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LICENCE

In Electrical and Electronic Engineering

Title:

Smart Cane for Blind People

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Abstract

Blindness is a state of lacking the visual perception due to physiological or neurological factors. Partial blindness represents the lack of integration in the growth of the optic nerve or visual center of the eye and total blindness is the full absence of the visual light perception. Imagine walking into an unfamiliar place. One has to ask for guidance in order to reach the destination. But what if this person was visually impaired? He would have completely depended on other people to reach his destination.

The smart stick comes as a proposed solution to enable the visually challenged to navigate and identify the world around them with ease using advanced technology represented in an innovative intelligent cane integrated with an *Infrared sensor* to detect stair-cases and holes, along with an *Ultrasonic* to detect any other obstacles in front of the user within a range of four meters. When any obstacle is close enough the system sends warnings through *buzzer sounds and vibrations*; if the hurdle is not that close the circuit does nothing.

Moreover, a *Radio Frequency* module is embedded in the system allowing the user to find his stick whenever and wherever he loses it. Not to mention a GPS and GSM module used to send out the user's exact location to an emergency contact of his choice in case of an unfortunate incident. Our system will be empowering the blind to move twice their normal speed because she/he feels safe. The smart stick is of a low cost, fast response, low power consumption and lightweight.

Keywords: smart stick, obstacle detection, GPS, GSM.

Contents

Acknowledgements

Praise to Allah the Almighty and most merciful forgiving us the wisdom, persistence and potency to complete this project.

We revere the patronage and moral support extended with love by our families, especially our parents whose financial and constant passionate encouragement made this undertaking a reality.

`It is our genuine and deepest pleasure to submit our heartiest gratitude and appreciation to our respected supervisor Dr.AMMAR, for his guidance, timely advice and scientific approach that made the completion of this project possible.

We prefusely thank our colleagues, distinguished teachers and people whose assistance and contributions are greatly acknowledged.

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Introduction

According to statistics gathered by the World Health Organization WHO[9], an estimated 1.3 billion people are visually impaired, 39 million of whom are completely blind facing many difficulties in their day to day life when it comes to interacting with their environment.

More than 90% of the world's legally blind people live in low- and middle-income countries[8]. Moreover, because of the limited types of jobs they can do, over half of them are unemployed which makes them rely on their families for mobility and financial support.

Physical movement also represents a challenge for them as they have little to no contact with their surroundings making them more prone to falls and other accidents[1], hence, it can become tricky to distinguish their whereabouts and destination, which will end up opposing them from interacting with people and social activities due to their limited mobility, and it only gets worse when travelling to an unfamiliar location. So, to navigate unknown places, the visually impaired will need support from either his cane (on which he cannot fully depend) or a fully sighted person. They are always trying their best to be normal and comfortable, unfortunately, their life activities are greatly restricted by loss of eyesight as they can only walk in fixed routes that are significant in their lives using blind navigation equipment and the accumulated memories in their long term exploration.

Based on the investigations about basic daily activity characteristics and modes of the visually impaired[4], the study found that the main difficulties encountered in a trip of the blind included walking on the road, finding way, taking a bus..

In the past, different systems have been designed[2] (with limitations and no solid understanding of the non-visual perception) for the user's mobility and navigation assistance and are typically known as travel aids or blind mobility aids[6]. The most successful and widely used is the long conventional walking cane with a red tip which is the international symbol of blindness. It is used to detect obstacles on the ground, uneven surfaces, holes, steps, and puddles. Blind pedestrians usually tap their cane on the ground, and the resulting vibrations indicate the nature of the surface. Tapping also produces sound, which is then reflected by nearby obstacles[2]. Very skillful visually impaired travelers are able to detect these echoes and their direction of origins.

However, it can only be used for indoor navigations, and has neither hurdle detection nor location determination feature in outdoor environment [6].

Technically, many of the people suffering from low vision could restore normal eyesight with the help of eyeglasses or contact lenses. But unfortunately, those who suffer from complete loss of perception can only detect the object that is being hit by the walking stick.

Our project aims to design and implement an intelligent and cheap stick that will make living with blindness much easier presenting an approach to overcome the major challenges faced by the visually impaired in their day to day life. It combines different features in one cane compared to the ones previously designed[5], [3], [7] that are lacking when it comes to sensors and modules such as the GSM, GPS and RF modules, each working on making our project more effective and efficient.

Historical Background

In the past, different systems have been designed (with limitations and no solid understanding of the non-visual perception) for the user's mobility and navigation assistance and are typically known as travel aids or blind mobility aids.The most successful and widely used is the long conventional walking cane with a red tip which is the international symbol of blindness. It is used to detect obstacles on the ground, uneven surfaces, holes, steps, and puddles. Blind pedestrians usually tap their cane on the ground, and the resulting vibrations indicate the nature of the surface. Tapping also produces sound, which is then reflected by nearby obstacles.Very skillful visually impaired travelers are able to detect these echoes and their direction of origins. However, Smart Stick for Blind People can be used only for indoor navigations, and has neither hurdle detection nor location determination feature in outdoor environment.Technically, many of the people suffering from low vision could restore normal eyesight with the help of eyeglasses or contact lenses. But unfortunately, those who suffer from complete loss of perception can only detect the object that is being hit by the walking stick.Our project aims to design and implement an intelligent and cheap stick that will make living with blindness much easier presenting an approach to overcome the major challenges faced by the visually impaired in their day to day life. It combines different features in one cane compared to the ones previously designed that are lacking when it comes to sensors and modules such as the GSM, GPS and RF modules, each working on making our project more effective and efficient.

White cane

Throughout history, the cane, staff, and stick have existed as traveling aids for the blind and visually impaired. Dating back to biblical times records show that a shepherd's staff was used as a tool for solitary travel. The blind used such tools to alert them to obstacles in their centuries, the "cane" was used merely as a tool for travel and it was not until the twentieth century that the cane, as we know it today, was promoted for use by the blind as a symbol to alert others to the fact the path. This new role for the white cane had its origins in the decades between the two World Wars, beginning in Europe and then spreading to North America. James Biggs of Bristol claimed to have invented the white cane in 1921. After an accident claimed his sight, the artist had to readjust to his environment. Feeling threatened by increased motor vehicle traffic around his home, Biggs decided to paint his walking stick white to make himself more visible to motorists. It was not until ten years later that the white cane

established its presence in society. In February, 1931, Guilly d'Herbemont launched a scheme for a national white stick movement for blind people in France. The campaign was reported in British newspapers leading to a similar scheme being sponsored by rotary clubs throughout the United Kingdom. In May 1931 the BBC suggested in its radio broadcasts that blind individuals might be provided with a white stick, which would become universallyrecognized as a symbol indicating that somebody was blind or visually impaired. The first special White Cane Ordinance was passed in December 1930 in Peoria, Illinois. It granted blind pedestrians protections and the right-of-way while carrying a white cane. In 1935, Michigan began promoting the white cane as a visible symbol for the blind. On February 25, 1936, an ordinance was passed by the City of Detroit recognizing the white cane. To promote the new ordinance, a demonstration was held at City Hall where the blind and visually impaired people were presented with white canes. The following year, Donald Schuur wrote the provision of a bill and had it proposed in the Michigan State Legislature. The proposal gave the carrier of the White Cane protection while traveling on the streets of Michigan. Governor Frank Murphy signed the bill into law in March, 1937.

Chapter 1

Software System Design

System Overview

The system sequence of the circuit’s process is shown in fig.3.1. Initially, the distance between the person and the surrounded obstacles is calculated by an ultrasonic sensor, if it is in a certain range, it will trigger an alarm (buzzer and a vibrator motor) in a certain frequency according to the calculated value. An IR sensor is also used to check the obstacles at the ground level (stairs) then activates the alarm if an obstacle is detected. When the user loses his/her stick the RF transmitter (on the remote control) sends a message to the RF receiver (on the stick) then activates the alarm to help the user find the stick’s location. The GPS tracks the user’s location, it records the coordinates (the latitude, longitude and altitude feet) then sends them to the user’s emergency contact using the GSM module.

In order to control the different sensors, two arduino Uno microcontrollers are used. The arduino IDE is an open-source software where the code (a set of c/c++ instructions) is written and uploaded to the arduino boards. The environment is written in Java and based on Processing and other open-source software.

The Used Libraries

Radio Head RH ASK

Driver to send and receive unaddressed, unreliable datagrams00 via inexpensive ASK (Amplitude Shift Keying) or OOK (On off Keying) RF transceivers.

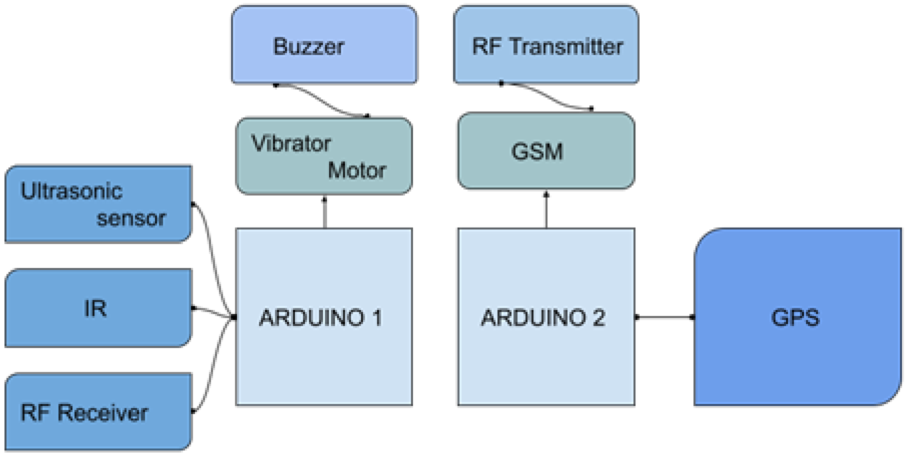


Figure 1.1: The Overall Block Diagram

Serial Peripheral Interface SPI

SPI is a synchronous serial data protocol used by microcontrollers for communicating with one or more peripheral devices quickly over short distances. It can also be used for communication between two microcontrollers. With an SPI connection there is always one master device (usually a microcontroller) which controls the peripheral devices. It is needed for compilation in our case.

Tiny GPS++

It is a new Arduino library for parsing NMEA data streams provided by GPS modules.This library provides compact and easy-to-use methods for extracting position, date, time, altitude, speed, and course from consumer GPS devices.

Software Serial

The Arduino hardware has built-in support for serial communication on pins 0 and 1 (which also goes to the computer via the USB connection). The native serial support happens via a piece of hardware (built into the chip) called a UART. This hardware allows the Atmega chip to receive serial communication even while working on other tasks, as long as there room in the 64 byte serial buffer. The Software Serial library has been developed to allow serial communication on other digital pins of the Arduino, using software to replicate the functionality. It is possible to have multiple software serial ports with speeds up to 115200 bps.

Software Design

Microcontroller 1

High-level Flowcharts

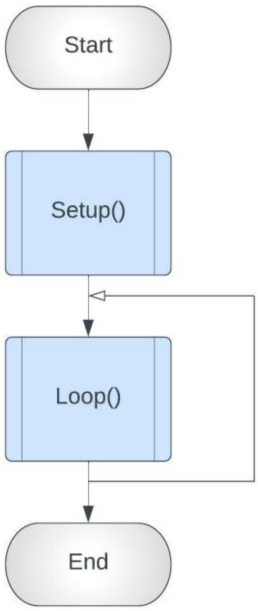


Figure 1.2: The overall flowchart of the microprocessor program

The program contains two main functions: the setup which is executed once for initializing the different sensors, input and output ports and the loop function which is executed repeatedly. We will see later what these subroutines contain in details.

The Setup()

The RF receiver is initialized, after declaring the pins, if the initialization fails, an error message is displayed to allow the programmer to fix it.

The loop()

The loop subroutine contains the call of the different needed subroutines to read the sensed values, process the data and then activate the alarm if needed in the appropriate frequency.

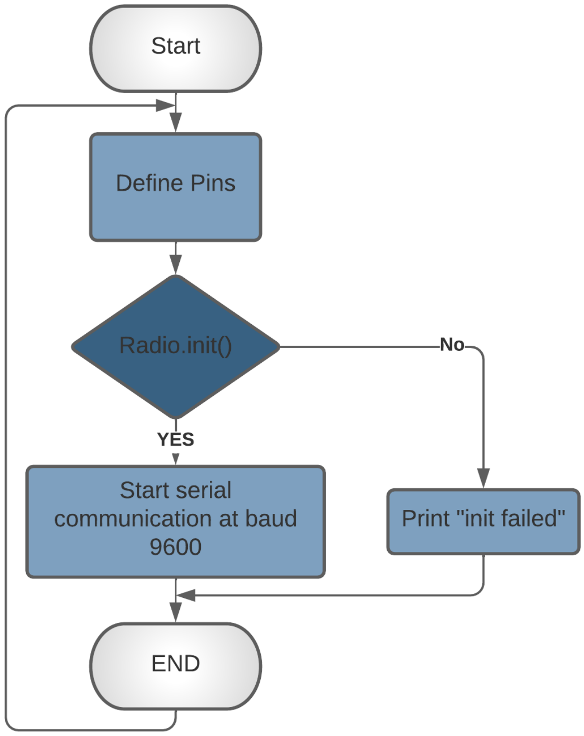


Figure 1.3: The Setup subroutine flowchart

The loop subroutine contains the call of the different needed subroutines to read the sensed values, process the data and then activate the alarm if needed in the appropriate frequency. First, the Arduino gets the data from the ultrasonic sensor to calculate the distance between the user and theclosest obstacle. The calculated value is sent as a parameter to the Buzz subroutine, to determine the frequency of the buzzer based on a set of conditions. After that, the Arduino reads data from the IR and activates the alarm based on the state of the IR led using the Buzz IR function. When the user pushes the transmitter button the state of the RF receiver turns to non-blocking so that it can receive the sent message, an alarm is activated if the right message is sent using the Buzz-RFsubroutine.

Note :

More details about the called subroutines are available in low level flowcharts.

Low Level Flowcharts

Microcontroller 2

Top Level Flowcharts

Since we used the same microcontroller type (Arduino Uno), we have the same structure as the first arduino code (Setup() executed once and loop() executed repeatedly).

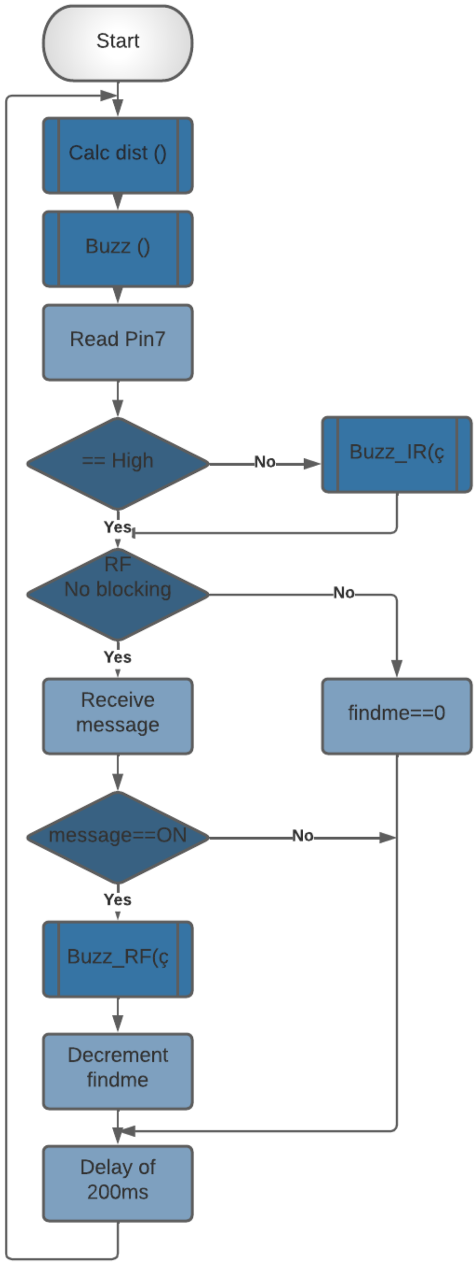


Figure 1.4: The loop subroutine flowchart

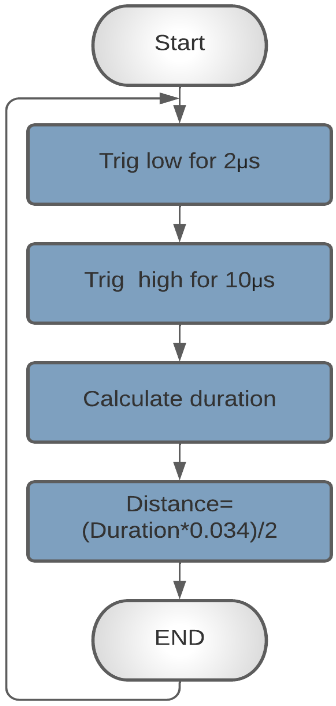


Figure 1.5: CalcDist() subroutine flowchart

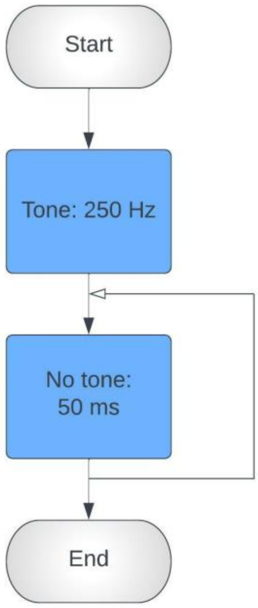


Figure 1.6: Buzz() subroutine flowchart

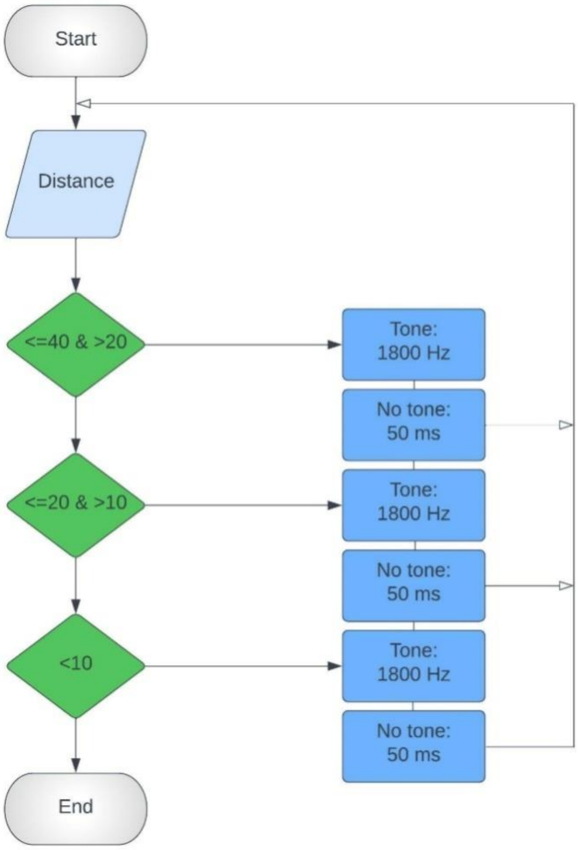


Figure 1.7: Buzz-IR() subroutine flowchart

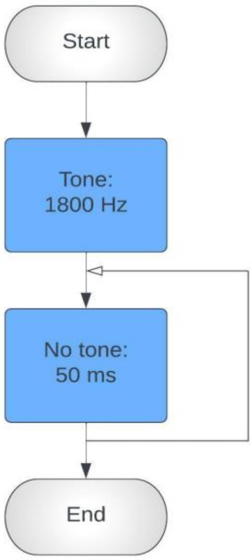


Figure 1.8: Buzz-RF() subroutine flowchart

The Setup()

Similarly to the RF receiver, the RF transmitter is initialized after declaring the pins and initializingthe serial communication, if the initialization fails, an error message is displayed to allow the programmer to fix it.

The loop()

When the serial communication is available i.e, the arduino is ready to receive data from the module, the GPS' used library will encode the received characters one by one to form the NMEA sentences. After that, if the GPS location is updated, the TinyGPS++'s predefined functions will extract only the latitude and the longitude from the NMEA sentences.

If the SOS button is pushed down, the GSM will take the last recorded coordinates as a string andsend them to the user's emergency contact via AT commands.

In case of pressing the FindMe button, the RF transmitter will send the message "ON" at 433MHz frequency.

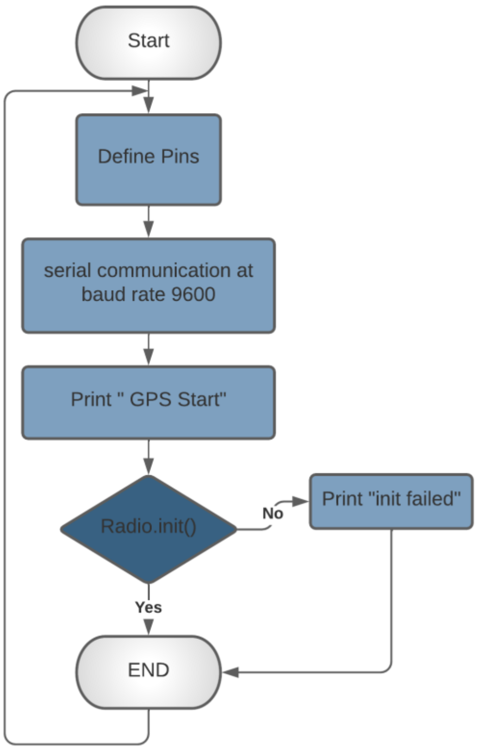


Figure1.9: The Setup() subroutine flowchart

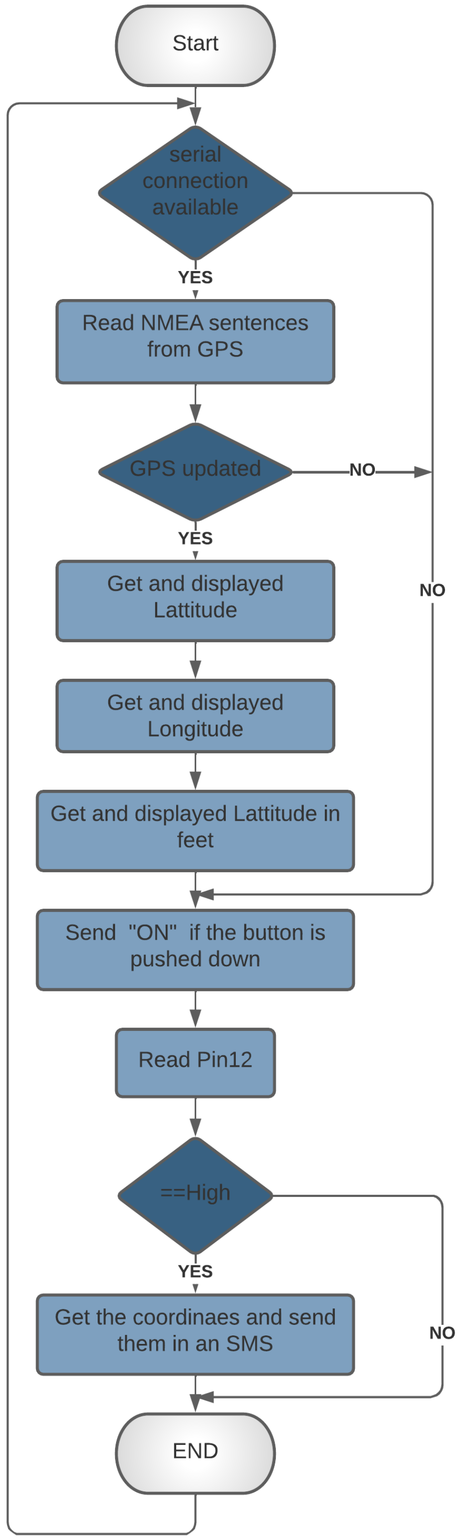


Figure1.10: The loop() subroutine flowchart

Chapter 2

Hardware System Design

The system requirements

In order to ensure the proper operation of our stick, we need the system to have the properties listed below:

- It needs to detect all kinds of obstacles and simultaneously alert the user of their presence.
- It should be able to help the visually impaired in emergency situations by sending an SMS with his coordinates to a contact of his choosing.
- It should contain a system to help the user find his stick.

The system structure

The objective here is to design the structure of the system's components. The structure is based on the requirements developed in the previous section, that we divided our system with different modules responsible of fulfilling them. The general block diagram of our system is shown in the figure 2.1.

Hardware Description

Arduino Uno

The Arduino UNO is an open-source microcontroller board based on the Microchip ATmega328P . The board is equipped with 14 digital and analog input/output (I/O) pins that may be interfaced to various expansion boards and other circuits: 6 analog input pins, a USB connection, a power barrel jack, an ICSP header and a reset button.

(The ATmega328 on the Arduino Uno comes preprogrammed with a boot loader that allows upload- ing new codes to it without the use of an external hardware programmer)

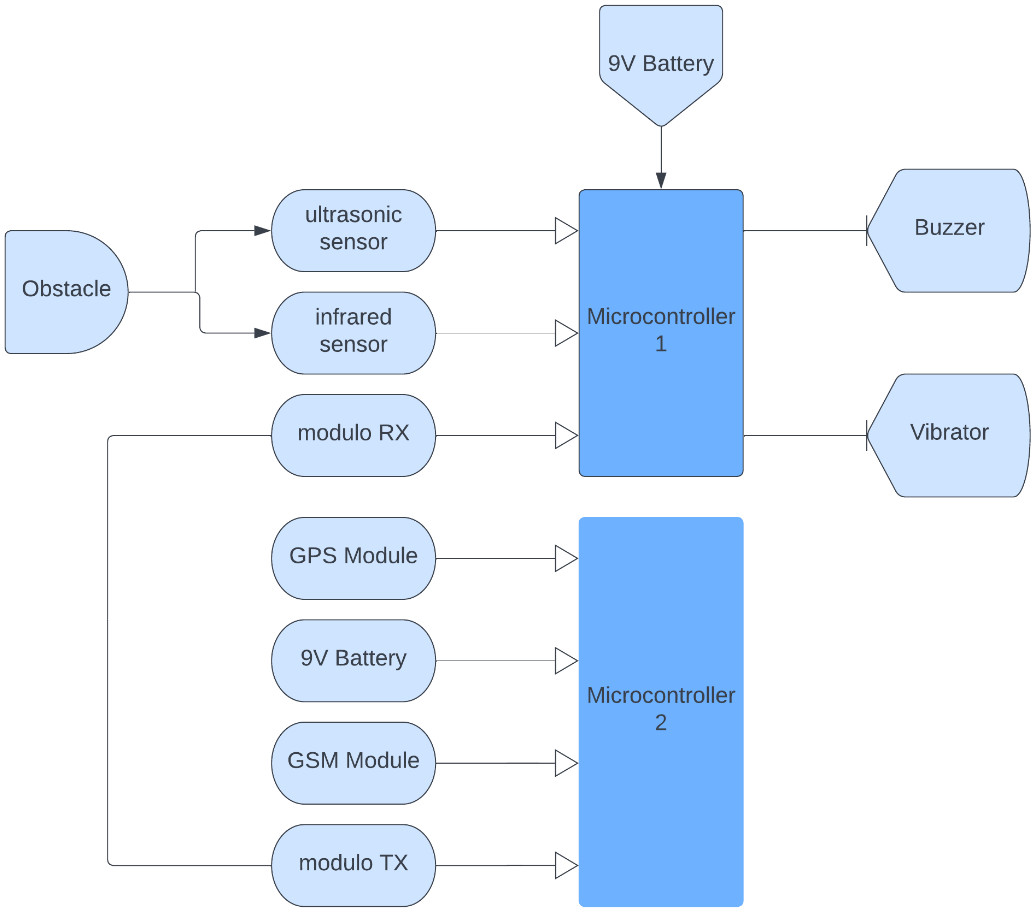


Figure 2.1: The General Block Diagram

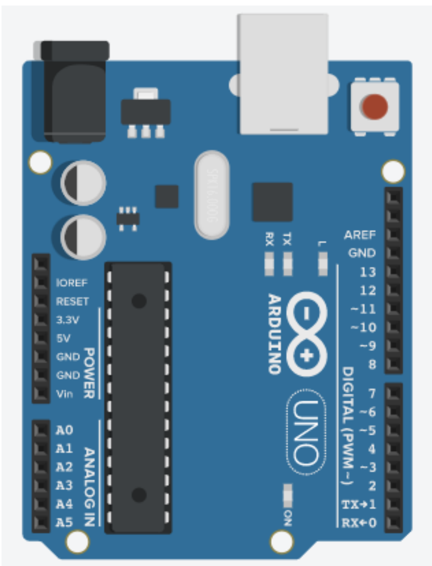


Figure 2.2: The Arduino Uno Board

Ultrasonic Sensor (HC-SR04)

Ultrasonic sensors are used in the harshest conditions for a variety of applications where measuring distance or sensing objects is required. The module has two eyes which form the Ultrasonictransmitter and Receiver.

The HC-SR04's head emits a sound wave and receives the reflected one back from the target, it measures the distance by estimating the time between the emission and reception as shown in equation (1) below:

$$D = \frac{T_S}{C} \qquad (1.1)$$

Where: D: The distance

T_S: The time between the emission and the reception

C: The sonic speed

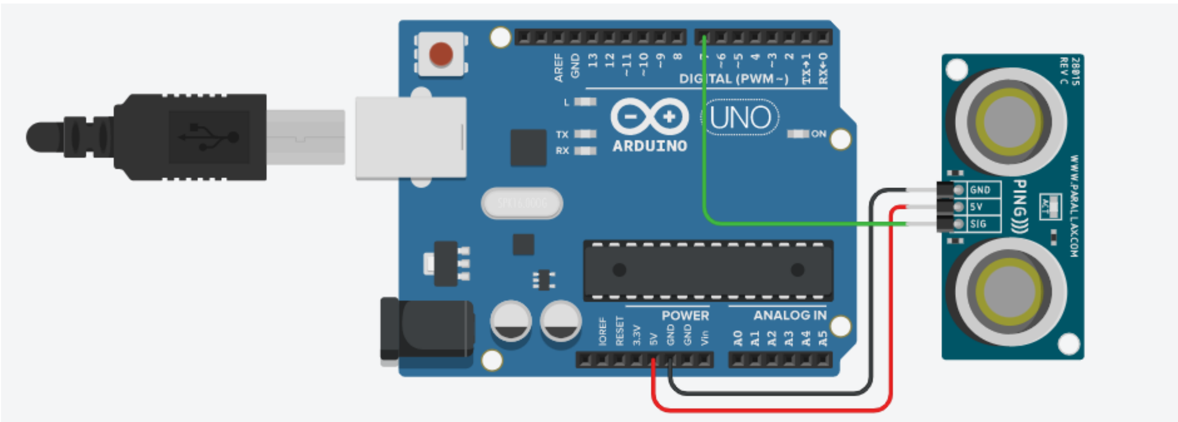


Figure 2.3: The Ultrasonic Sensor HC SR04 Connections

Infrared sensor(IR)

Infrared sensors are used to sense certain characteristics of their surroundings by either emitting or detecting infrared radiation or measuring the heat being emitted by an object and detecting motion (All objects with a temperature above absolute zero emit heat energy in the form of radiation).

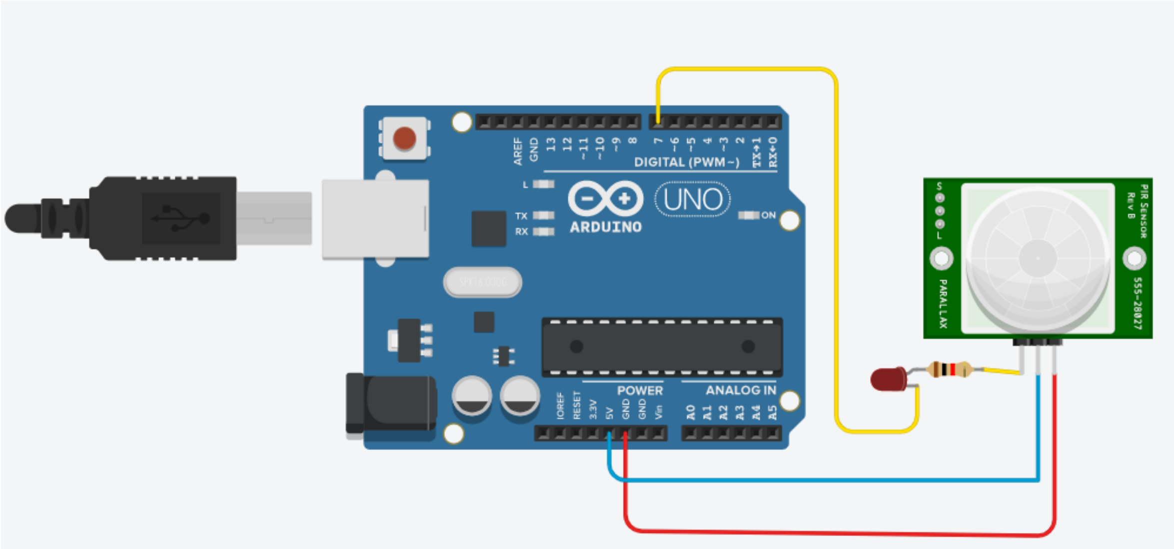


Figure 2.4: The Infrared Sensor Connections

RF sensor

An RF (Radio Frequency) sensor is a small electronic module that transmits and/or receives radio signals between two devices by its transmitter and receiver (Tx & Rx) pair that operates at a frequency of 433MHz.

The RF transmitter receives serial data and sends it wirelessly through the RF's antenna. The transmitted data is obtained by an RF receiver operating at the same frequency as that of the transmitter.

Signals passing through it can travel large distances making it suitable for long range applications.

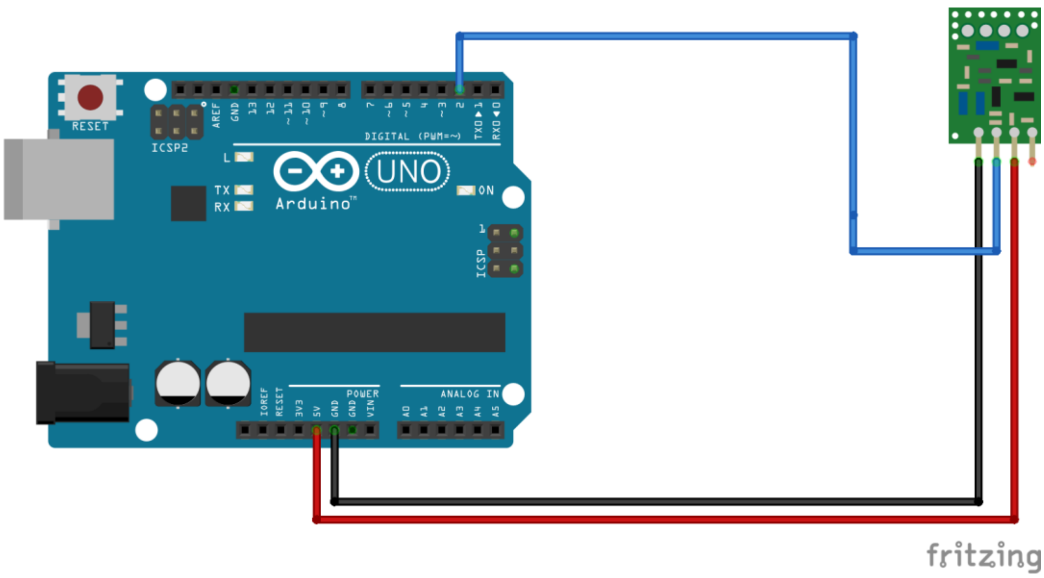


Figure 2.5: The RF Transmitter Connections

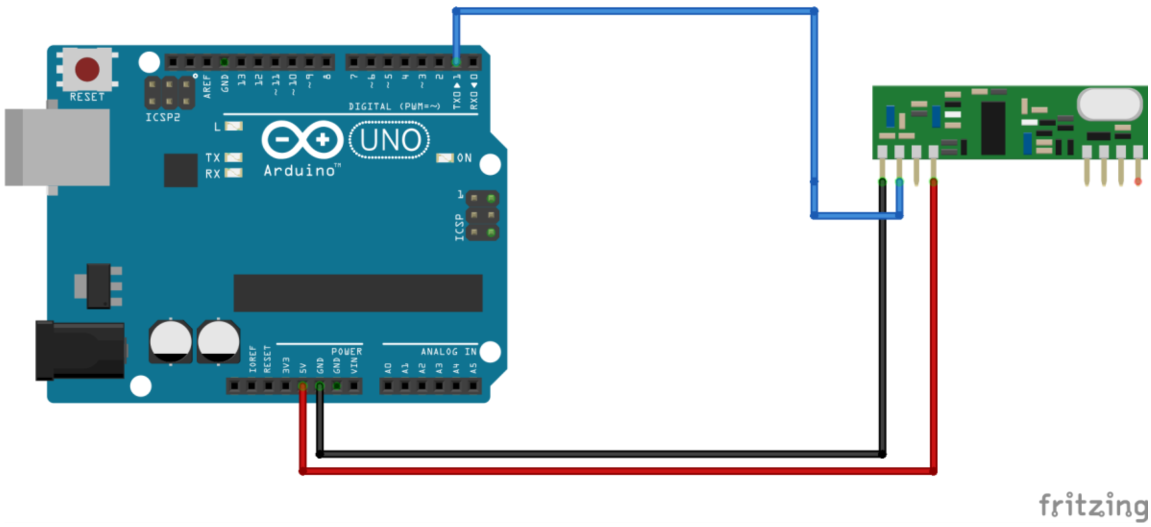


Figure 2.6: The RF Receiver Connections

GPS Module

The GPS (Global Positioning System) module is a device that receives information from GPS satellites and then calculates its geographical position. The GPS does not require the user to transmit any data, and it operates independently of any telephonic or internet reception. Its working principle is based on the 'Trilateration' mathematical theorem.

Note:

The GpsTEP module available in PROTEUS 8 PROFESSIONAL does not require GND and VCC pins but in our circuit we added those two pins.

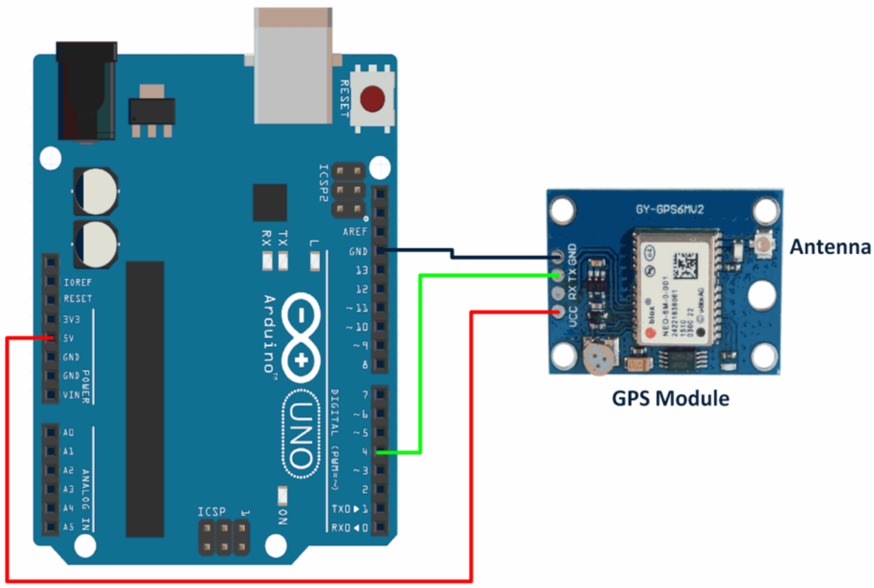


Figure 2.7: The GPS Connections

GSM Module

The Global System for Mobile Communications (GSM) is a part of the evolution of wireless mobile telecommunications.

It digitizes and compresses information, then sends it down to a channel with two other streams of user data, each in its own time slot. This module needs the AT commands for interacting with a processor or controller, which are exchanged through serial communication (these commands are sent by the controller/processor). The GSM sends back a result after it receives a command.

Similar to the GPS module, the GSMLibraryTEP in PROTEUS 8 PROFESSIONAL does not require a ground and vcc connections but we have them in our circuit in order to power the module.

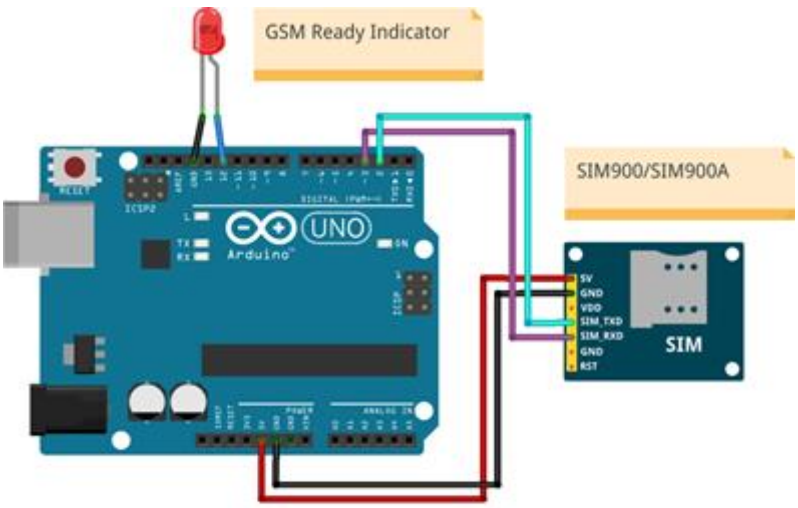


Figure2.8: The GSM Connections

Piezoelectric Buzzer

A piezo buzzer is a sound producing device. It consists of piezo crystals in between two conductors.

When a potential difference is applied across these crystals, they push one conductor and pull the other by their internal property. The continuous pull and push action generates a sharp sound wave. Piezo buzzers generate a loud & sharp sound. So, they are typically used as alarm circuits. Typically, they can generate a sound in the range of 2 to 4 kHz.

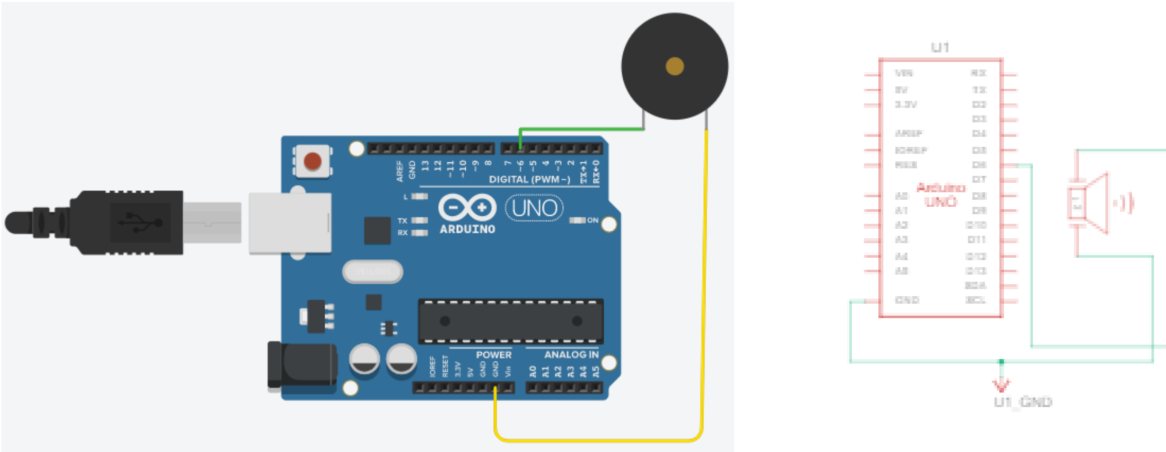


Figure 2.9: The Buzzer Connections

Vibration motor

A vibration motor is a compact size coreless DC motor used to inform the users of receiving the signal by vibrating, no sound. They are widely used in a variety of applications including cell phones.

In our circuit, both the piezo buzzer and vibrating motor are connected in parallel to form an alarm.

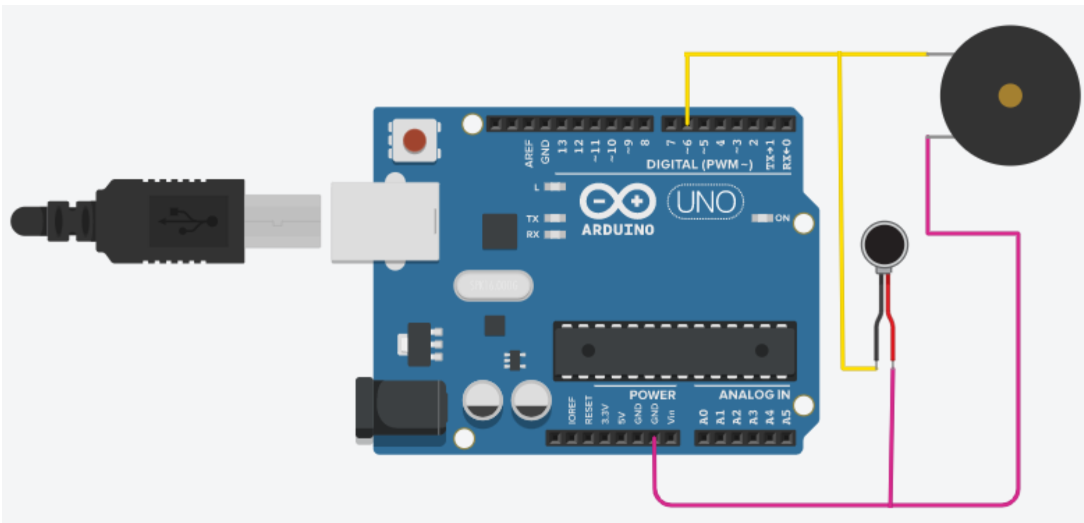


Figure 2.10: Vibrating motor connections

Water sensor:

Water sensor brick is designed for water detection, which can be widely used in sensing rainfall, water level, and even liquid leakage.

Connecting a water sensor to an Arduino is a great way to detect a leak, spill, flood, rain, etc. It can be used to detect the presence, the level, the volume and/or the absence of water. While this could be used to remind you to water your plants, there is a better Grove sensor for that. The sensor has an array of exposed traces, which read LOW when water is detected.

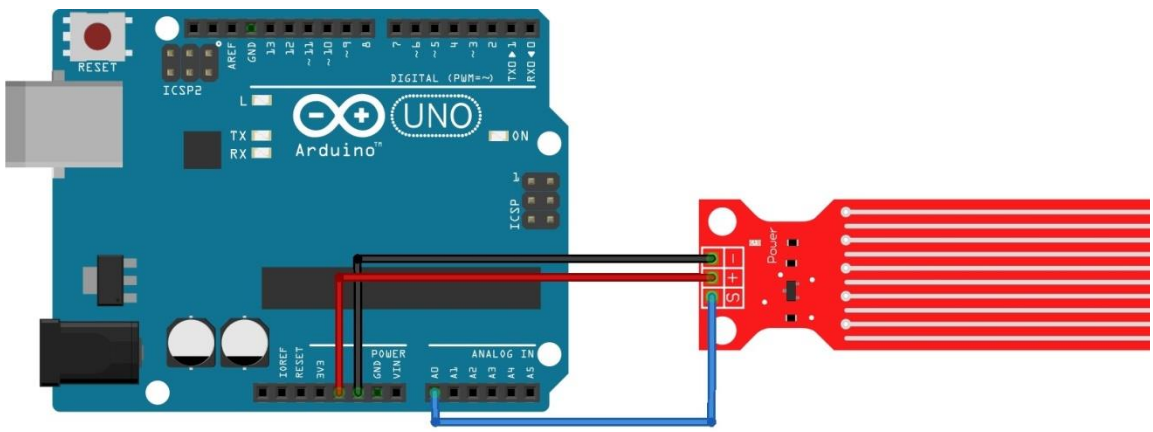


Figure2.11: water sensor connection

The Overall Circuit

<u>Design A:</u>

Microcontroller 1

The first circuit consists of:

- Arduino UNO
- Ultrasonic sensor
- Infrared sensor
- Modulo RX (RF receiver)
- Buzzer
- Vibrating motor

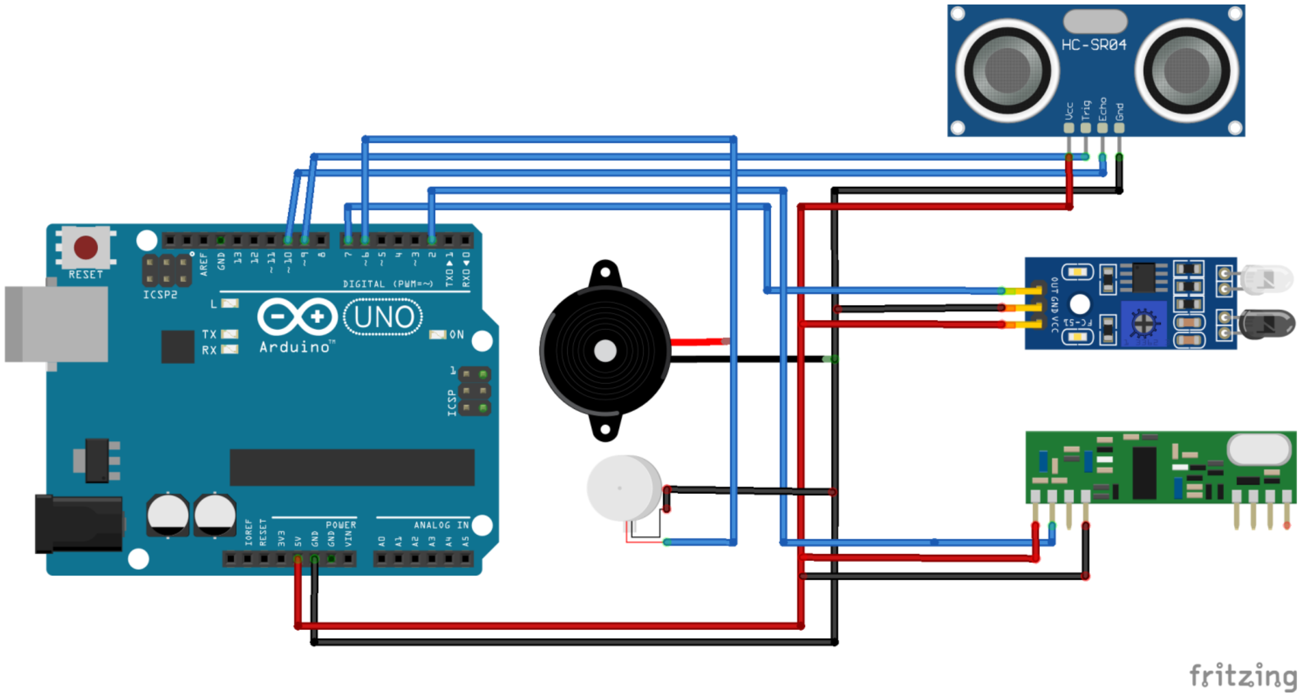


Figure 2.12: Arduino 1 Overall Circuit

Microcontroller 2

The second circuit consists of:

- Arduino UNO
- Modulo TX (RF transmitter)
- GPS module
- GSM module

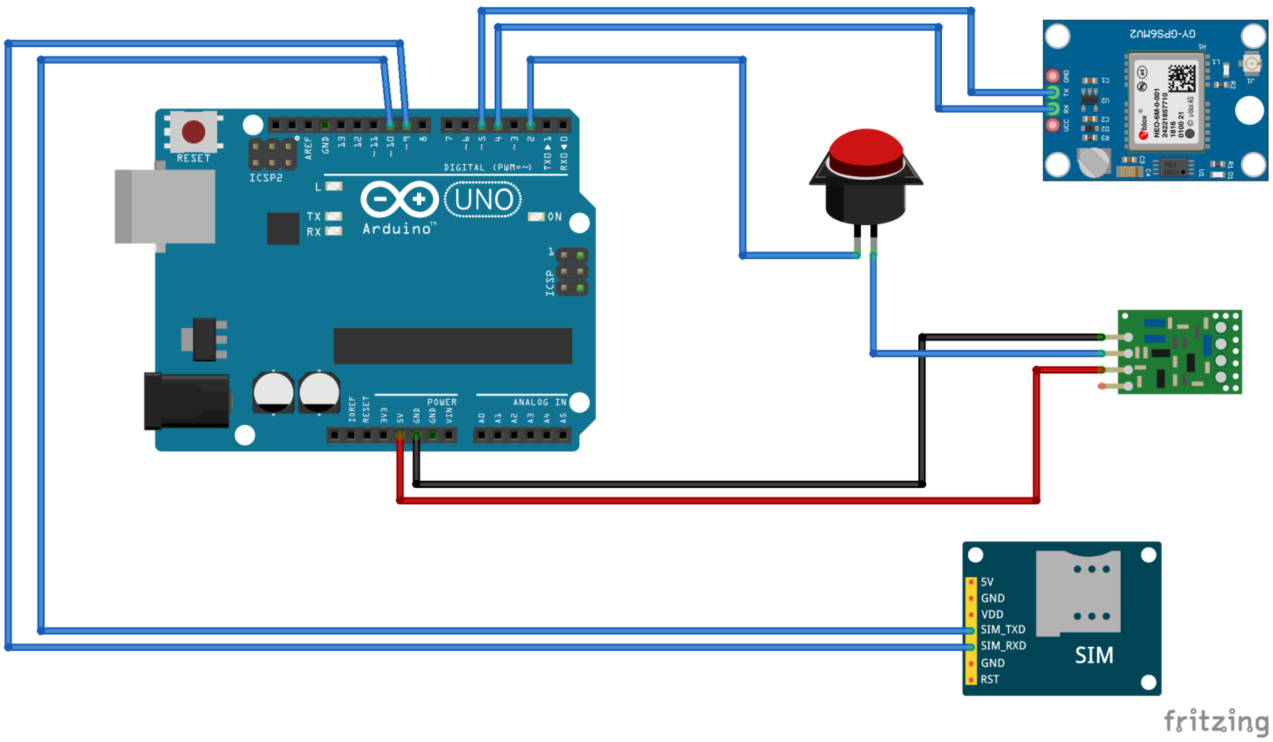


Figure2.13: Arduino 2 Overall Circuit

Design B:

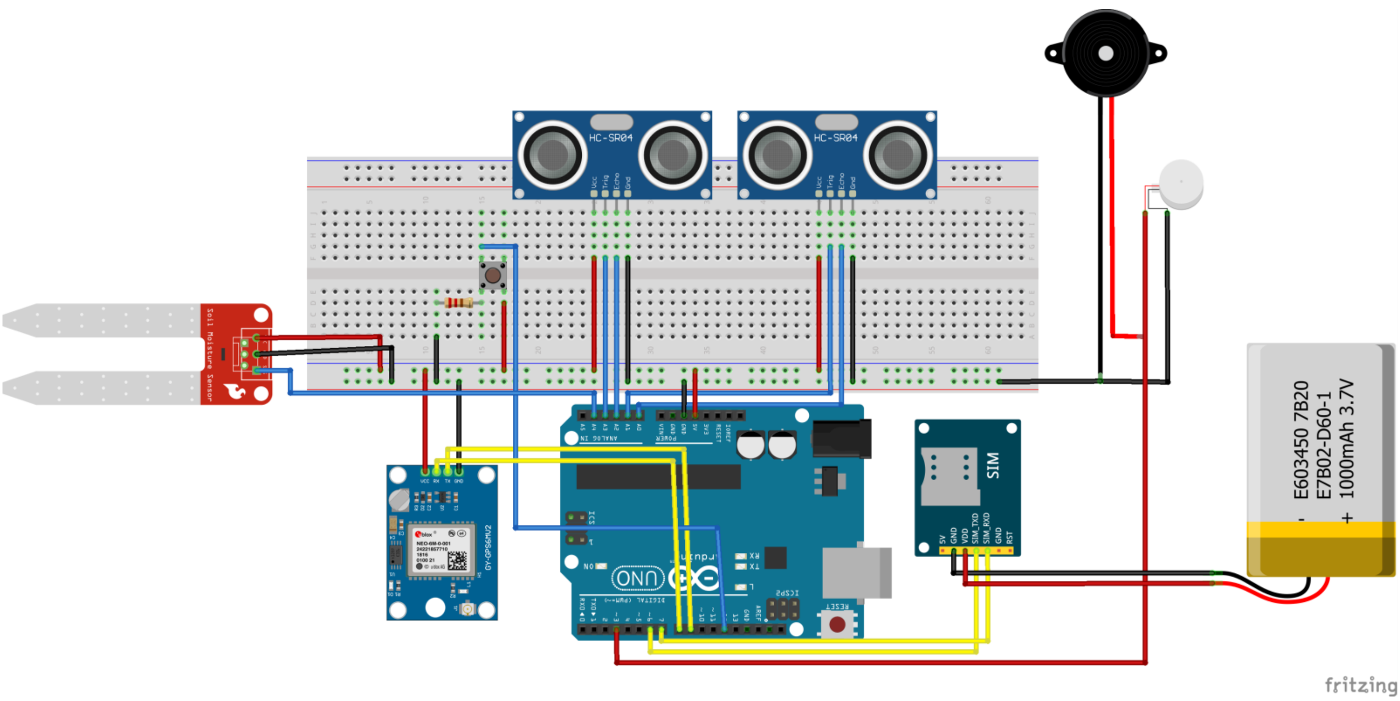


Figure2.14: Overall circuit of Design B

Chapter 3

Simulation and Results

The presented system is designed and configured for practical use. The stick is able to handle seven states that may face the blind people. The system will respond to each state according to a specific program which is coded and uploaded to both Arduino microcontrollers.

Listed below are the results of simulation of the overall system:

We have tabulated all the necessary information about our work during the six weeks of our project; we have calculated the project productivity so that we can choose the best design to represent:

Design A:

Design A	week 1	week 2	week 3	Total
TOTAL HOURS	9	11	14	34
Satisfied hours	5.67	2.97	4.06	12.7

Table 1: total hours and satisfied hours of Design A

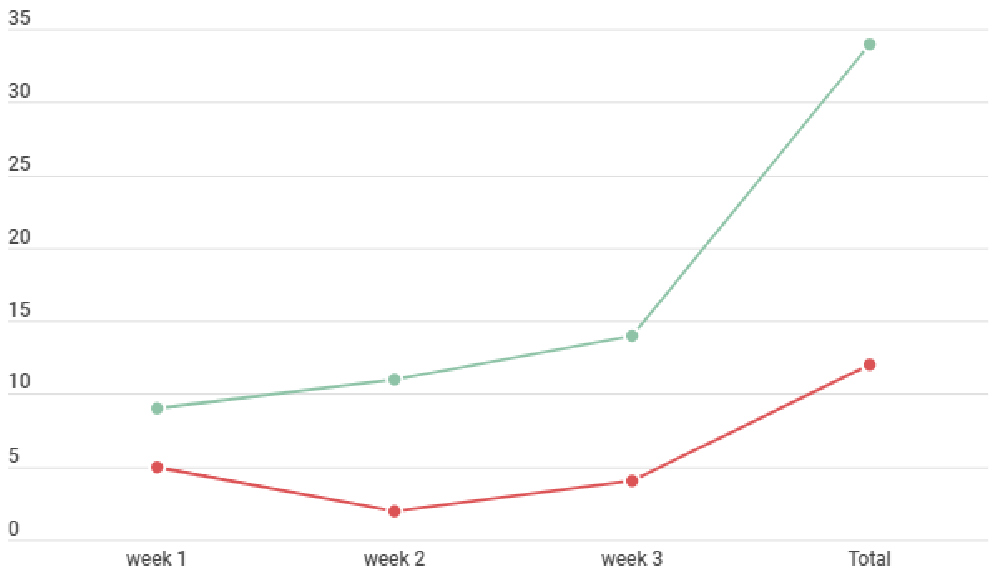


Figure 3.1: Growth of our work on Design B during the first 3 weeks

Design B:

Design B	week 4	week 5	week 3	Total
TOTAL HOURS	7	8	9	24
Satisfied hours	5.67	2.97	4.06	12.7

Table 2: total hours and satisfied hours of Design B

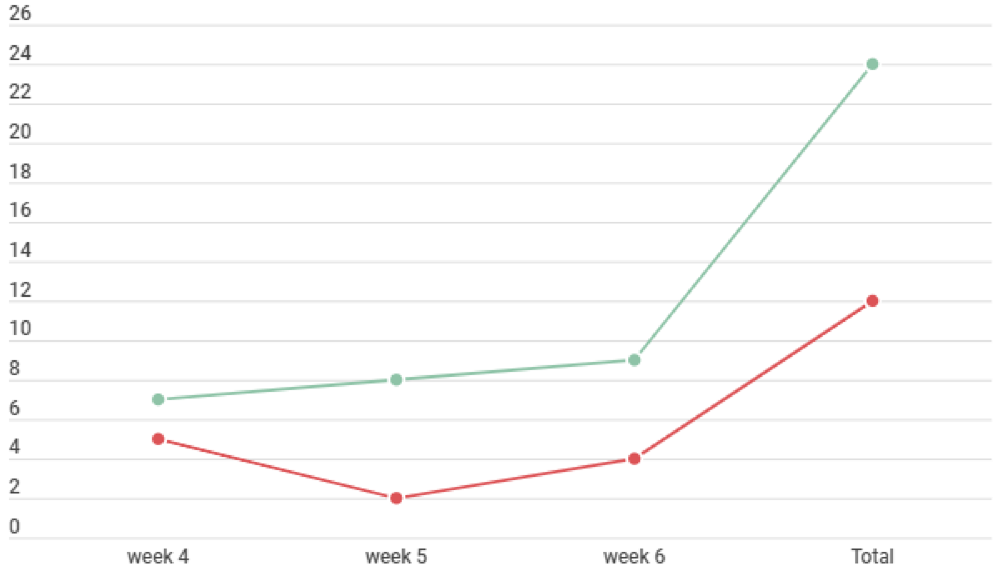


Figure 3.2:_ Growth of our work on Design B during the last 3 weeks

Then we calculate percentage of productivity as follows:

$$productivity(\%) = \frac{satisfied\ hours \times 100}{total\ hours}$$

Next, we compared the productivity of each two parallel weeks in order to conclude the best design that we have to continue our simulation with; the results as follows:

	Productivity Design A	Productivity Design B
week 1 compared to 4	63%	65%
week 2 compared to 5	27%	49%
week 3 compared to 6	29%	57%
Total	39.66%	57%

Table 3: productivity of each design versus the compared weeks

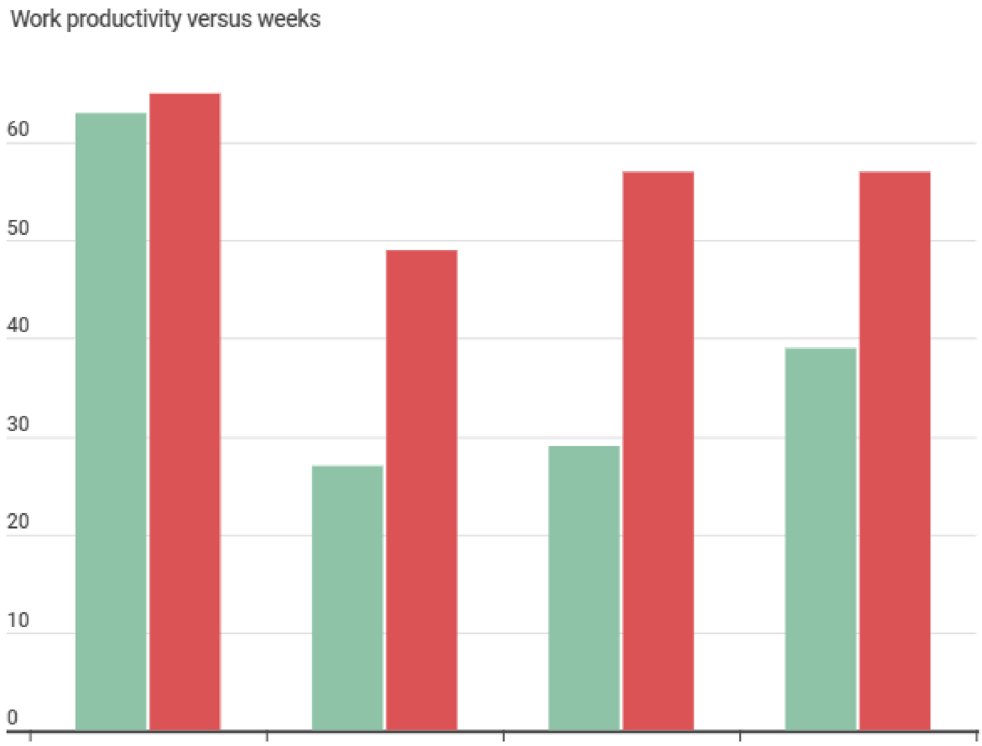


Figure 3.3: work productivity versus weeks (Green: Design A   Red: Design B)

As we can see, we can notice that the **Design B** gave us the productivity with an advantage of **17**% compared to Design A.

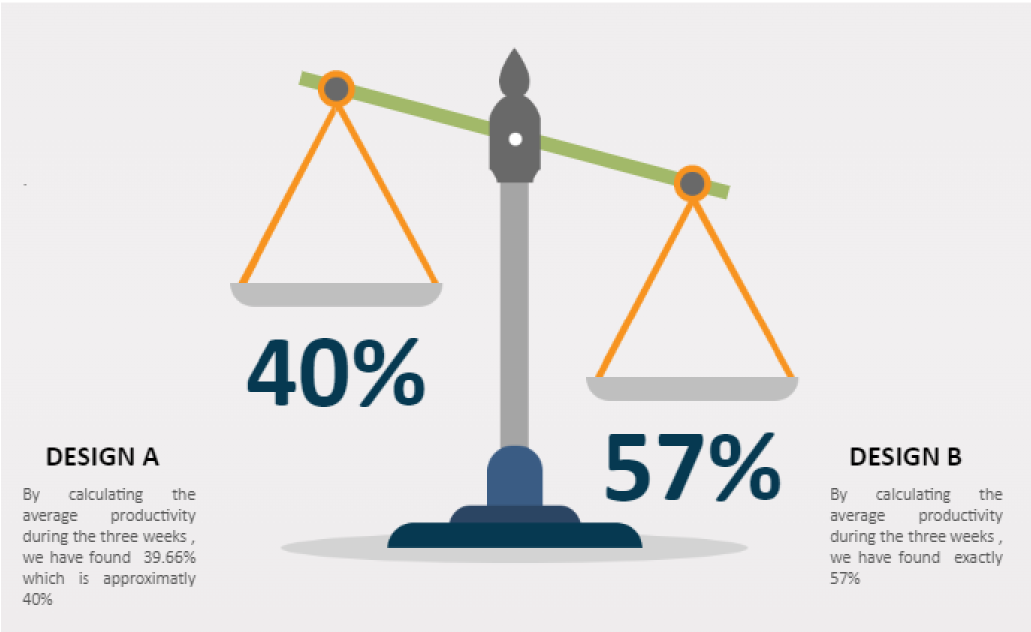


Figure 3.4: balance diagram

Design B:

Ultrasonic Sensor

Whenever an obstacle is detected on the left, right or front side of the stick, this sensor echoes back sound waves after striking the hurdle that are processed by the Arduino causing an alarm sound to go off from the buzzer (blinking in our simulation) while simultaneously generating vibrations that can be sensed in case there is too much noise around the user.

Depending on the distance between the blind person and the obstacle, three zones are formed that differ in the frequency of sound alarm and intensity of vibrations i.e, far (safe) zone (light vibrations and sounds), close zone (medium vibrations and sounds) and danger zone (intense vibrations and sounds) providing enough time to change his path to avoid the possibility of collision.

Our results show precise values for the estimated distance between the visually impaired and the obstacle indicating the efficiency of our system.

Water Sensor

The water sensor measures or detects the water present on its surface by varying its resistance. That is the water sensor acts as the water dependent variable resistor more the water present on its surface lower will be its resistance and in the similar way dryer the water sensor gets higher will be its resistance thus in this way the water sensor measures the presence of water.

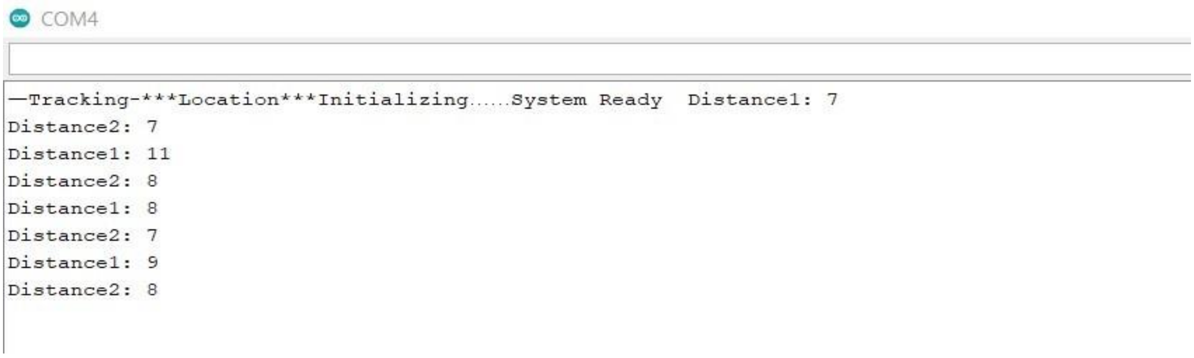


Figure 3.5: Overall Circuit of Design B Simulation.

GPS Module

GPS Module is used to exact location. In our project we use to GPS Module connection are as follows:

Vcc: **5v** Ground: **Gnd** Rx: **8** Tx: **9**

It provides reliable positioning and navigation to the blind civilian user on a continuous basis which will assist him in reaching his destination without getting lost.

As shown below in the simulation, the GPS module is giving real-time and accurate data about the user's exact location:

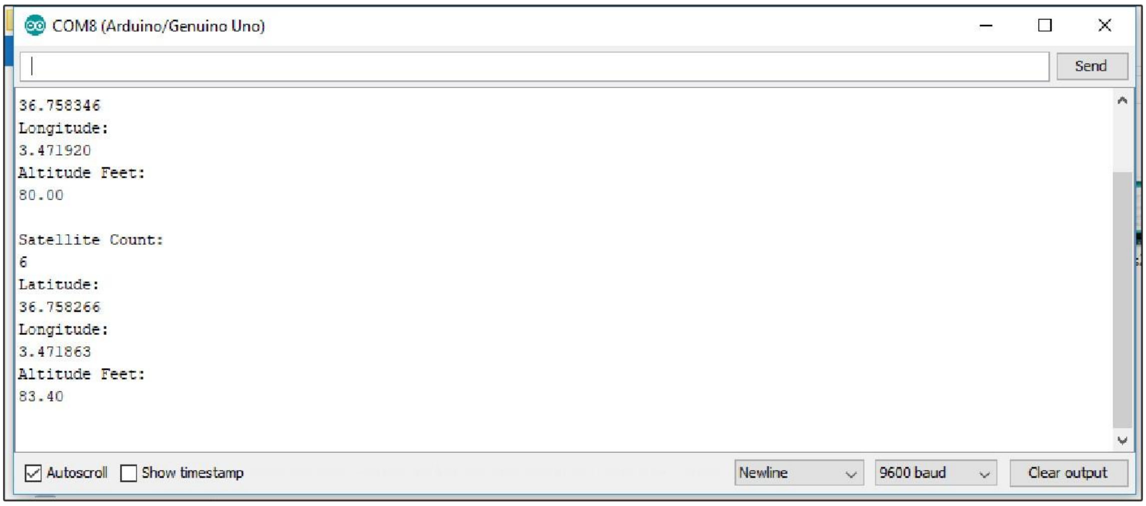


Figure 3.6: GPS Results (ARDUINO Serial Monitor)

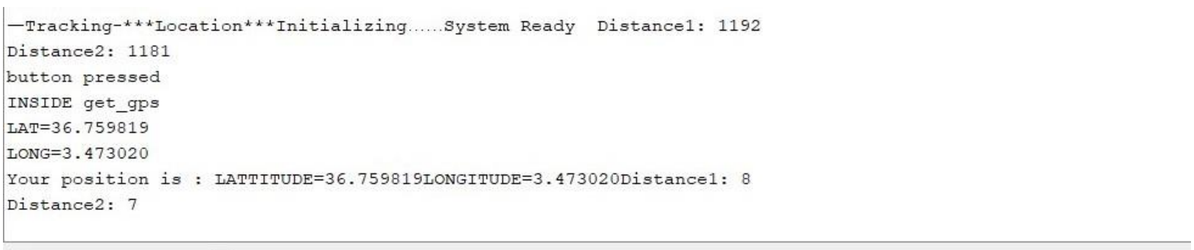


Figure 3.7: GPS Results 2 (ARDUINO Serial Monitor)

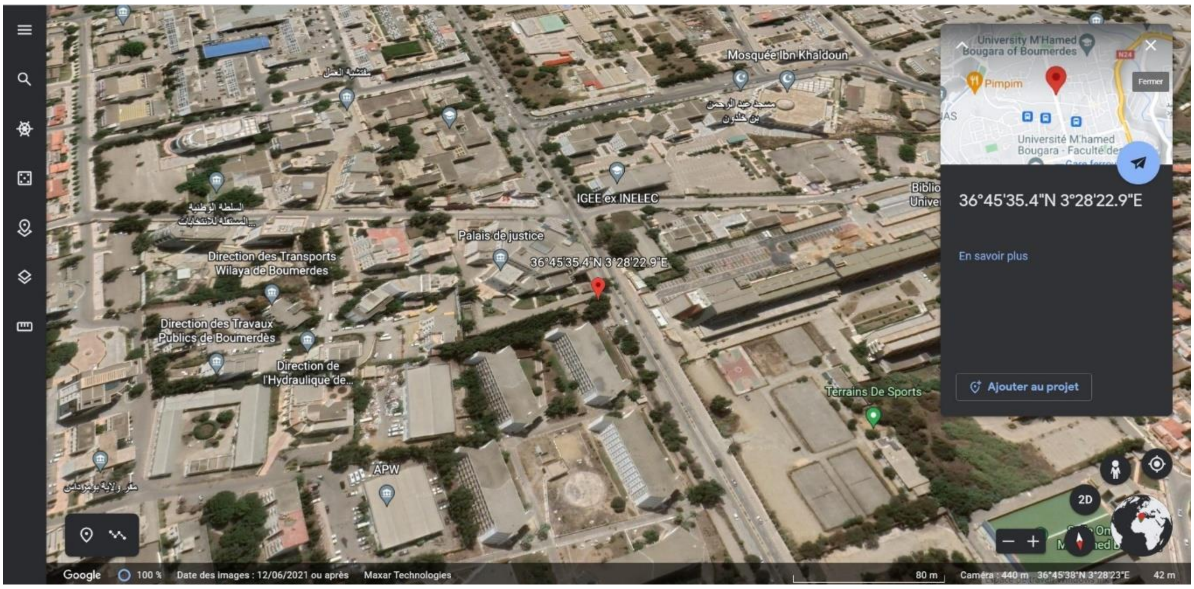


Figure 3.8: GPS Results (Google Earth Monitor)

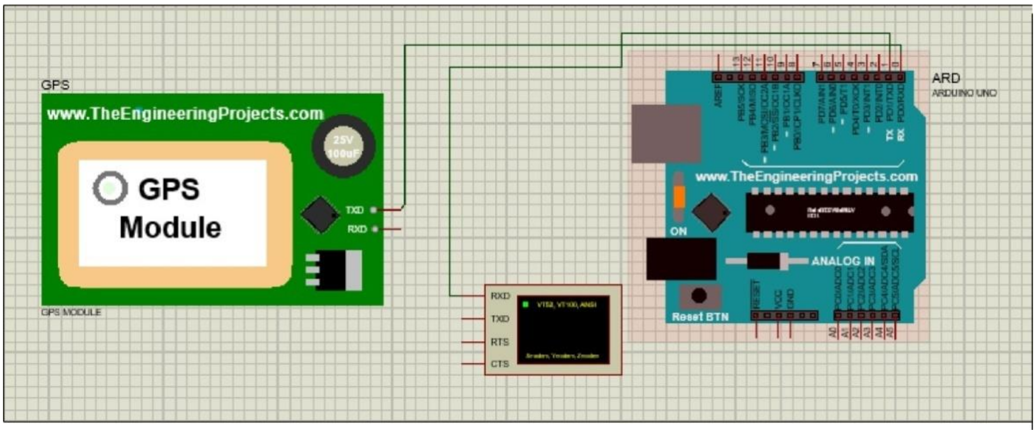


Figure 3.9: GPS Results Simulation

GSM Module

It works in coordination with the GPS module. In case of an emergency, a text message with the user's exact location will be immediately sent to a contact of his choosing with the push of a button.

Shown below are the results of simulation :

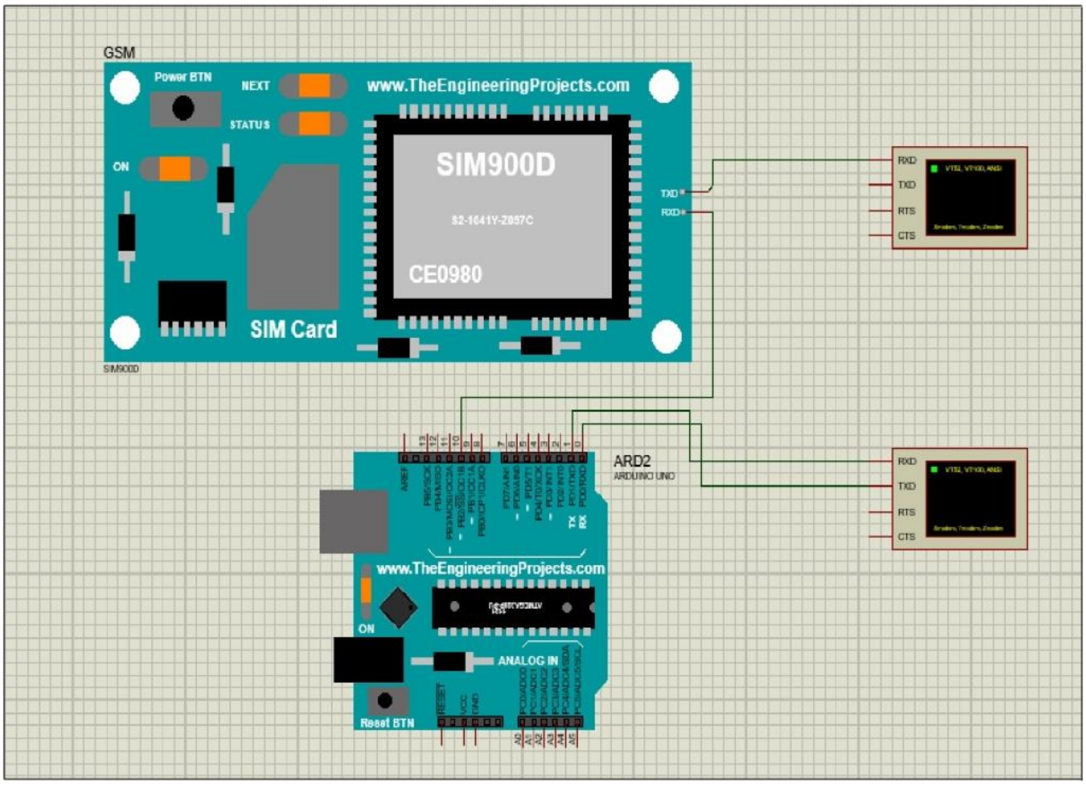


Figure 3.10: GSM Simulation

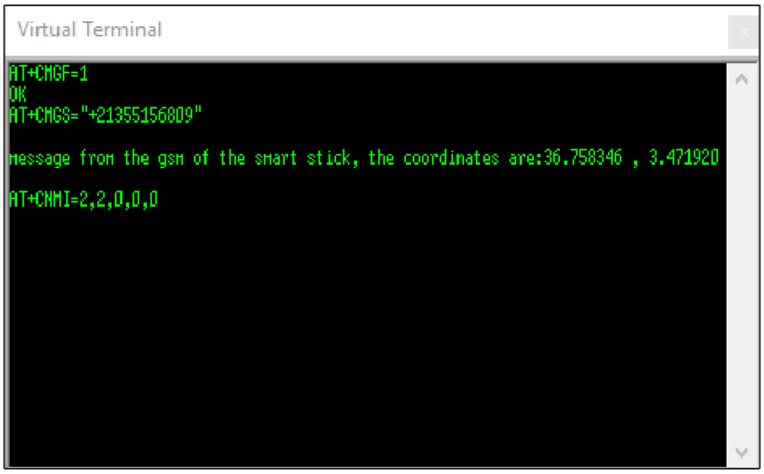


Figure 3.11: GSM Simulation Virtual Terminal

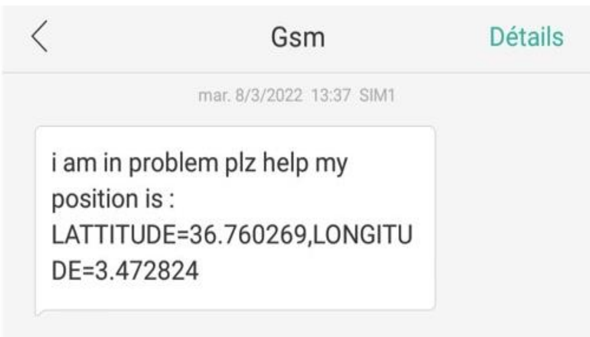


Figure 3.12: GSM Simulation; results on the phone

A simple, cheap, configurable, easy to handle electronic guidance system is proposed providing constructive assistance and support for the blind and visually impaired. The system has been designed, implemented, tested, and verified.

The real-time results obtained are encouraging and indicate that the system is efficient and unique in its capability of specifying and detecting any sort of obstacle that may encounter the blind. It is able to scan areas left, right, and in front of the blind person regardless of its height or depth. Therefore, it will be favored by those who use it. The ultrasonic sensor as well as the IR have been fully utilized in order to advance the mobility of the blind and visually impaired people in a safe and independent way. Moreover, the GSM and GPS module are working with great coordination as well as the RF module allowing them to find their canes in case of losing them.

This system does not require any special training due to its ease of use, resolving all kinds of limitations that are related to most of the mobility problems that the blind may face and influence their daily lives.

Conclusion and Future Work

This project, constructed with high accuracy, is an attempt to fill the gap formed in the visually impaired people's lives by providing them strength, self dependency and autonomy. Here we have designed an electronically smart guiding stick that is incorporated with multiple sensors which will help in navigating the way while walking and keep alarming the person if any sign of danger or inconvenience is detected. The developed prototype gives great results in detecting obstacles paced at a distance in front of the blind person. At the same time, this stick comprises of a FindMe feature, SOS and GPS tracking enabling the user to comfortably use it, indoors as well as outdoors, with very high efficiency.

The system has been designed giving priority to safety, comfort, cost effectiveness and strength to endure the rough environment. It can be improved to increase its capability of decision making by introducing some other sensors that will increase the area of application such as water & humidity sensor,fire sensor, additional Ultrasonic sensors etc. It can also be provided with an Android application and voice assistance. The design can also be enhanced by adding the ability to fold the stick.

Appendix

We used the following code in ARDUINO tutorial :

```
#include <SoftwareSerial.h>
#include <TinyGPS++.h>
int buttonpin=12;
float lattitude,longitude;
float a[2];
float *p;
SoftwareSerial gpsSerial(8,9);
SoftwareSerial gsmSerial(6,7);
TinyGPSPlus gps;
const int trigPin1 = 6;
const int echoPin1 = 5;
long duration1;
int distance1;
const int trigPin2 = 2;
const int echoPin2 = 4;
long duration2;
int distance2;
void setup() {
  // put your setup code here, to run once:
pinMode(trigPin1, OUTPUT);
pinMode(echoPin1, INPUT);
pinMode(3, OUTPUT);
Serial.begin(9600);
pinMode(trigPin2, OUTPUT);
pinMode(echoPin2, INPUT);
pinMode(buttonpin,INPUT) ;
Serial.begin(9600);

delay(1000);
gpsSerial.begin(9600);
delay(1000);
gsmSerial.begin(9600);
delay(1000);
Serial.print("—Tracking-");
Serial.print("***Location***");
gsmSerial.println("AT+CNMI=2,2,0,0,0");
delay(3000);
Serial.print("Initializing......");
delay(2000);
Serial.print("System Ready  ");
delay(1000);
}
void loop() {
  // put your main code here, to run repeatedly:
  digitalWrite(trigPin1,LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin1,HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin1,LOW);
duration1 = pulseIn(echoPin1, HIGH);
distance1= duration1*0.034/2;
Serial.print("Distance1: ");
```

```
Serial.println(distance1);
 digitalWrite(trigPin2,LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin2,HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin2,LOW);
duration2 = pulseIn(echoPin2, HIGH);
distance2= duration2*0.034/2;
Serial.print("Distance2: ");
Serial.println(distance2);
if (distance1<=20||distance2<=20){
tone(3,1000);
delay(1000);
noTone(3);
tone (3,1000);
delay(1000);
noTone (3);
tone(3,1000);
delay(1000);
noTone (3);
}
else if (distance1<=15||distance2<=15){
tone (3,500);
delay(500);
tone(3,500);
delay(500);

noTone(3);
tone(3,500);
delay(500);
noTone(3);
}
else{
noTone(3);
int sensorValue = digitalRead(A4);
if (sensorValue==1){
  tone(3,1500);
delay(1500);
noTone(3);
tone(3, HIGH);
delay(1500);
}
else{
noTone(3);
  if(digitalRead(buttonpin)==HIGH)
  {
    Serial.println("button pressed");
    delay(2000);
    SendMessage();}
  }
  }
 if (gsmSerial.available()>0)
 Serial.write(gsmSerial.read());
  while(gsmSerial.available())
```

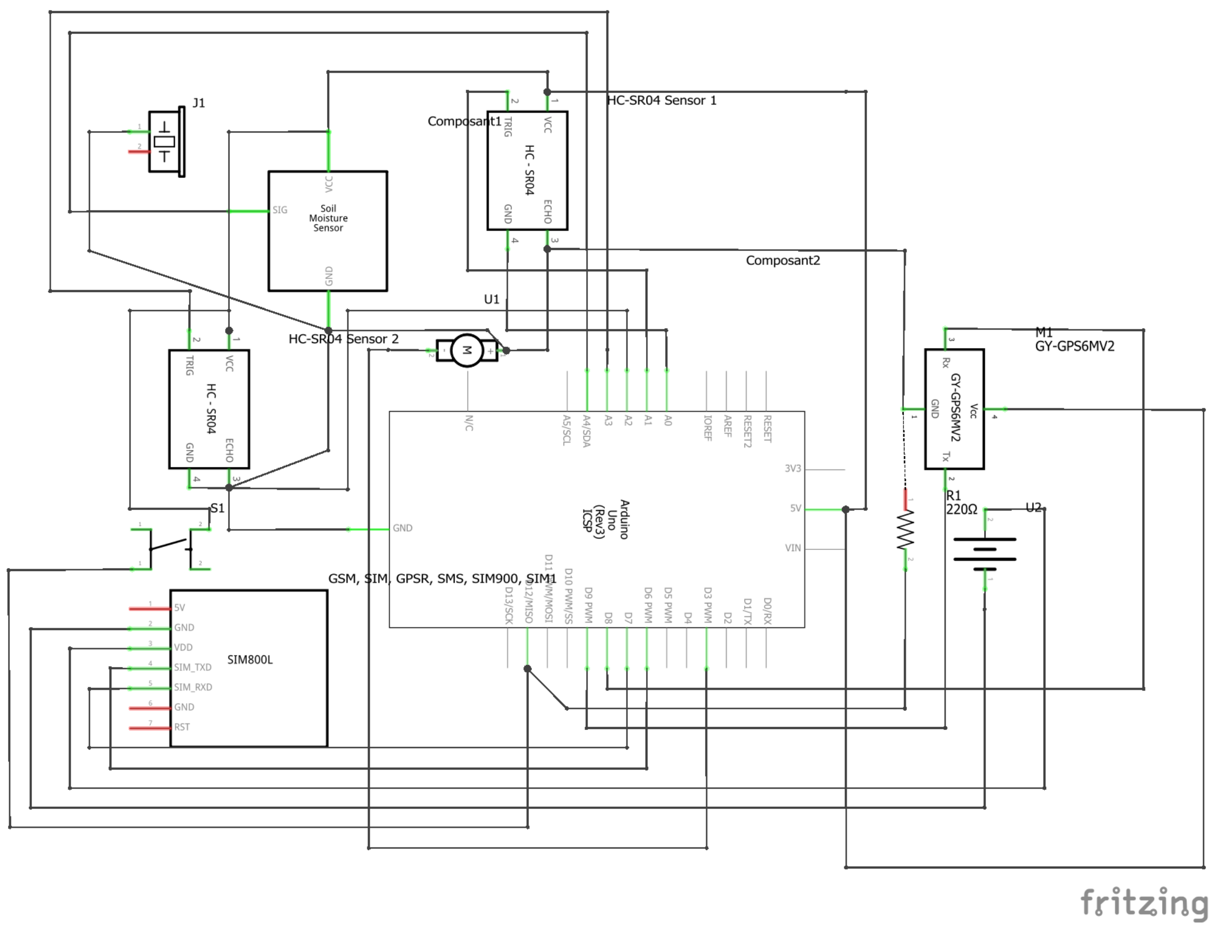
```
  {
  gsmSerial.read();
  }
  while(Serial.available())
  {
   Serial.read();
  }
 get_gsm();
  }
float *get_gps()
{
   gpsSerial.listen();
   Serial.println("INSIDE get_gps");
   while(1)
  {
   while (gpsSerial.available() > 0)
   { gps.encode(gpsSerial.read()); }
      if (gps.location.isUpdated())
      {
       Serial.print("LAT=");  Serial.println(gps.location.lat(), 6);
       Serial.print("LONG="); Serial.println(gps.location.lng(), 6);
       lattitude=gps.location.lat();
       longitude=gps.location.lng();
      break;
      }
}
a[0]=lattitude;
a[1]=longitude;

     delay(1000);
    }
   }
 }
void SendMessage()
{
  gsmSerial.println("AT+CMGF=1");
  //Sets the GSM Module in Text Mode
  delay(1000);
  // Delay of 1000 milli seconds or 1 second
 gsmSerial.println("AT+CMGS=\"+0778944442\"\r");
 // Replace x with mobile number
  delay(1000);
  gsmSerial.println("i am in problem plz help my  ");
  // The SMS text you want to send
  delay(1000);
     p=get_gps();
     gsmSerial.listen();
     Serial.print("Your position is : ");
     gsmSerial.print("position is : ");
```

```
     Serial.print("LATTITUDE="); Serial.print(*p,6);gsmSerial.print("LATTITUDE=");
gsmSerial.print(*p,6);gsmSerial.print(",");
// The SMS text you want to send
Serial.print("LONGITUDE=");Serial.print(*(p+1),6);
gsmSerial.print("LONGITUDE=");gsmSerial.print(*(p+1),6);
//The SMS text you want to send
     delay(100);
    gsmSerial.println((char)26);
}

return a;
}
  void get_gsm()
{
   gsmSerial.listen();
    while(gsmSerial.available()>0)
   {Serial.println("INSIDE gsmSerial.available");
    if(gsmSerial.find("Track"))
    {Serial.println("INSIDE track");
     gsmSerial.println("AT+CMGF=1");
     //Sets the GSM Module in Text Mode
     delay(1000);  // Delay of 1 second
     gsmSerial.println("AT+CMGS=\"+0778944442\"\r");
     // Replace x with mobile number
     delay(1000);
     p=get_gps();
     gsmSerial.listen();
     Serial.print("Your Car Location: ");
     gsmSerial.print("Your Car Location: ");
     Serial.print("LATTITUDE="); Serial.print(*p,6);
     gsmSerial.print("LATTITUDE=");gsmSerial.print(*p,6);gsmSerial.print(",");
     // The SMS text you want to send
     Serial.print("LONGITUDE="); Serial.print(*(p+1),6);
     gsmSerial.print("LONGITUDE=");gsmSerial.print(*(p+1),6);
     // The SMS text you want to send
     delay(100);
     gsmSerial.println((char)26);
     // ASCII code of CTRL+Z for saying the end of sms to  the module
```

the schematic circuit of final project (Design B):



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