer full-scale range of ±4800μT. Other industry-leading features include programmable digital filters, a precision clock with 1% drift from -40°C to 85°C, an embedded temperature sensor, and programmable interrupts. The device features I^2C and SPI serial interfaces, a VDD operating range of 2.4V to 3.6V, and a separate digital IO supply, VDDIO from 1.71V to VDD.

5.2 Gyroscope Features

The triple-axis MEMS gyroscope in the MPU-9250 includes a wide range of features:

- Digital-output X-, Y-, and Z-Axis angular rate sensors (gyroscopes) with a user-programmable full-scale range of ±250,±500,±1000,and ±2000°/sec and integrated16-bit ADCs
- Digitally-programmable low-pass filter
- Gyroscope operating current: 3.2mA
- Sleep mode current: 8µA
- Factory calibrated sensitivity scale factor
- Self-test

5.3 Accelerometer Features

The triple-axis MEMS accelerometer in MPU-9250 includes a wide range of features:

- Digital-output triple-axis accelerometer with a programmable full scale range of ±2*g*, ±4*g*, ±8*g* and ±16*g* and integrated 16-bit ADCs
- Accelerometer normal operating current: 450µA
- Low power accelerometer mode current: 8.4µA at 0.98Hz, 19.8µA at 31.25Hz
- Sleep mode current: 8µA
- User-programmable interrupts
- Wake-on-motion interrupt for low power operation of applications processor
- Self-test

5.4 Magnetometer Features

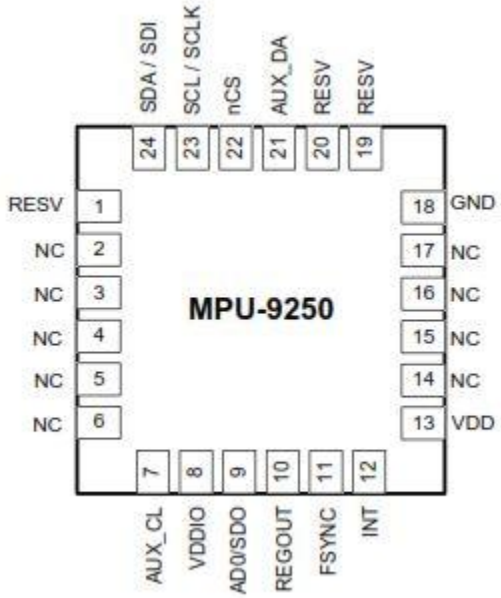
The triple-axis MEMS magnetometer in MPU-9250 includes a wide range of features:

- 3-axis silicon monolithic Hall-effect magnetic sensor with magnetic concentrator
- Wide dynamic measurement range and high resolution with lower current consumption.
- Output data resolution of 14 bit (0.6µT/LSB)
- Full scale measurement range is ±4800µT
- Magnetometer normal operating current: 280µA at 8Hz repetition rate
- Self-test function with internal magnetic source to confirm magnetic sensor operation on end products

5.5 Pin out and signal description

Table 5.5

Pin Number	Pin Name	Pin Description
1	RESV	Reserved. Connect to VDDIO.
7	AUX_CL	I²C Master serial clock, for connecting to external sensors
8	VDDIO	Digital I/O supply voltage
9	AD0 / SDO	I²C Slave Address LSB (AD0); SPI serial data output (SDO)
10	REGOUT	Regulator filter capacitor connection
11	FSYNC	Frame synchronization digital input. Connect to GND if unused.
12	INT	Interrupt digital output (totem pole or open-drain)
13	VDD	Power supply voltage and Digital I/O supply voltage
18	GND	Power supply ground
19	RESV	Reserved. Do not connect.
20	RESV	Reserved. Connect to GND.
21	AUX_DA	I²C master serial data, for connecting to external sensors
22	nCS	Chip select (SPI mode only)
23	SCL / SCLK	I²C serial clock (SCL); SPI serial clock (SCLK)
24	SDA / SDI	I²C serial data (SDA); SPI serial data input (SDI)
2 – 6, 14 - 17	NC	Not internally connected. May be used for PCB trace routing.



Pin out Diagram **FIGURE 5.5**

5.6 Orientation of Axes

The diagram below shows the orientation of the axes of sensitivity and the polarity of rotation. Note the pin 1 identifier (•) in the figure.

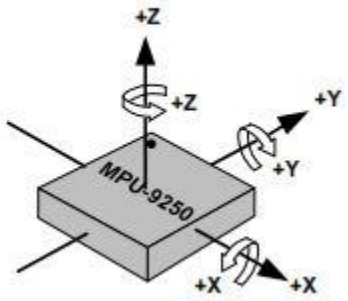


FIGURE 5.6

Orientation of Axes of Sensitivity and Polarity of Rotation for Accelerometer and Gyroscope

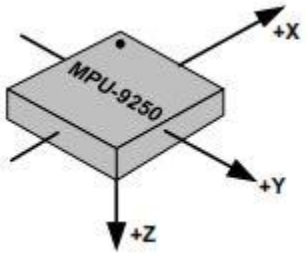
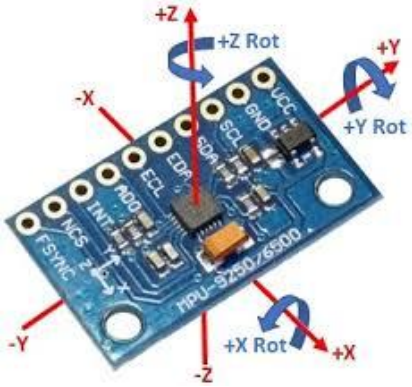


FIGURE 5.6.1

Orientation of Axes of Sensitivity for Compass



MAGNETOMETER MODULE **FIGURE 5.6.2**

CHAPTER 6

BUZZER AND SPEAKER

6.1 Overview

A buzzer is a small yet efficient component to add sound features to our project/system. It is very small and compact 2-pin structure hence can be easily used on breadboard, Perf Board and even on PCBs which makes this a widely used component in most electronic applications. There are two types are buzzers that are commonly available. The one shown here is a simple buzzer which when powered will make a Continuous Beeeeeeppp.... sound, the other type is called a readymade buzzer which will look bulkier than this and will produce a Beep. Beep. Beep. Sound due to the internal oscillating circuit present inside it. But, the one shown here is most widely used because it can be customized with help of other circuits to fit easily in our application. This buzzer can be used by simply powering it using a DC power supply ranging from 4V to9V. A simple 9V battery can also be used, but it is recommended to use a regulated +5V or+6V DC supply. The buzzer is normally associated with a switching circuit to turn ON or turnoff the buzzer at required time and require interval.

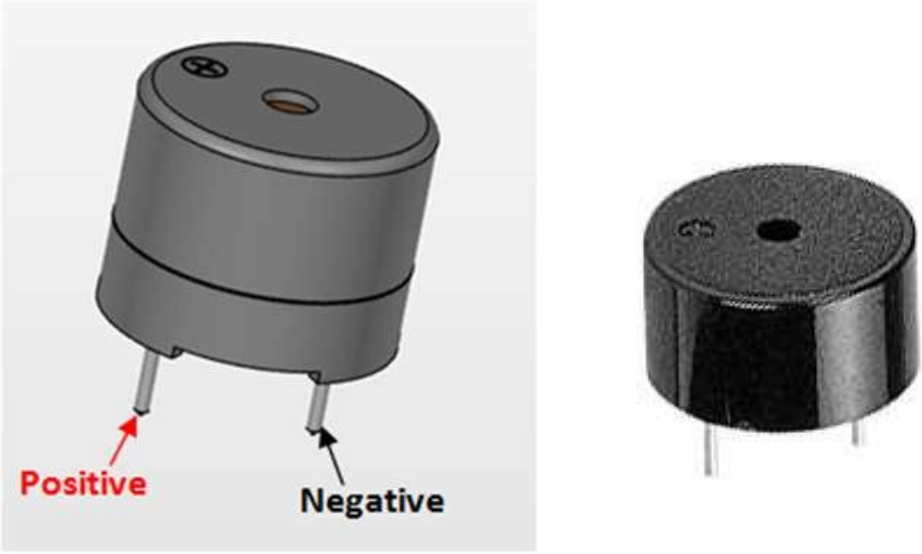


FIGURE 6.1

6.2 Buzzer pin configuration

Table 6.2

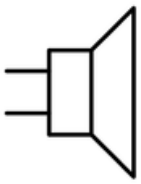
Pin Number	Pin Name	Description
1	Positive	Identified by (+) symbol or longer terminal lead. Can be powered by 6V DC
2	Negative	Identified by short terminal lead. Typically connected to the ground of the circuit

6.3 Buzzer Features and Specifications

- Rated Voltage: 6V DC
- Operating Voltage: 4-8V DC
- Rated current: <30mA
- Sound Type: Continuous Beep
- Resonant Frequency: ~2300 Hz
- Small and neat sealed package
- Breadboard and Perf board friendly

6.4 SPEAKER

The dynamic speaker operates on the same basic principle as a dynamic microphone, but in reverse, to produce sound from an electrical signal. When an alternating current electrical audio signal is applied to its voice coil, a coil of wire suspended in a circular gap between the poles of a permanent magnet, the coil is forced to move rapidly back and forth due to Faraday's law of induction, which causes a diaphragm (usually conically shaped) attached to the coil to move back and forth, pushing on the air to create sound waves. Besides this most common method, there are several alternative technologies that can be used to convert an electrical signal into sound. The sound source (e.g., a sound recording or a microphone) must be amplified or strengthened with an audio power amplifier before the signal is sent to the speaker.



SPEAKER SYMBOL **FIGURE 6.4**

CHAPTER 7

RF TRANSMITTER AND RECEIVER

An RF module (short for radio-frequency module) is a (usually) small electronic device used to transmit and/or receive radio signals between two devices. In an embedded system it is often desirable to communicate with another device wirelessly. This wireless communication may be accomplished through optical communication or through radio-frequency (RF) communication. For many applications, the medium of choice is RF since it does not require line of sight. RF communications incorporate a transmitter and a receiver. They are of various types and ranges. Some can transmit up to 500 feet. RF modules are typically fabricated using RF CMOS technology.

RF modules are widely used in electronic design owing to the difficulty of designing radio circuitry. Good electronic radio design is notoriously complex because of the sensitivity of radio circuits and the accuracy of components and layouts required to achieve operation on a specific frequency. In addition, reliable RF communication circuit requires careful monitoring of the manufacturing process to ensure that the RF performance is not adversely affected. Finally, radio circuits are usually subject to limits on radiated emissions, and require Conformance testing and certification by a standardization organization such as ETSI or the U.S. Federal Communications Commission (FCC). For these reasons, design engineers will often design a circuit for an application which requires radio communication and then "drop in" a pre-made radio module rather than attempt a discrete design, saving time and money on development.

RF modules are most often used in medium and low volume products for consumer applications such as garage door openers, wireless alarm or monitoring systems, industrial remote controls, smart sensor applications, and wireless home automation systems. They are sometimes used to replace older infrared communication designs as they have the advantage of not requiring line-of-sight operation.

Several carrier frequencies are commonly used in commercially available RF modules, including those in the industrial, scientific and medical (ISM) radio bands such as 433.92 MHz, 915 MHz, and 2400 MHz. These frequencies are used because of national and international regulations

governing the used of radio for communication. Short Range Devices may also use frequencies available for unlicensed such as 315 MHz and 868 MHz.

7.1 Types of RF Modules

The term RF module can be applied to many different types, shapes and sizes of small electronic sub assembly circuit board. It can also be applied to modules across a huge variation of functionality and capability. RF modules typically incorporate a printed circuit board, transmit or receive circuit, antenna, and serial interface for communication to the host processor.

Most standard, well known types are covered here:

- Transmitter module
- Receiver module
- Transceiver module
- System on a chip module.

7.2 Transmitter Modules

An RF transmitter module is a small PCB sub assembly capable of transmitting a radio wave and modulating that wave to carry data. Transmitter modules are usually implemented alongside a microcontroller which will provide data to the module which can be transmitted. RF transmitters are usually subject to regulatory requirements which dictate the maximum allowable transmitter power output, harmonics, and band edge requirements.

7.3 Receiver Modules

An RF receiver module receives the modulated RF signal, and demodulates it. There are two types of RF receiver modules: superheterodyne receivers and super regenerative receivers. Super regenerative modules are usually low cost and low power designs using a series of amplifiers to extract modulated data from a carrier wave. Super regenerative modules are generally imprecise as their frequency of operation varies considerably with temperature and power supply voltage.[citation needed] Superheterodyne receivers have a performance advantage over super regenerative; they offer increased accuracy and stability over a large voltage and temperature range. This stability comes from a fixed crystal design which in the past tended to mean a

comparatively more expensive product. However, advances in receiver chip design now mean that currently there is little price difference between superheterodyne and super regenerative receiver modules.

7.4 Transceiver modules

An RF transceiver module incorporates both a transmitter and receiver. The circuit is typically designed for half-duplex operation, although full-duplex modules are available, typically at a higher cost due to the added complexity.

7.5 System on a chip (SoC) module

A SoC module is the same as a transceiver module, but it is often made with an onboard microcontroller. The microcontroller is typically used to handle radio data packetisation or managing a protocol such as an IEEE 802.15.4 compliant module. This type of module is typically used for designs that require additional processing for compliance with a protocol when the designer does not wish to incorporate this processing into the host microcontroller.

7.6 Host microcontroller interface

RF modules typically communicate with an embedded system, such as a microcontroller or a microprocessor. The communication protocols include UART, used in Digi International's X-Bee modules, Serial Peripheral Interface Bus used in Anaren's AIR modules and Universal Serial Bus used in Roving Networks' modules. Although the module may use a standardized protocol for wireless communication, the commands sent over the microcontroller interface are typically not standardized as each vendor has its own proprietary communications format. The speed of the microcontroller interface depends on the speed of the underlying RF protocol used: higher speed RF protocols such as Wi-Fi require a high-speed serial interface such as USB whereas protocols with a slower data rate such as Bluetooth Low Energy may use a UART interface.

7.7 RF signal modulation

There are several types of digital signal modulation methods commonly used in RF transmitter and receiver modules:

ASK, OOK, FSK, direct-sequence spread spectrum, frequency-hopping spread spectrum.

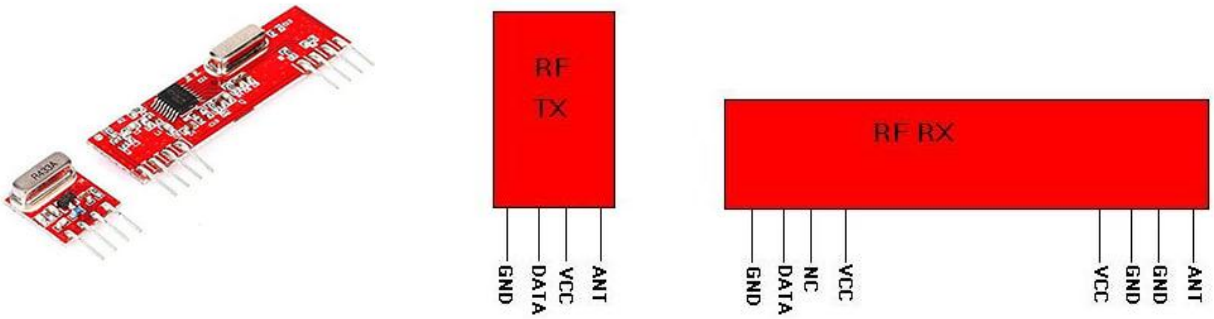
433 MHz Wireless RF Transmitter Receiver Module

RF module is a set of RF transmitters (Tx) and RF receiver (Rx) and operates at a frequency of 433 MHz. RF Tx and Rx are encoded and decoded by a pair of encoder and decoder IC, often HT12E and HT12D and uses ASK modulation technique. The module receives data serially and transmits wirelessly through the antenna. RF Rx receives data when RX and TX operate at the same frequency.

7.8 Specifications

- Operating frequency: 433MHz
- Open space operating range: 400 m with 45 cm antenna
- Rx current supply: 3.5 mA
- Rx operating voltage: 5V
- Rx typical sensitivity: 105Dbm
- Tx operating voltage: 3-6V
- Tx output power: 4-12Dbm
- Power consumption: low

7.9 Pin Description

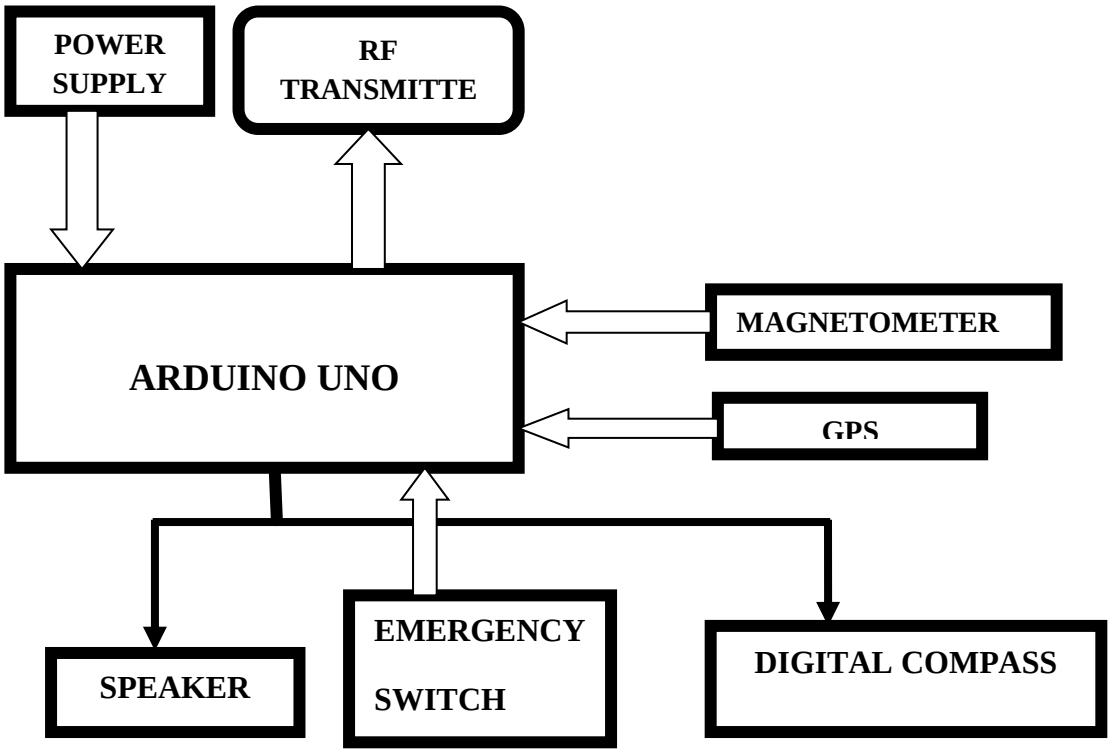


RF MODULE **FIGURE 7.9**

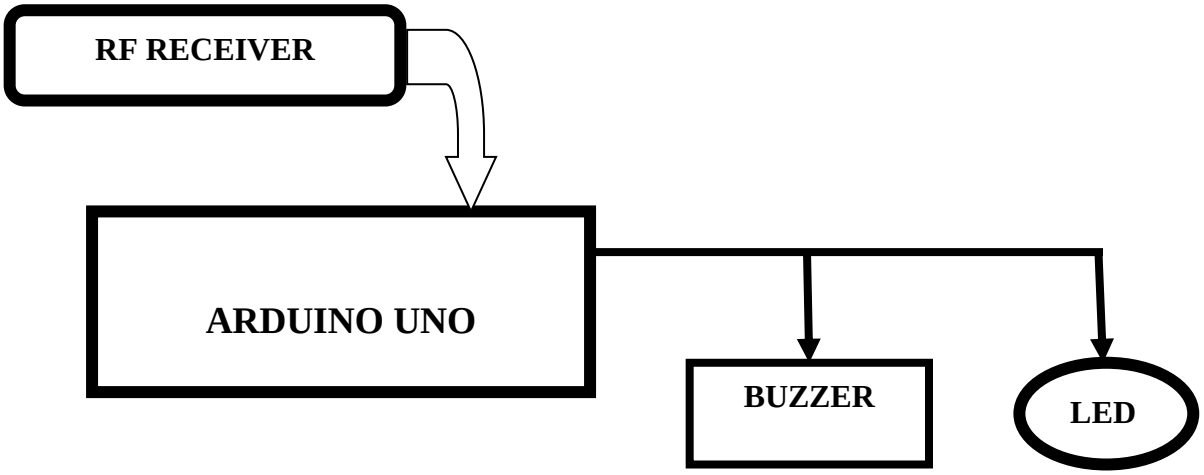
CHAPTER 8

8.1 Block Diagram

TRANSMITTER:



RECEIVER:



8.2Circuit diagram:

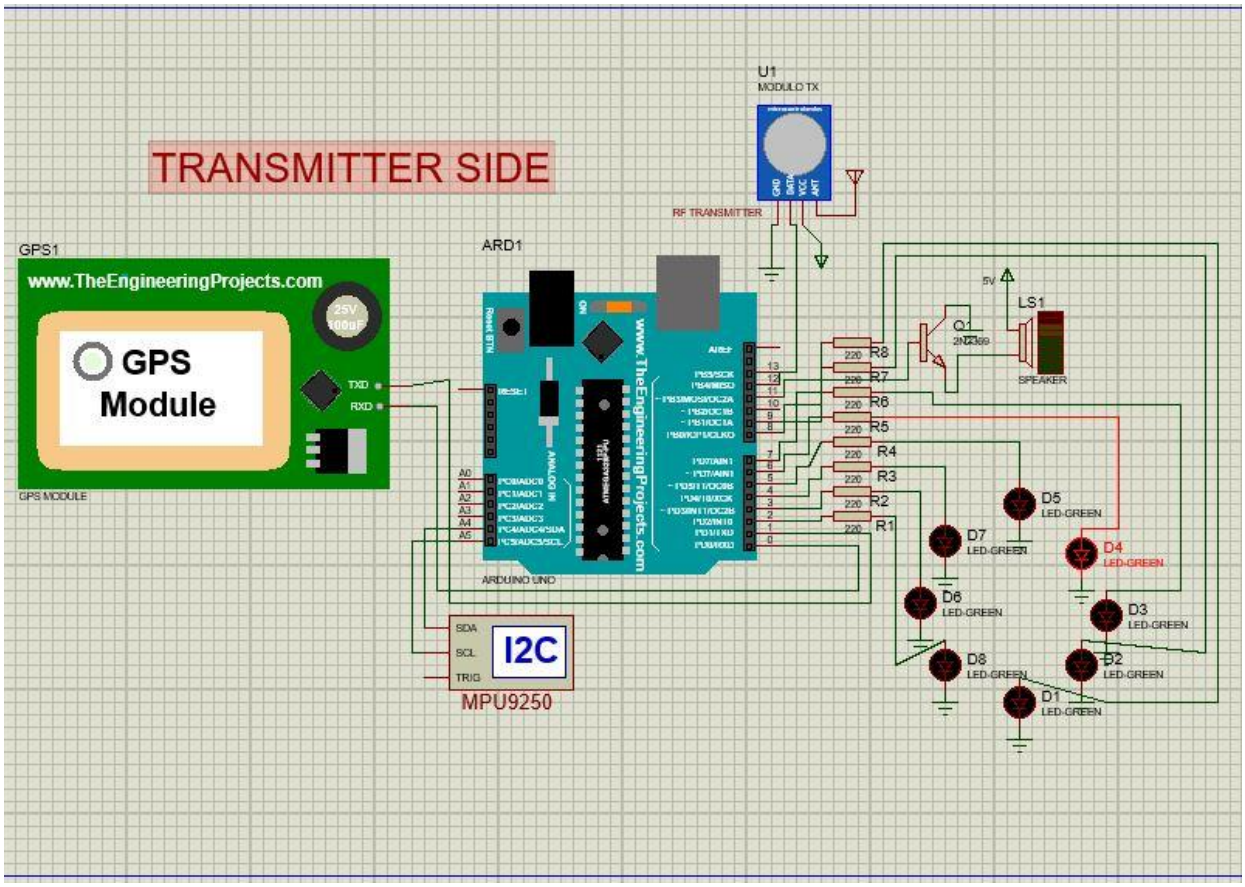
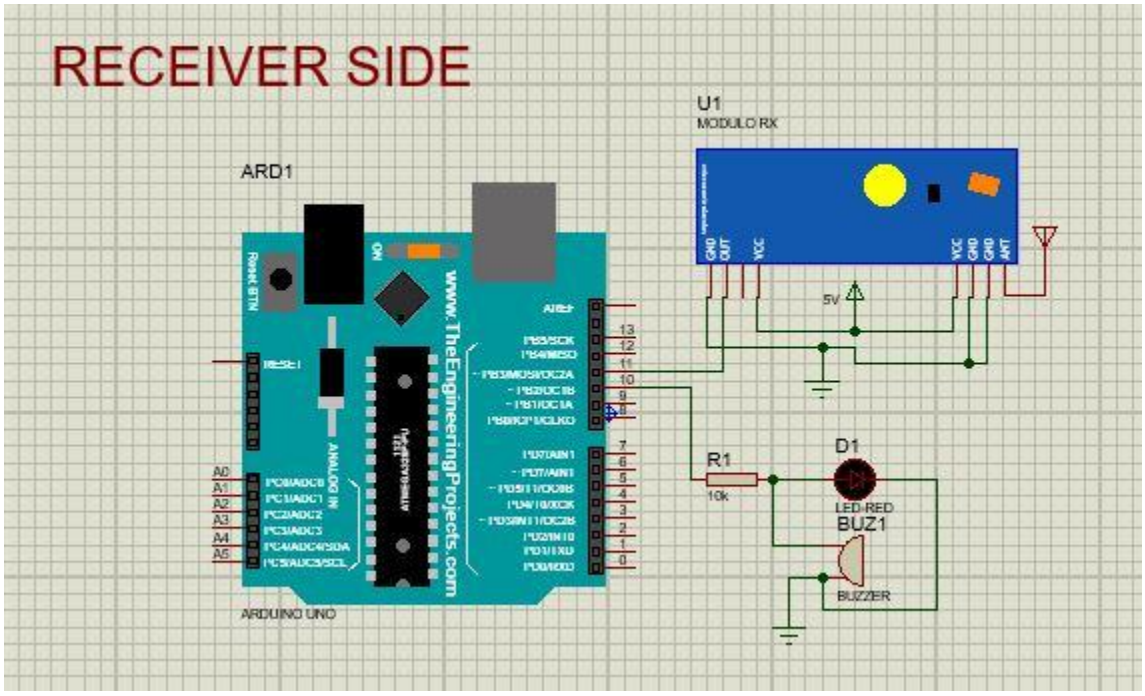


FIGURE 8.2



8.3 HARDWARE SETUP:

Transmitter

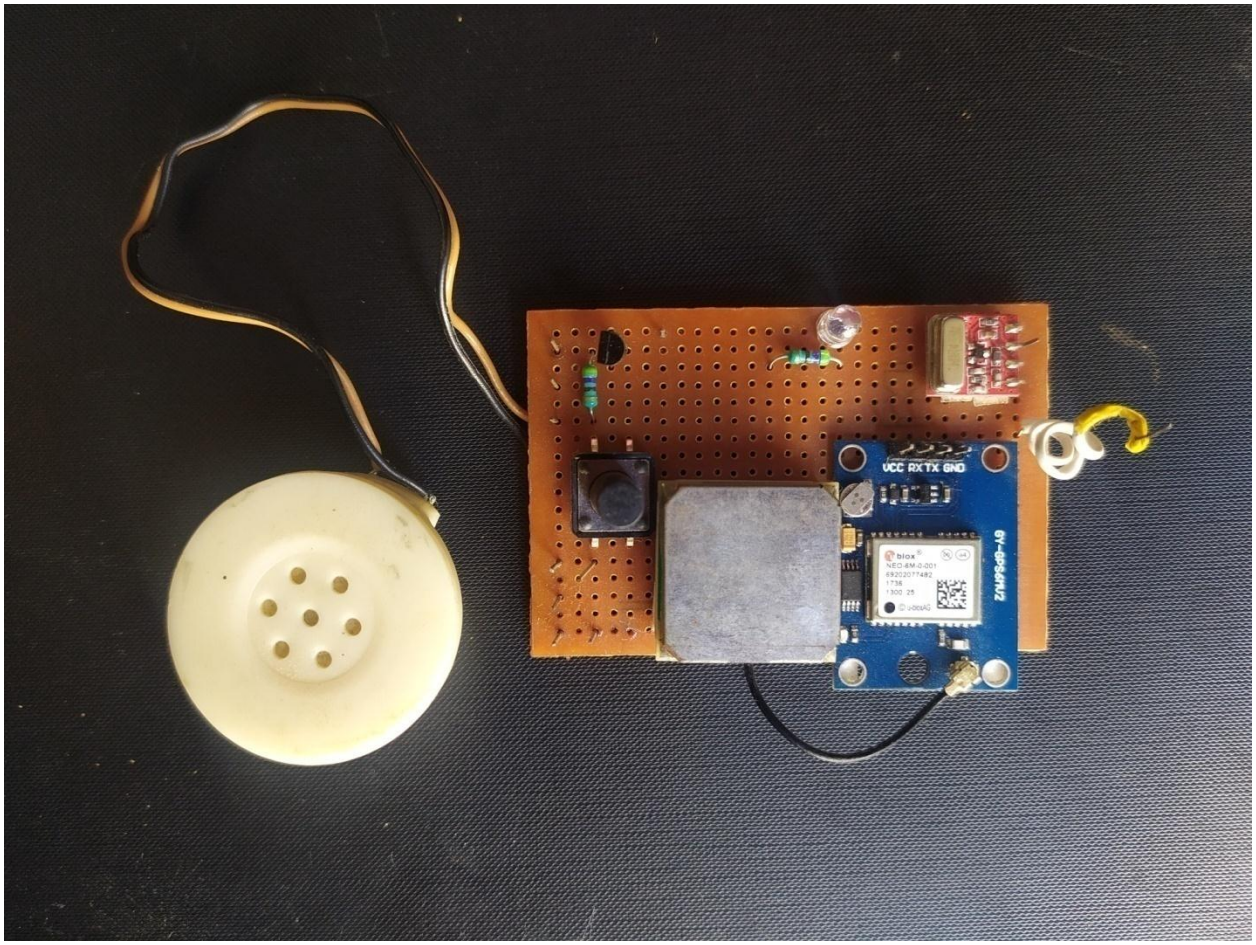


FIGURE 8.3

Transmitter side consists of

- GPS module
- RF transmitter
- Antenna
- Emergency button
- Danger LED
- Transistor
- Speaker

Digital compass:

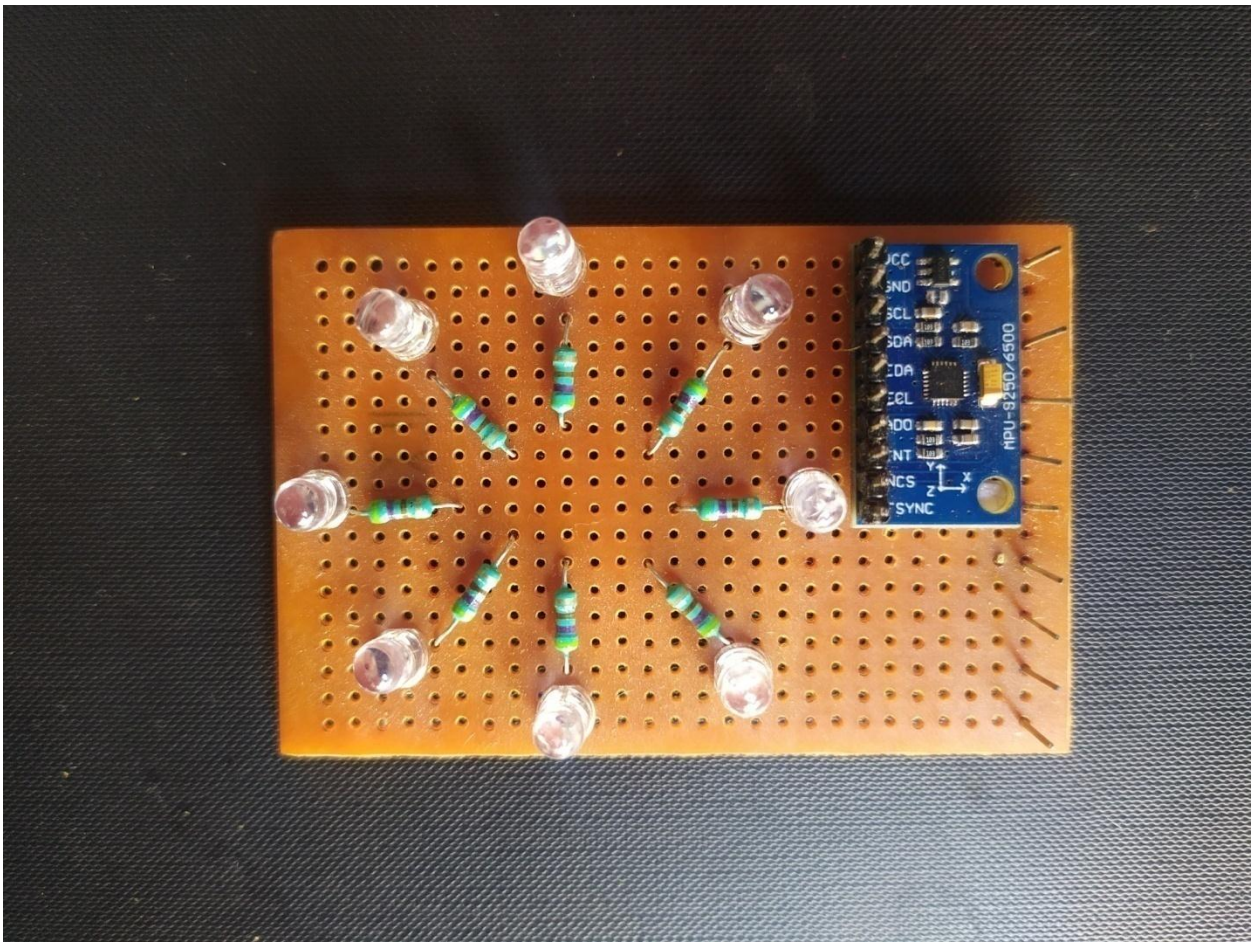


FIGURE 8.3.1

Digital compass consists of

- 8 LEDs to indicate directions
- Resistors
- MPU-9250
- Male header pins

Receiver:

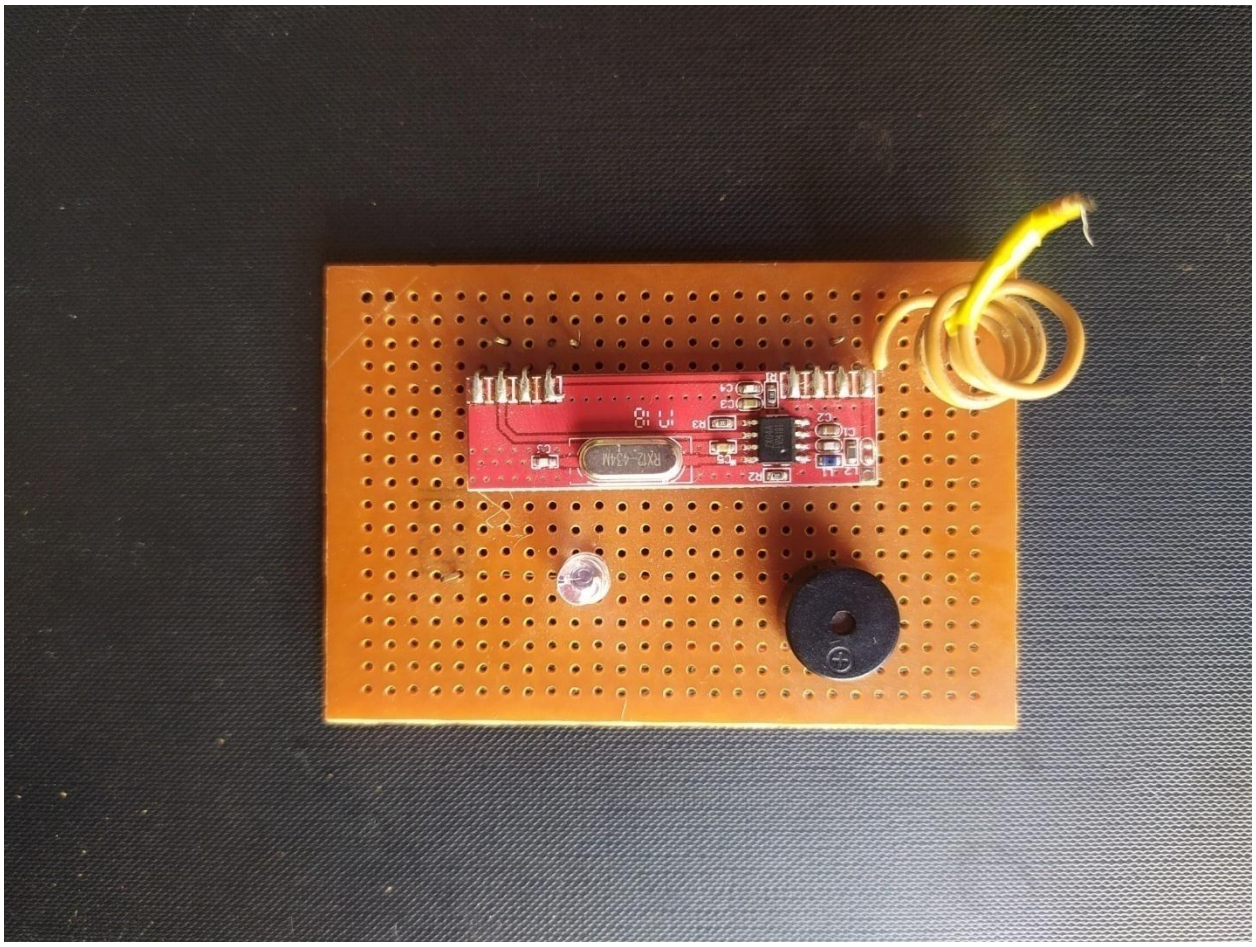


FIGURE 8.3.2

Receiver side consists of

- RF Receiver
- LED
- Buzzer
- Antenna

CHAPTER 9

WORKING

In this project first the coordinates of the boat are obtained through the GPS module. The GPS module is connected to the arduino it serially transmits the latitudes and longitudes to the arduino. From the obtained value it is compared with the border coordinates stored in the arduino. If the boat is nearby the border danger alert through the speaker occurs, further the boat crosses another level of danger zone then the latitudes, longitudes of the boat is transmitted to the coastal guards through RF module connected with the arduino. In the receiver side there is a danger led and the buzzer to indicate the coastal guards that the boat tends to cross the border. The boat is provided with the digital compass and the emergency button, if any unusual situation arises they can inform the coastal guards by pressing the emergency button, it sends the information to the coastal guards that they are in danger.

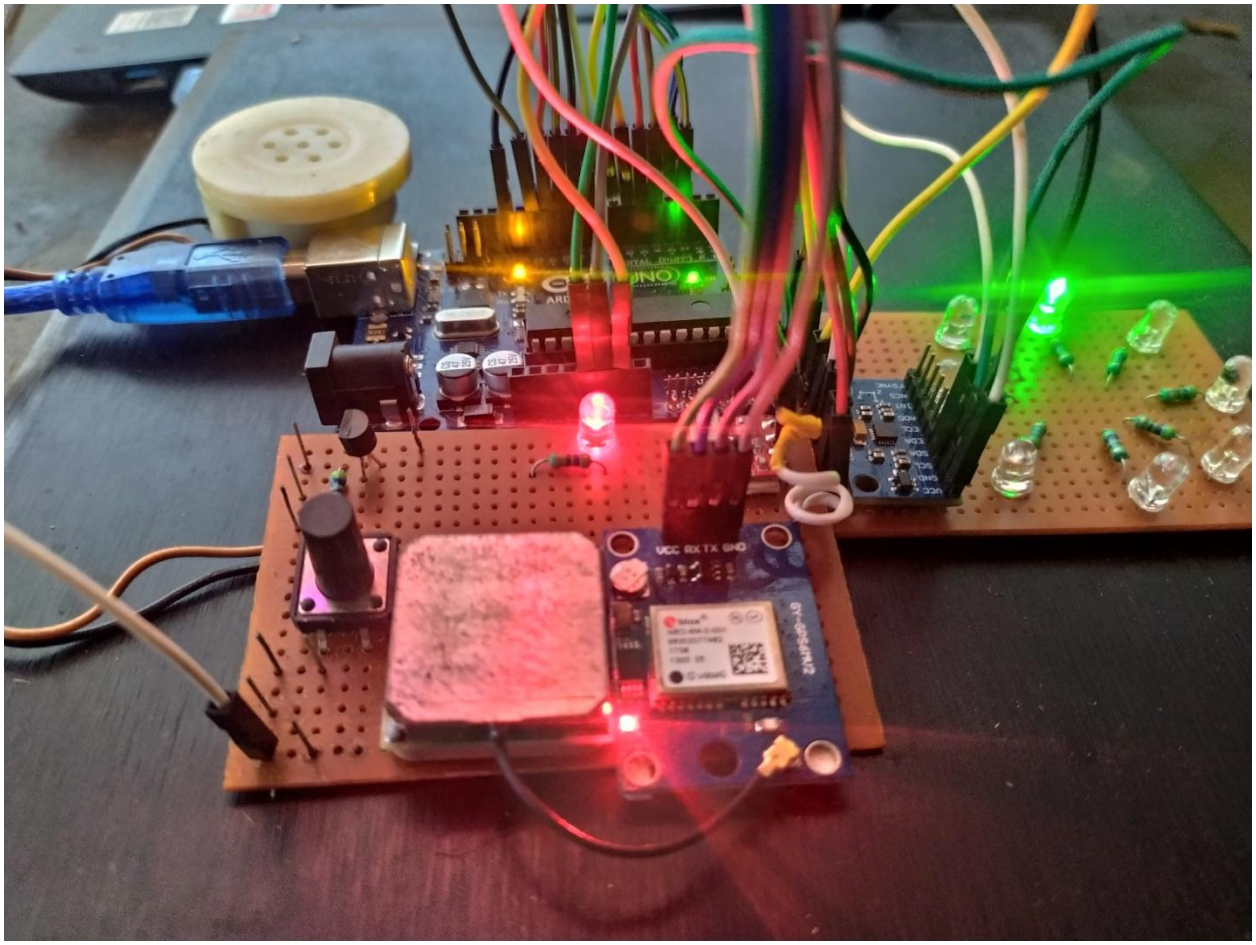


FIGURE 9.1

DIGITAL COMPASS

From the magnetometer the three axis values are calculated from that value it is converted into the directions like east, west, north, south and all other directions. The ADC values are obtained from the magnetometer and they are mathematically split to find the direction. For 8 directions 8 LED are connected to observe the direction like the compass. When the boat turns are deviate the direction of the boat was calculated using the arduino digital compass. While rotating the magnetometer also changes its direction.

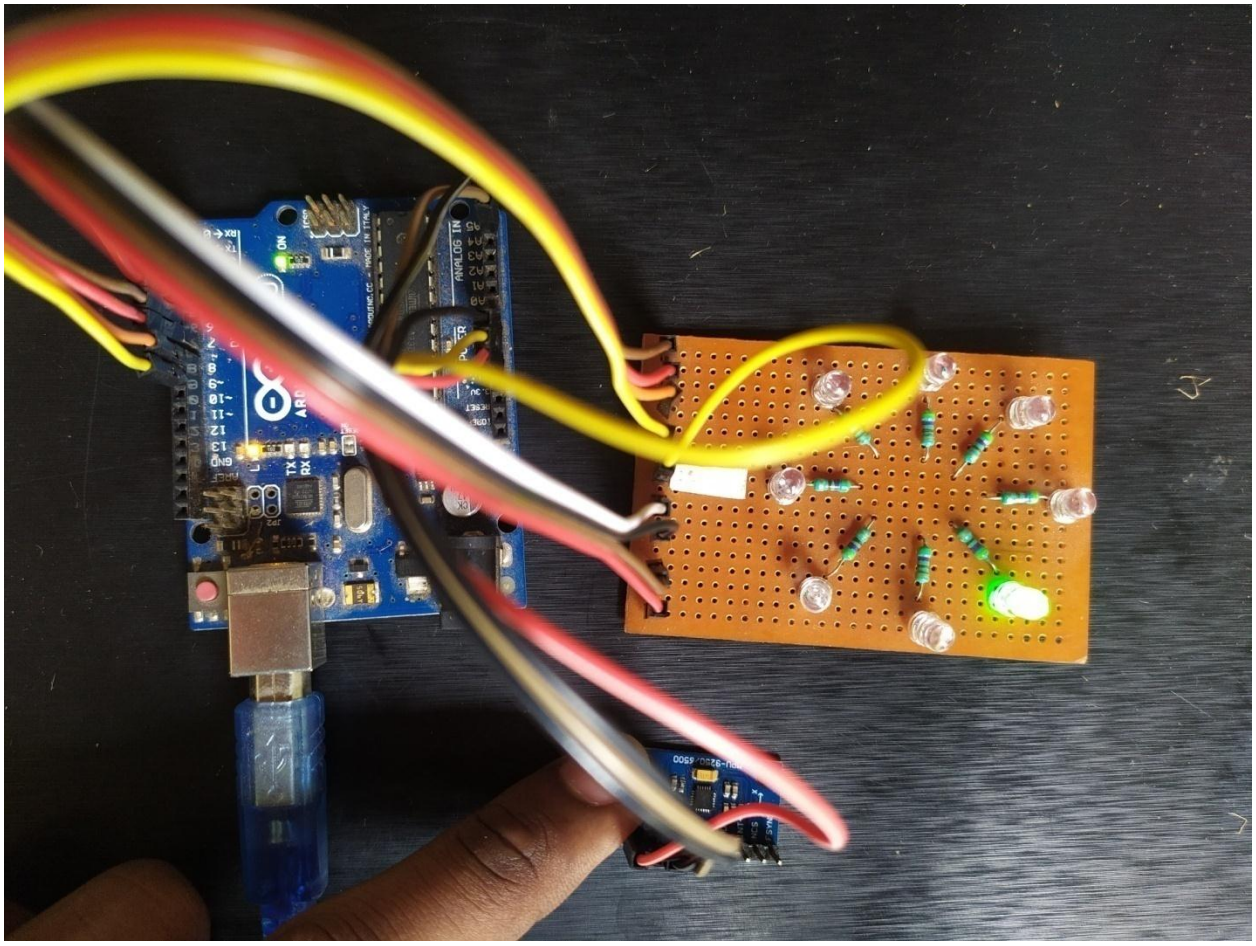
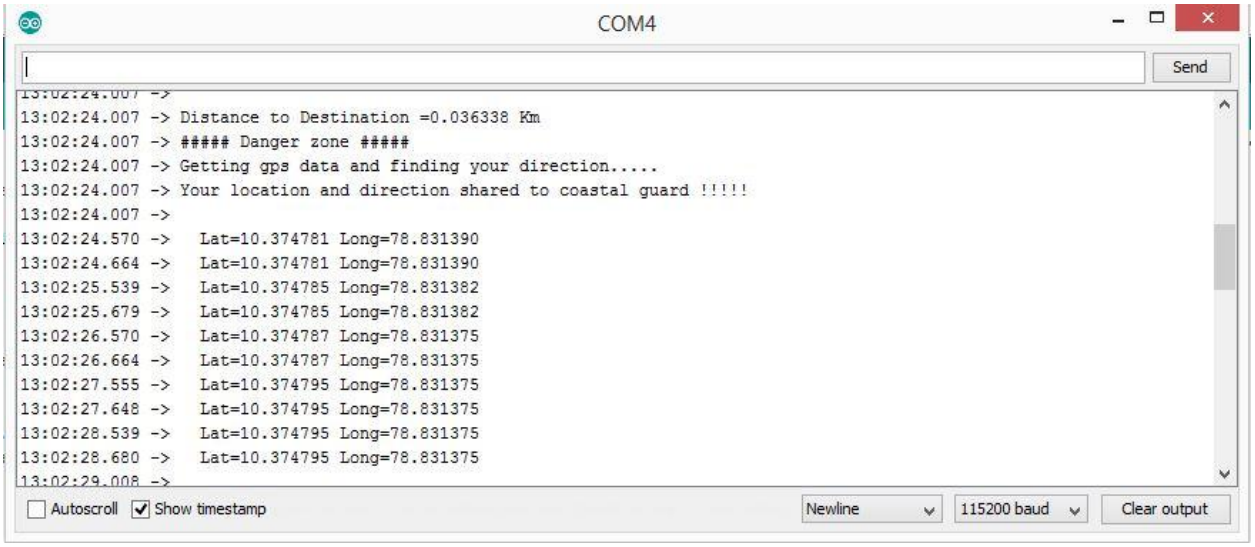


FIGURE 9.2

RESULTS

The data are transmitted and received through the arduino using the RF module which is observed below

TRANSMITTER SIDE



RECEIVER SIDE

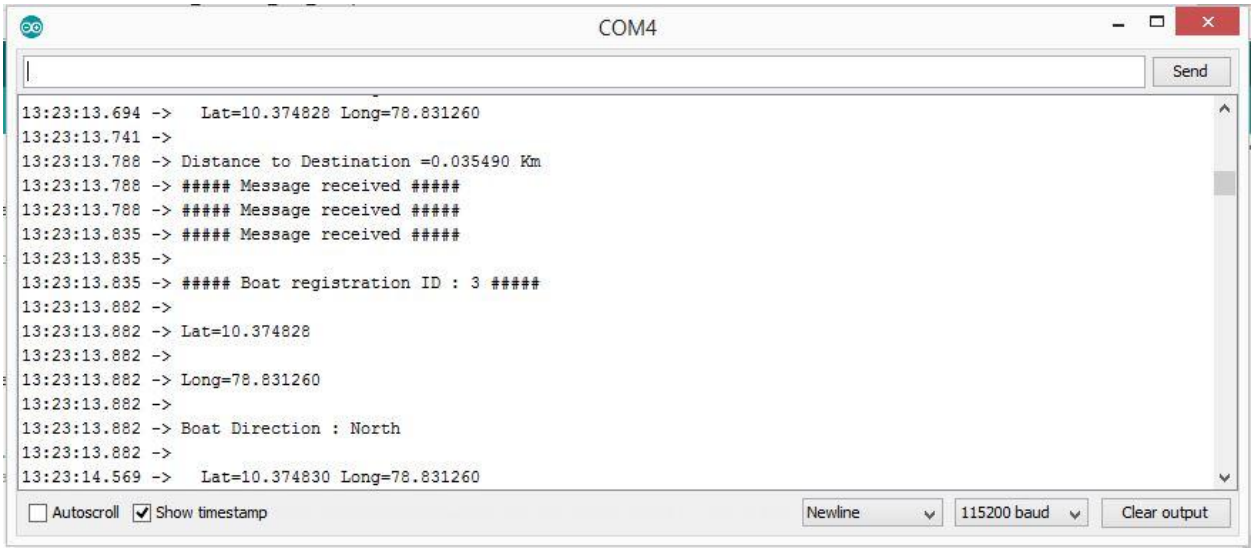
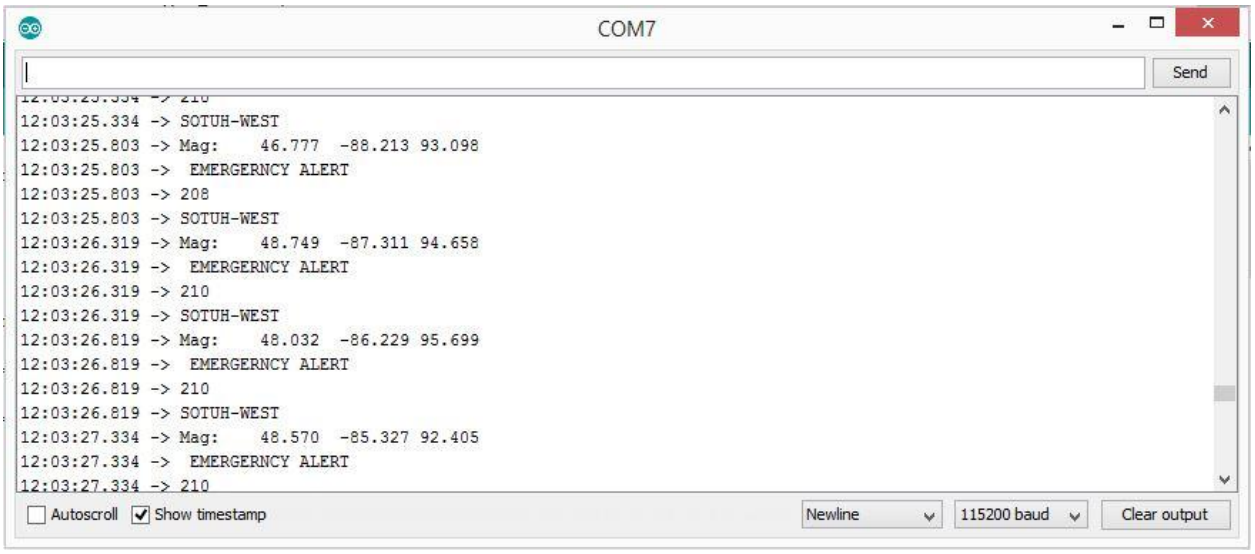


FIGURE 9.3

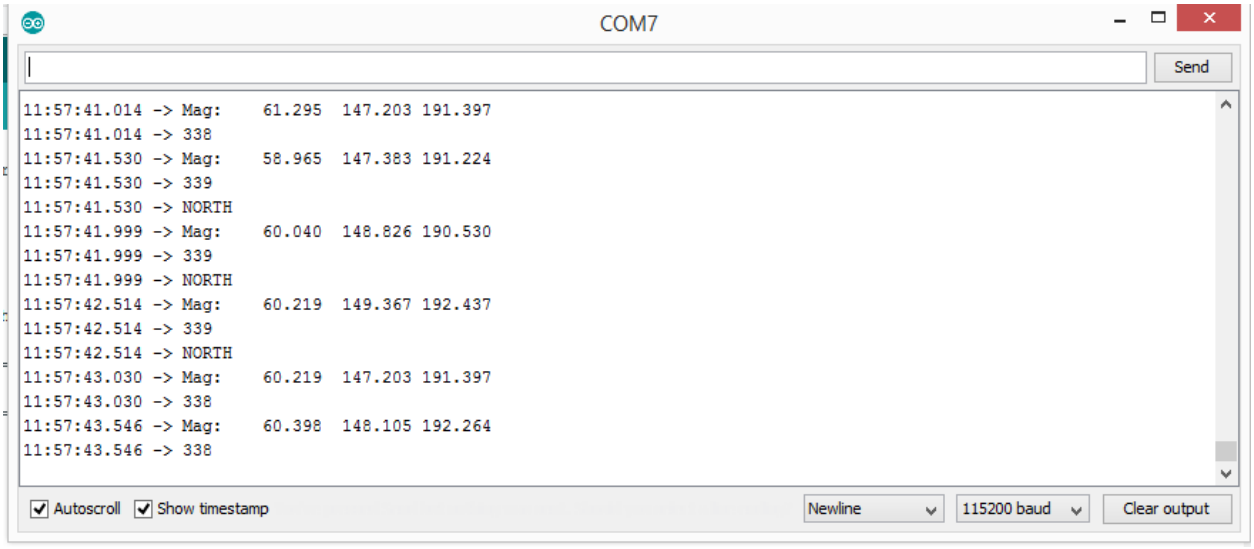
The GPS coordinates which consists of latitudes and longitudes are found and the emergency alert system is tested and shown below



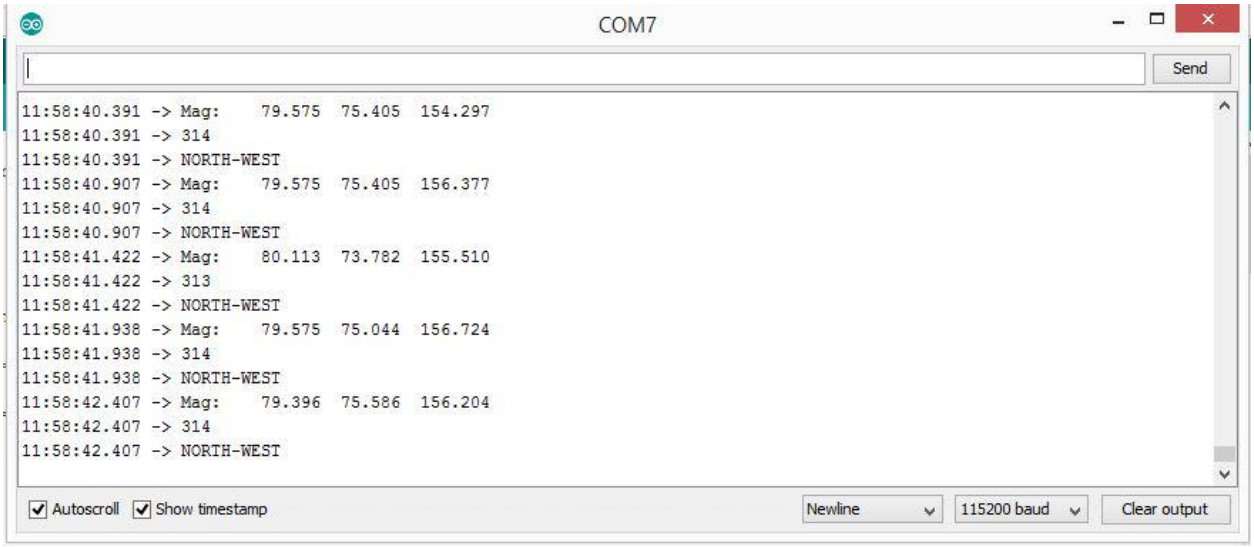
EMERGENCY VOICE ALERT

FIGURE 9.4

The direction finding through the digital compass is verified through the arduino connected with the magnetometer MPU-9250. All the direction results are shown below

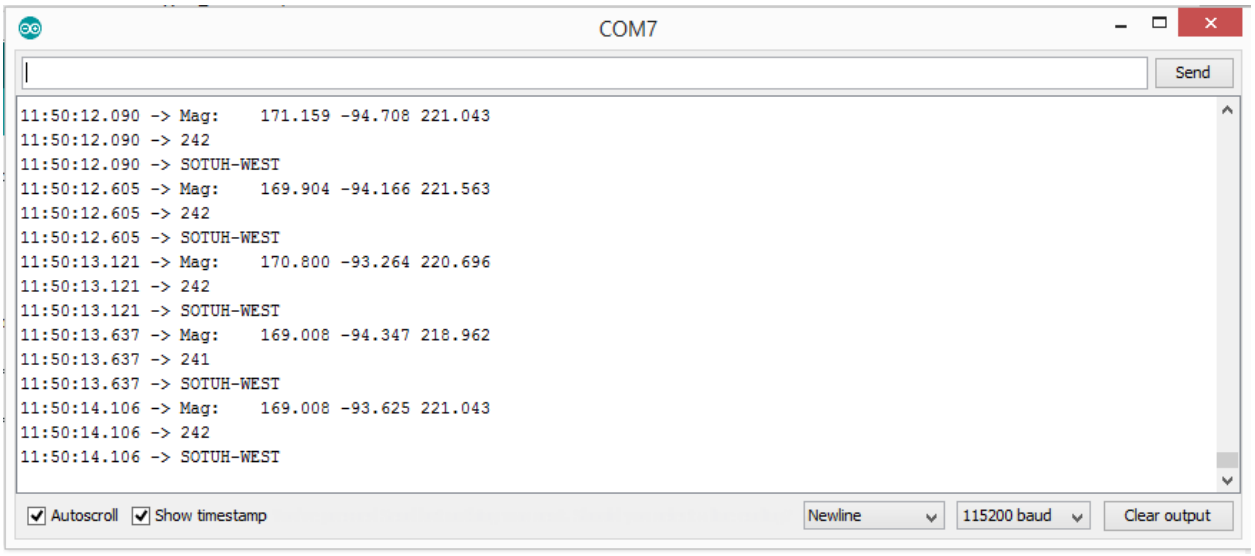


NORTH

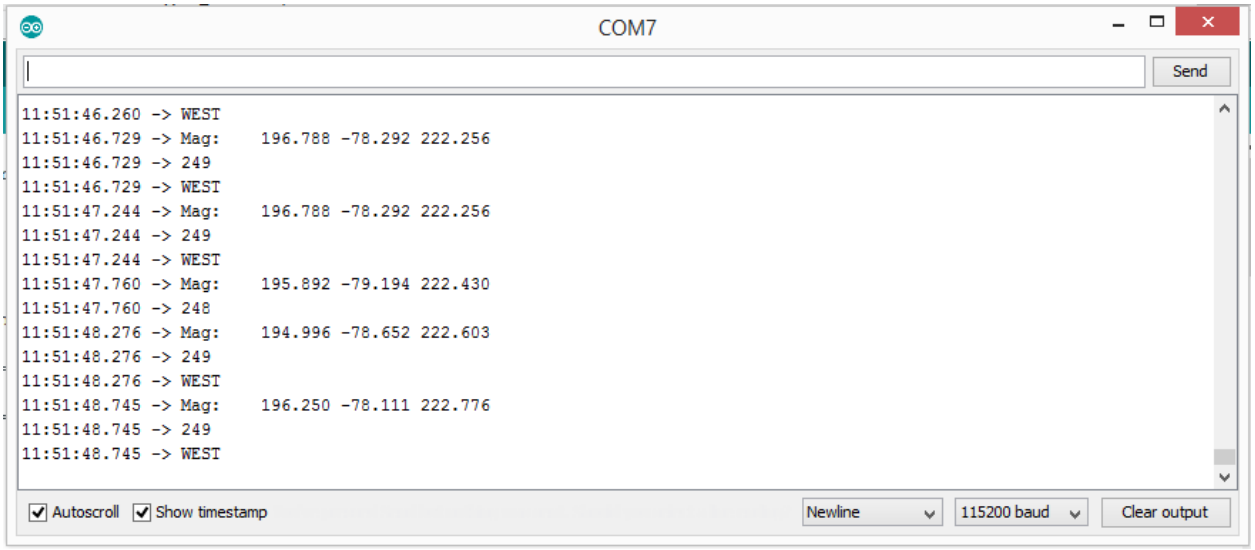


NORTH-WEST

FIGURE 9.4



SOUTH-WEST



WEST

FIGURE 9.4.1

CHAPTER 10

CONCLUSION

GPS is the safest tool for fishermen, especially in maritime navigation purpose. All these systems completely integrated and possible solution for alerting fishermen in maritime when they are crossing border limit. This system keeps control on navigation purpose for seaway transport, and help fishermen for safe fishing. Basic modules need for these systems are GPS and GSM for navigation and monitoring respectively. With the help of this system user can determine the vessel location, can get distance information from destination point. This system can be easily upgradable with any module to make it efficient

REFERENCES

1. Cost Effective GPS-GPRS Based Object Tracking System Proceedings of the International Multi Conference of Engineers and Computer Scientists 2009 Vol II, MECS 2009.
2. Peng Wang, Zhao, Z., Chongbin Xu, Zushun Wu, & Yi Luo. (2010). Design and implementation of the low-power tracking system based on GPS-GPRS module. 2010 5th IEEE Conference on Industrial Electronics and Applications. doi:10.1109/iciea.2010.5516772
3. Saha, S., Singh, A., Bera, P., Kamal, M. N., Dutta, S., Gorian, U., … Sur, S. (2017). GPS based smart spy surveillance robotic system using Raspberry Pi for security application and remote sensing. 2017 8th IEEE Annual Information Technology, Electronics and Mobile Communication Conference (IEMCON).
4. Noman, A. T., Hossain, S., Islam, M. S., Islam, M. E., Ahmed, N., & Chowdhury, M. A. M. (2018). Design and Implementation of Microcontroller Based Anti-Theft Vehicle Security System using GPS, GSM and RFID. 2018 4th International Conference on Electrical Engineering and Information & Communication Technology (iCEEiCT). doi:10.1109/ceeict.2018.8628051