Microprocessors, Microcontrollers and Assembly Language Sessional

CSE - 306

Final Report

Smart White Cane

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1. Introduction

The WHO (World Health Organization) estimates that by way of of 2015 around 940 million publics through around grade of vision forfeiture. 246 million publics had short apparition and 39 million publics are blind. The common of public with unfortunate vision is in the unindustrialized creation besides stand concluded the oldness of 50 ages.

The serious problem encountered by blind people is mobility. They are not connected with the surrounding environment. They don't know about the things happening around them and require some time to realize what has happened. Most of the blind people are unemployed because of their visual impairment. They don't have any suitable job to lead their life without depending on others. When walking in the roads they eventually face many problems such as obstacles, collision with others, manholes. Blind people rely on their families and others for mobility and financial needs. Their visual impairment affects their interaction with others and social activities.

Many solutions were proposed in the past but still has limitations in them. These limitations may be caused due to lack of the proposals to analyze and provide solutions in the view of visual impaired perception.

2. Aim and Objectives

A Ultrasonic blind walking stick using Arduino Mega is discussed in the paper. This will Enable a blind person to know if there is any obstacle, probable collusion with others and manholes while walking in roads. Using this smart stick a blind person can also know if it's daytime or night. Also using this smart stick a blind person can know where the stick is remotely. Using this stick a blind person can also notify their close acquaintances if they are in trouble.

The objectives of this project is to achieve the following goals for a blind person :

- Object Detection and Light Intensity
  - Object detection is used so that the blind people can know that there is obstacle on their way and light intensity is used to inform the user about the light intensity of a certain place if it's day or night, dark or bright place.
- Location and Navigation
  - Location and Navigation is used to get the exact location of the user.
- Remote Messaging
  - Remote messaging is used to inform any of user's close relative about the exact location of the user.
- Remote Control
  - Remote control is used for finding the Cane if it's lost

3. Hardware Implementation

3.1 Component List

Name	Amount
1. Arduino Mega	2
2. Ultrasonic Sensor HC-SR04	4
3. IR Sensor	4
4. LDR	1
5. Buzzer	1
6. 433 MHz RF Transmitter Receiver Pair	1
7. Resistors	10
8. Capacitors	5
9. Push Buttons	2
10. Perf Board	1
11. GSM Module	1
12. GPS Module	1
13. 9V Batteries	2
14. 5V Batteries	1

3.2 Co-ordination of components

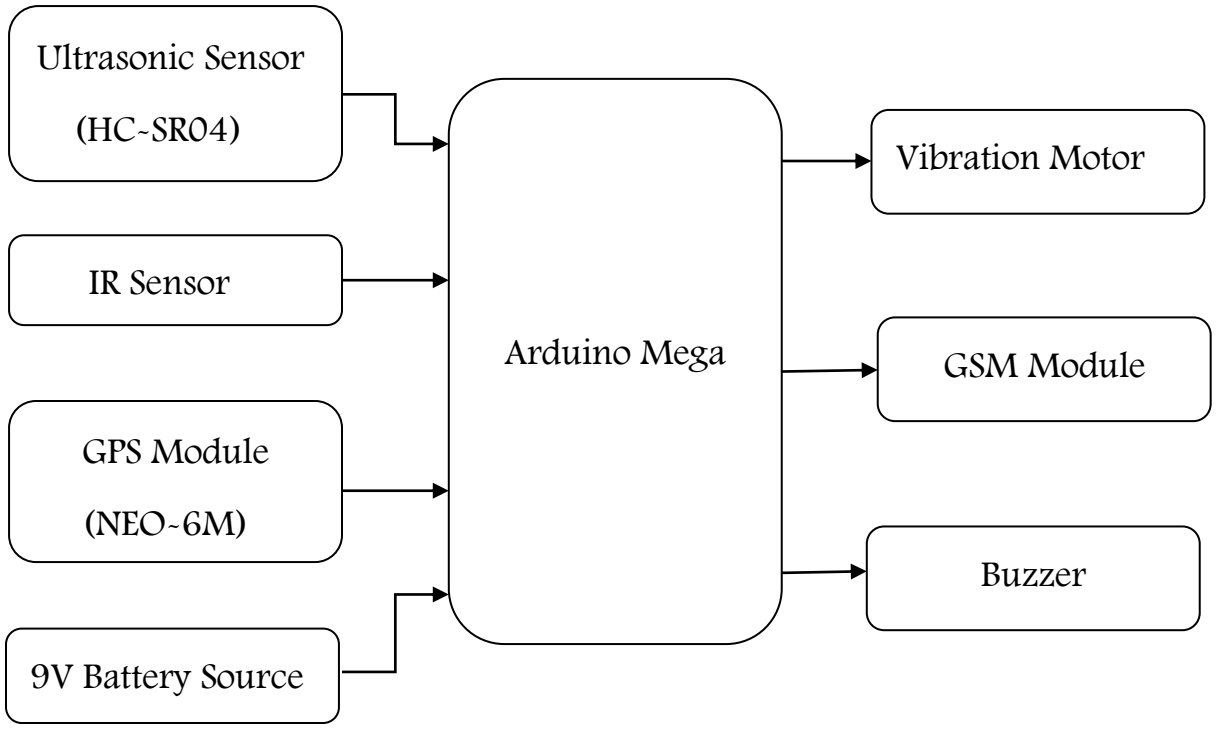

Fig 1.1 Arduino 1 Block Diagram

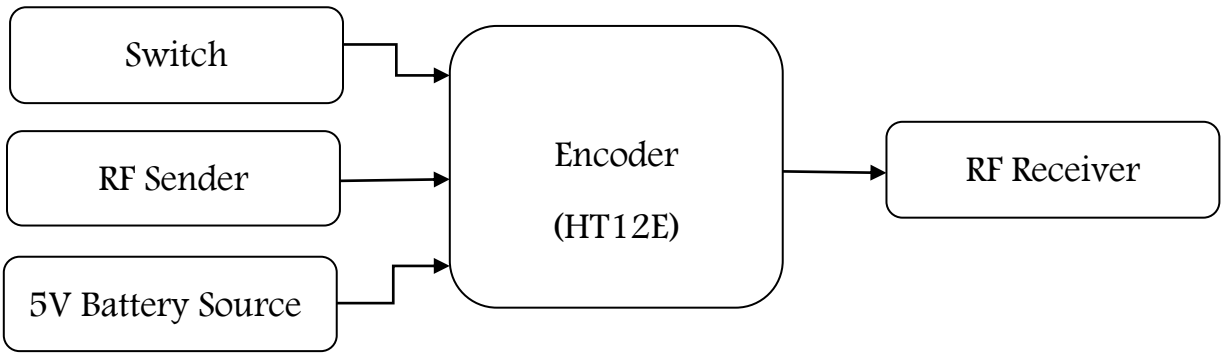

Fig 1.2 RF Sender Block Diagram

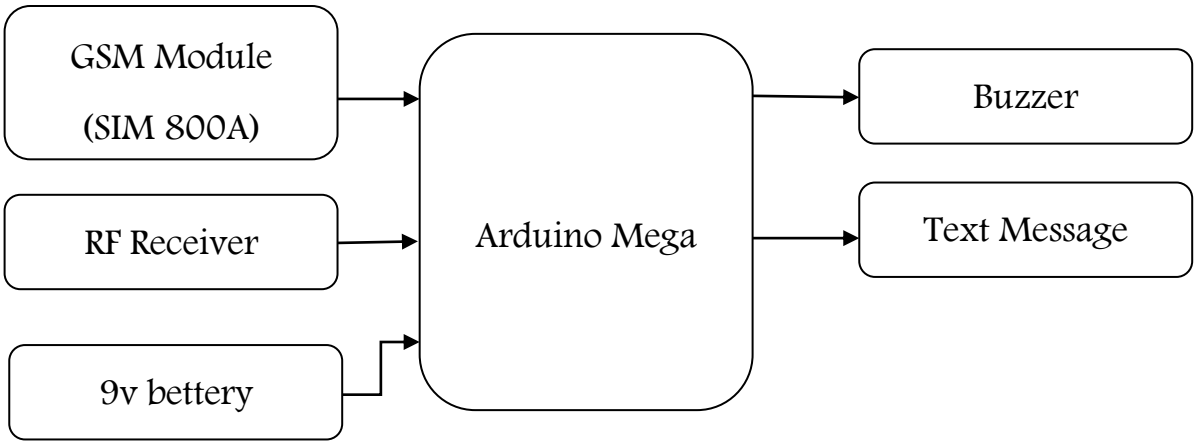

Fig 1.3 Arduino 2 Block Diagram

3.3 Connection Diagram

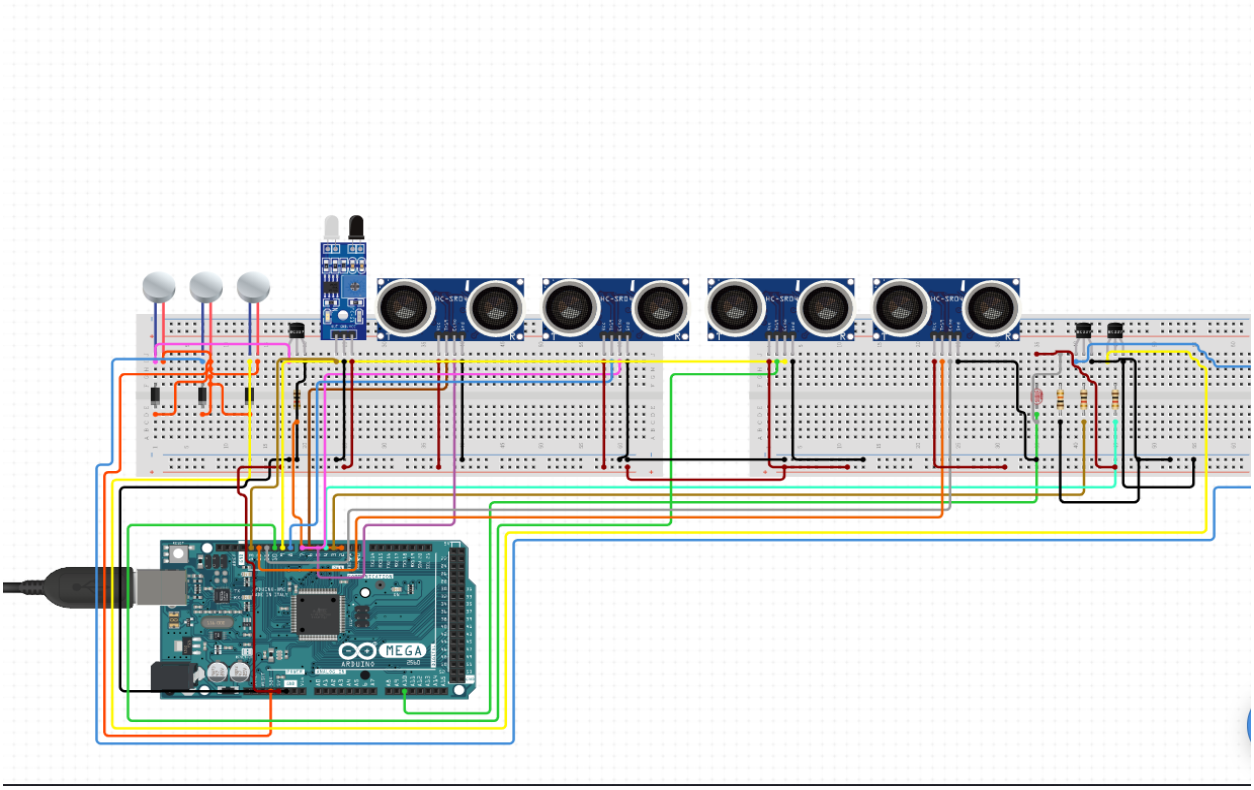

Fig 2.1 Connection Diagram 1

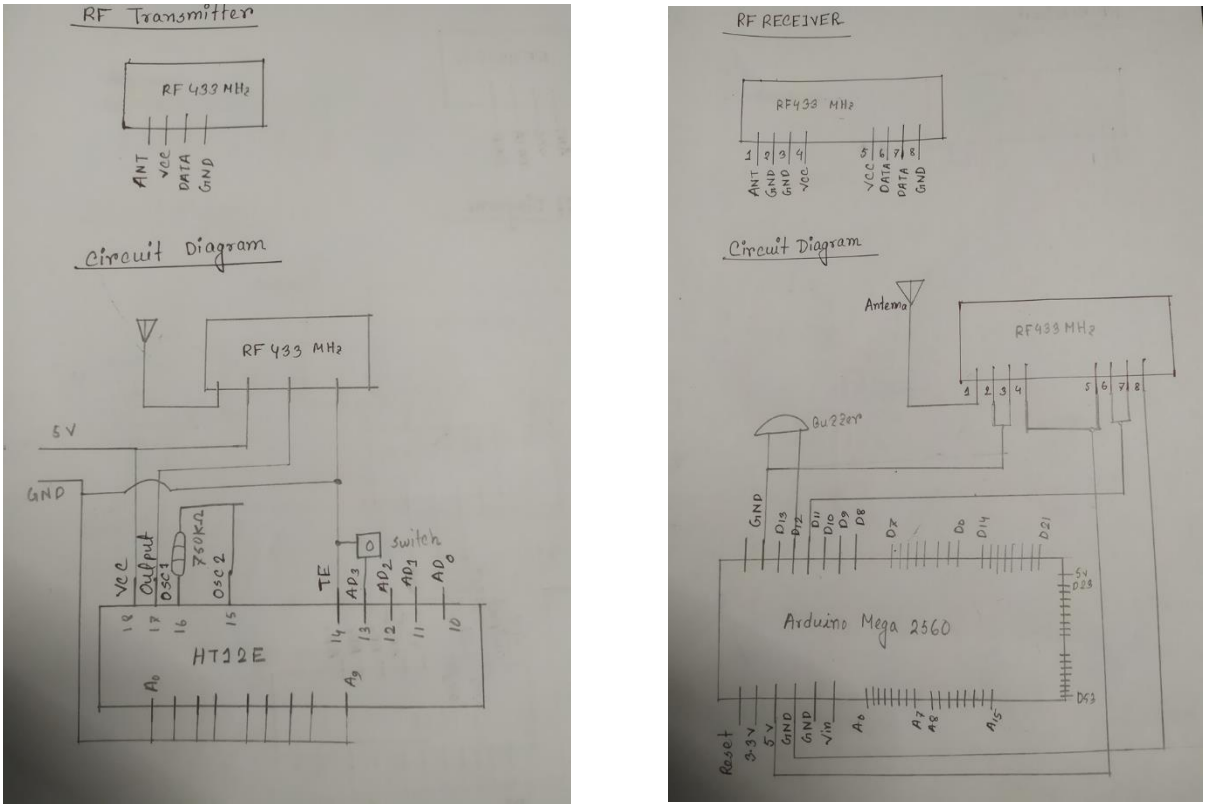

Fig 2.1 Connection Diagram 2

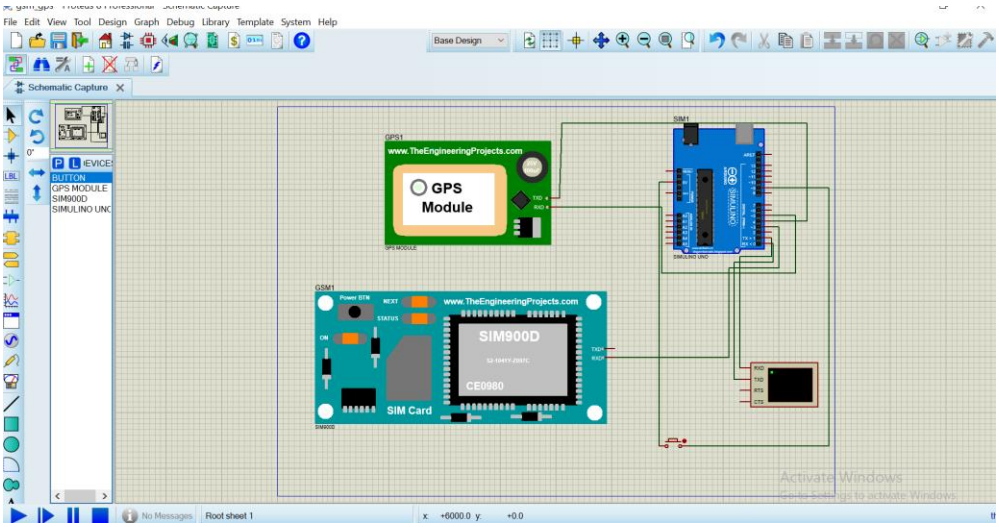

Fig 2.1 Connection Diagram 3

3. Working Procedure

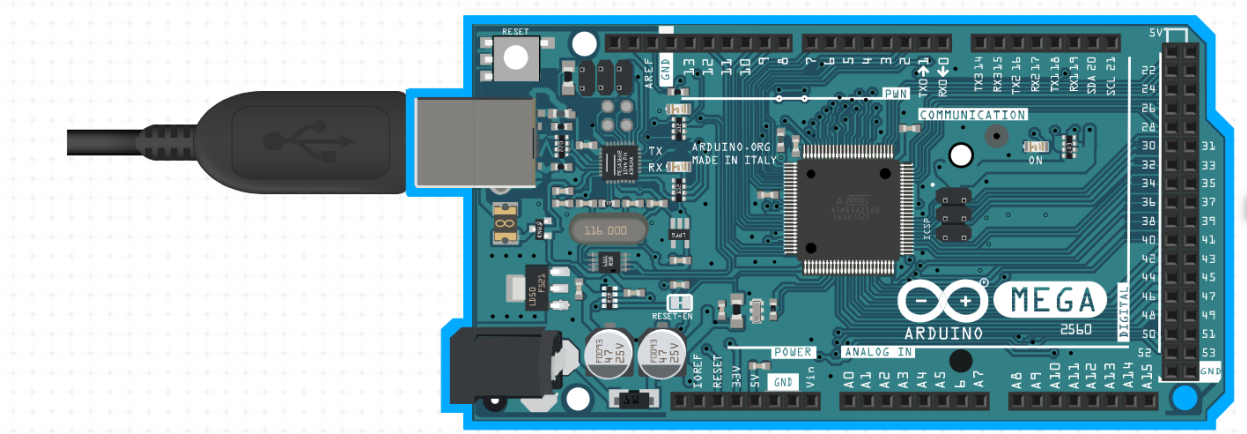

Fig 2.1 Arduino Mega PIN Diagram

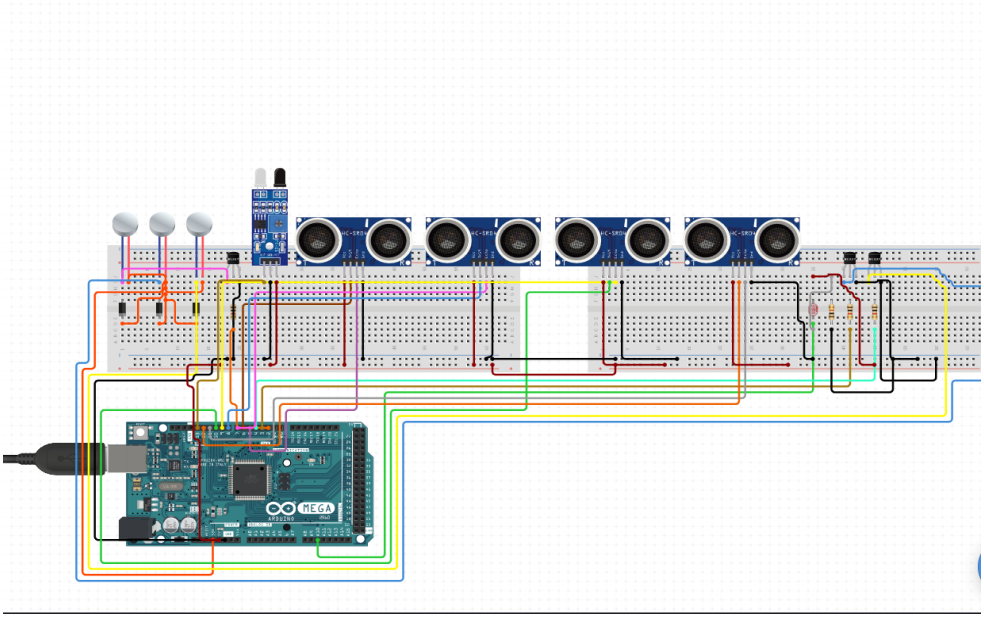

Fig 2.2 Object Detection and LDR Circuit Diagram

Object Detection:

For the purpose of object detection Ultrasonic Sensor - HC-SR04 and IR Obstacle Avoidance sensors were used. The main reason for using two types of detection sensors is to detect obstacle in multiple ranges from the smart stick. Ultrasonic Sensor - HC-SR04 is mainly used to detect obstacle from low to mid ranges as these sensors have a range of 2cm to 400cm with an accuracy of 3mm. These sensors will be fitted on to lower and mid part of the stick. The sensors while turned on keep taking readings of any object that is in their line of sight and send the reading to Arduino Mega 2560. A lower limit of detection range will be set inside Arduino and if any sensor crosses that limit it will prompt the Arduino to send signal to Vibration motor which will signal the user that some type of object is front of them. IR Obstacle Avoidance sensors are only used at lower parts of the stick to detect any obstacle at very low to low range, where the ultrasonic sensors are usually not able to take any readings. These also are also connected with the Arduino with a similar type of limit and the vibration motor enabling signal.

LDR:

This light sensor is used to detect any change in ambient light (sunlight). Referring to any change in the day and night cycle and enabling the user to understand if it's daytime or not. The sensor is also connected with Arduino and a small buzzer.

Code:

Ultrasonic Sensor (HC-SR04) :

```
// defines pins numbers


const int trigPin = 9;
const int echoPin = 10;

const int trigPin2=11;
const int echoPin2=12;

const int trigPin3=7;
const int echoPin3=8;




void setup() {
//pinMode(LEDR,OUTPUT);
pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output
pinMode(echoPin, INPUT); // Sets the echoPin as an Input
pinMode(trigPin2,OUTPUT);
pinMode(echoPin2,INPUT);
pinMode(trigPin3,OUTPUT);
pinMode(echoPin3,INPUT);

//digitalWrite (LEDR , LOW);
Serial.begin(9600); // Starts the serial communication
}



void firstsensor(){ // This function is for first sensor.
  int duration1, distance1;
  digitalWrite (trigPin, HIGH);
  delayMicroseconds (10);
  digitalWrite (trigPin, LOW);
  duration1 = pulseIn (echoPin, HIGH);
  distance1 = (duration1/2) / 29.1;

      Serial.print("1st Sensor: ");
      Serial.print(distance1);
      Serial.print("cm    ");
      Serial.println(" ");

}
```

```
void secondsensor(){ // This function is for first sensor.
  int duration2, distance2;
  digitalWrite (trigPin2, HIGH);
  delayMicroseconds (10);
  digitalWrite (trigPin2, LOW);
  duration2 = pulseIn (echoPin2, HIGH);
  distance2 = (duration2/2) / 29.1;

      Serial.print("2nd Sensor: ");
      Serial.print(distance2);
      Serial.print("cm    ");
      Serial.println(" ");

}
void thirdsensor(){ // This function is for first sensor.
  int duration3, distance3;
  digitalWrite (trigPin3, HIGH);
  delayMicroseconds (10);
  digitalWrite (trigPin3, LOW);
  duration3 = pulseIn (echoPin3, HIGH);
  distance3 = (duration3/2) / 29.1;

      Serial.print("3rd Sensor: ");
      Serial.print(distance3);
      Serial.print("cm    ");
      Serial.println(" ");

}

void loop() {
firstsensor();
secondsensor();
thirdsensor();
delay(500);

}
```

Light Dependent Resistor (LDR) :

```
int LDRPin = A0;

int sensorValue = 0;
void setup() {
Serial.begin(9600);
}
void loop() {
sensorValue = analogRead(LDRPin);
Serial.println(sensorValue);

delay(100);

}
```

Infrared Sensor (IR) :

```
int irPin=8;
int irPin2=7;
void setup()
{
  Serial.begin(9600);
  pinMode(irPin,INPUT);
  pinMode(irPin2,INPUT);
}

void loop()
{
  int detect=digitalRead(irPin);
  int detect2=digitalRead(irPin2);

  if(detect==LOW)
  {
    Serial.println("Obstacle detected by sensor 1!!");
    delay(1000);
  }
  if(detect2==LOW)
  {
    Serial.println("Obstacle detected by sensor 2!!");
    delay(1000);
  }
}
```

Location and Remote Messaging :

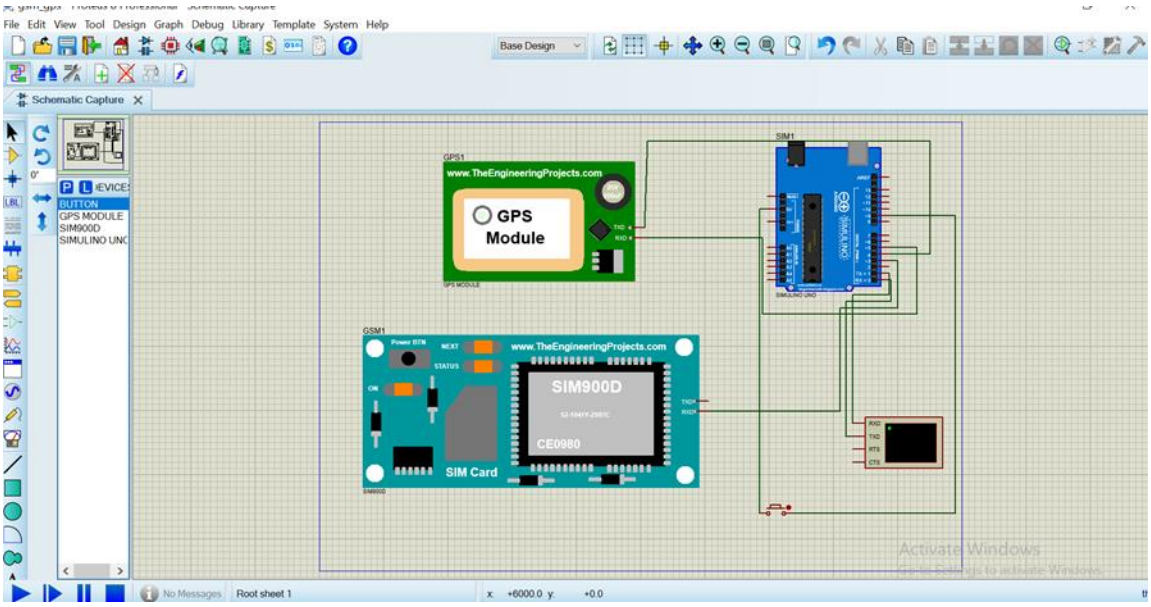

Fig 2.3 GSM Module & GPS Module

Description :

When the GSM modem receives a message, the microcontroller will process the message with the keyword Saved in it. Then, it will get the location of the stick from the GPS modem and transmit the location to the GSM modem in order to respond to the sender. In case of an emergency, the user of the stick can press the emergency button the microcontroller accesses the location from the GPS modem and transmit the location to the GSM modem which will send a SMS messages to the saved number in the system.

Code :

```
#include <SoftwareSerial.h>8
//SoftwareSerial SIM00A(18,19);
void setup()
{
  //SIM800A.begin(9600);   // Setting the baud rate of GSM Module
  Serial.begin(9600);    // Setting the baud rate of Serial Monitor
(Arduino)
  Serial.println ("SIM800A Ready");
  delay(100);
  Serial.println ("Type s to send message or r to receive message");
}
void loop()
{
  button_State = digitalRead(button1);   //We are constantly reading the
button State

  if (button_State == LOW) {            //And if it's pressed
    Serial.println("Button pressed");   //Shows this message on the serial
monitor
    delay(200);                         //Small delay to avoid detecting
the button press many times

    SendSMS();
}
 void SendMessage()
{
  Serial.println ("Sending Message");
  //SIM800A.println("AT+CMGF=1");    //Sets the GSM Module in Text Mode
  delay(1000);
  Serial.println ("Set SMS Number");
  Serial.println("ATD+8801635093073"); //Mobile phone number to send
message
  delay(1000);
  Serial.println ("Emergency!!!!");
  //SIM800A.println("Good morning, how are you doing?");// Messsage
content
  delay(100);
  Serial.println ("Finish");
  //SIM800A.println((char)26);// ASCII code of CTRL+Z
  delay(1000);
  Serial.println ("Message has been sent ->SMS Selesai dikirim");
}
```

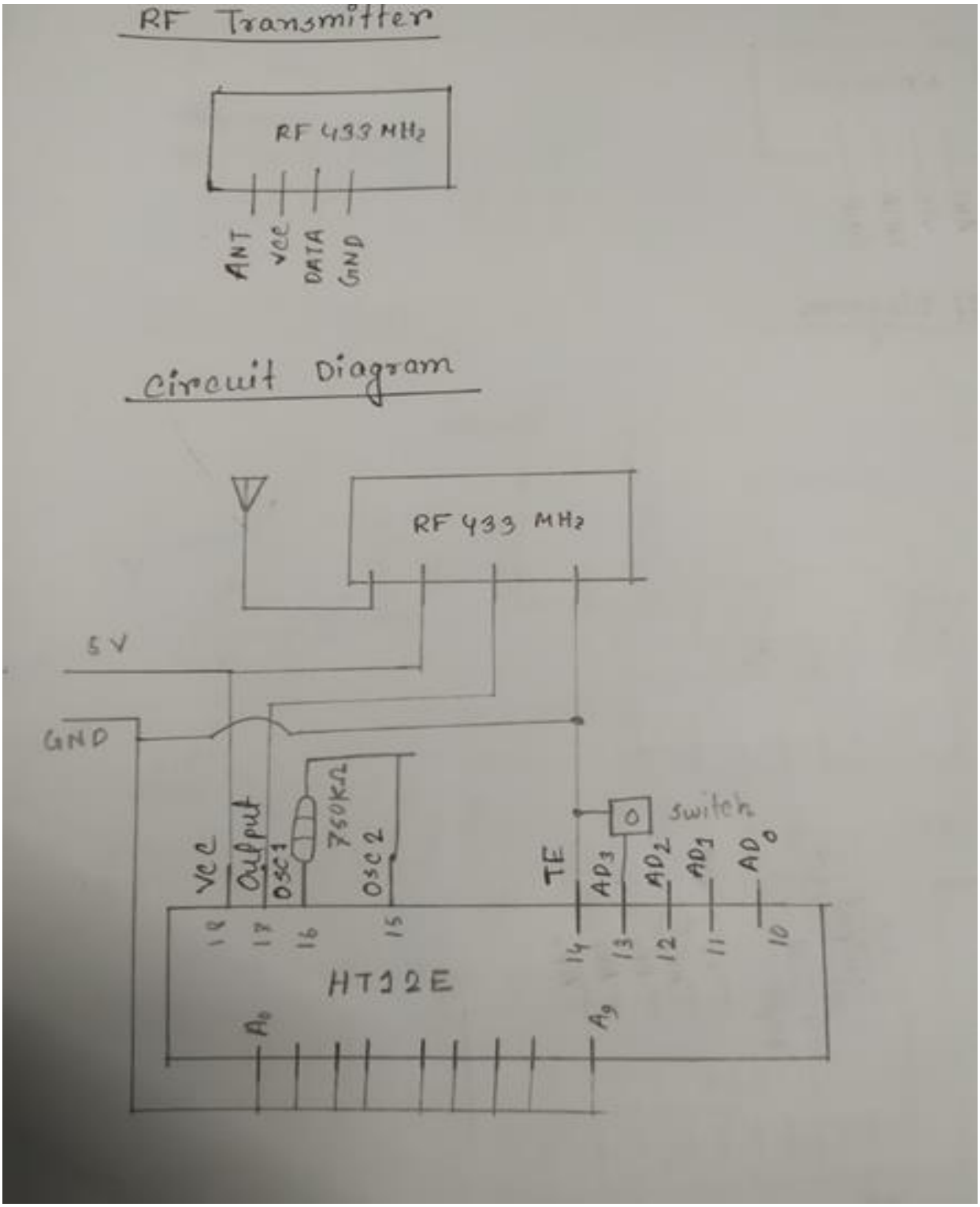

Fig 2.3 RF Transmitter 433 GHz

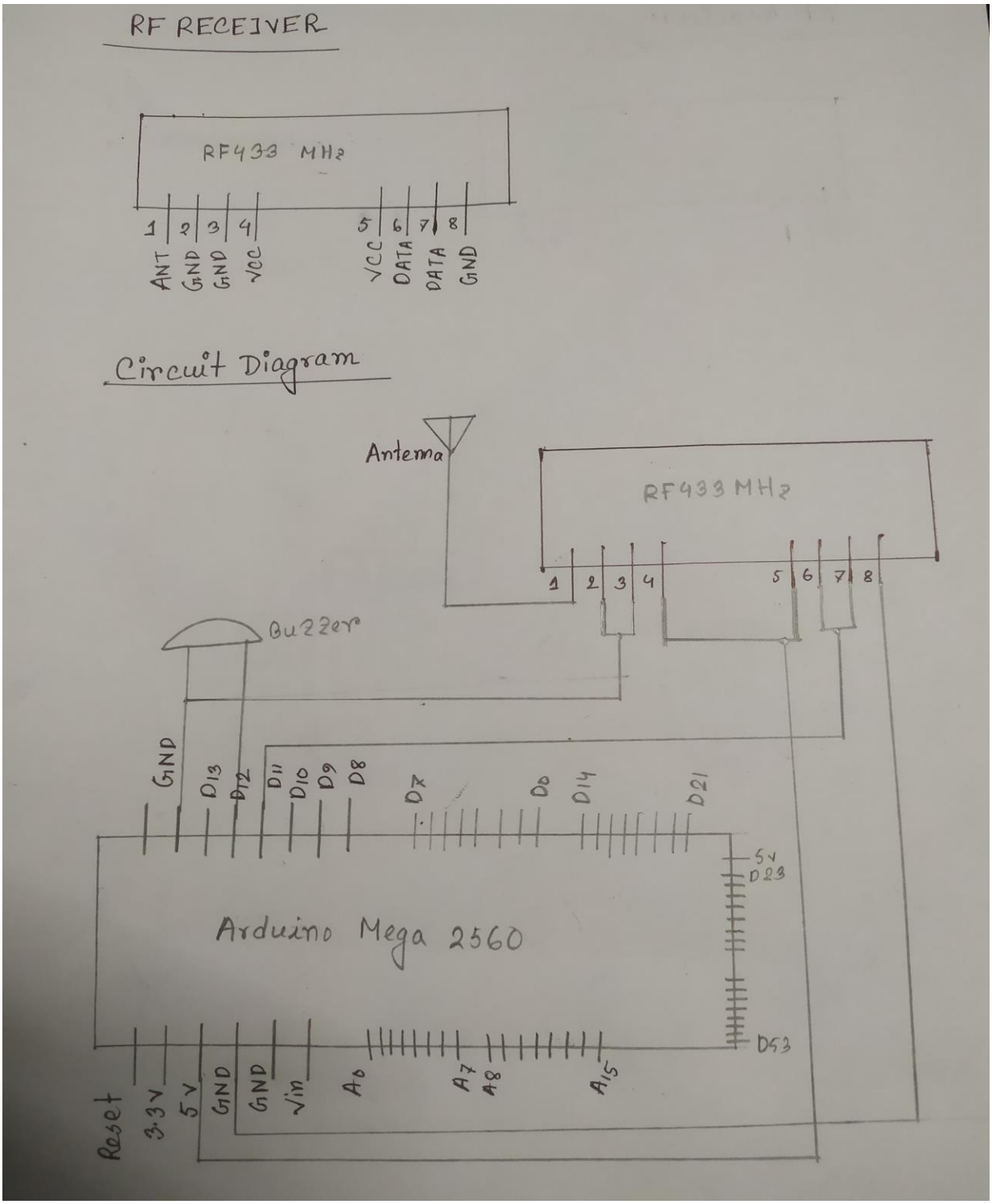

Fig 2.3 RF Receiver 433 GHz

Description :

An RF module (radio-frequency module) is a small electronic device used to transmit and receive radio signals between two devices. In an embedded system it is often desirable to communicate with another device wirelessly. RF module operates at Radio Frequency. This frequency range varies between 30 kHz & 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. This RF module is a combination of RF Transmitter and RF Receiver. The transmitter/receiver (Tx/Rx) pair operates at a frequency of 433 MHz. The RF transmitter receives serial data and transmits it wirelessly through through its RF antenna. The transmission occurs at the rate of 1 Kbps – 10 Kbps. RF receiver receives the transmitted data and it is operating at the same frequency as that of the transmitter.

4. Result and Analysis

Finally it's time to test our Smart White Cane arduino project. If we make sure the connections are done as per the connection diagram and the program is successfully uploaded. Now, power both the circuits using a 9V battery and we should start to see results. If we Move the Ultra Sonic sensor closer to object and you will notice the motor vibrating and this vibrating frequency increases as the stick goes closer to object. If the LDR is covered in dark or if there is too much light the buzzer will beep. If everything is normal the buzzer will not beep.

When we press the button on the remote the buzzer will give a long beep. If we press the emergency button on the cane a message will be sent to the number provided by the user that there is an emergency and the location provided by the GPS Module will be sent along with the message. Amazing!

5. Limitations and Future Scope

Although all the domains of these projects are meticulously chosen these is some limitations of this Smart White Cane. The remote control system is developed using RF receiver transmitter pair. If we press the button on the sender there will be a long beep so that the user can find their lost Stick. But if the stick in such a distance where the RF can't broadcast it's signal the buzzer will never beep as a result the user will not be able to find his stick.

Also the remote messaging technique is developed by using GSM module. After sending the message user will not be informed if the message is successfully sent or not. Also if there is insufficient balance in the sim used in GSM the message will not be sent.

If this project is carefully nurtured there are some future scope which can be added to this project. The object detection part was main developed because the blind people faces many problem while walking on street. The streets aren't always dry in monsoon the streets may

become wet and muddy. That's we can add water sensor to further detect if there is any water of mud infront of the user.

We have already implemented GPS technology for sending the position of the user their relatives or concerned people. In future using gps guidance to their destination will be given to the user by voice navigation. Using another sensor presence of water on the road will be detected. Fire and Smoke alarm system can also be included.

5. Conclusion

It is worth mentioning at this point that the aim of the of this project is design and implementation of a smart walking stick for the blind has been fully achieved .The smart stick as a basic platform for the coming generation of more adding devices to help the visually impaired to navigate safely both indoor and outdoor. It is effective and affordable. It leads the good result in detecting the obstacles on the path of the user in a range. This project offer low cost, reliable, portable, low power consumption and robust technology for navigation with obvious short response time .In this project, different types of sensors and other component with the light weight. It also include Global Positioning system (GPS) which is use to find the actual position of the blind person. And other function is Global system for mobile communication (GSM) module which help to send the location to their member in case the blind person get lost or if they are in the danger.