Palestine Polytechnic University

College of Information Technology and

Computer Engineering

Smart Walking Cane For Blind people

Submitted by:

Madleen Ahmad Almassri

Supervisor:

Eng:MazenKayedZalloum

2016/ 2017

Acknowledgements

First of all, and foremost we dedicate our all thanks and praises to Allah, for providing us with the strength to accomplish this work. We also would like to express our sincere thanks to our supervisor, Eng.Mazen KZalloum, for his continuous and effective guidelines which helped us a lot who gave me the greatest helping hand and supervision through the entire process and who was always there to advise me and correct our path whenever we go wrong. Finally I won’t forget to thank those who were continuously encouraged and support us, our families, friends, classmates and thanks to my father who stood by me and supported me and also for my husband.

Abstract

Blind stick is an innovative stick designed for visually disabled people for improved navigation.that propose an advanced blind stick that allows visually challenged people to navigate with ease using advanced technology. The blind stick is integrated with ultrasonic sensor . The project first uses ultrasonic sensors to detect obstacles ahead using ultrasonic waves. On sensing obstacles the sensor passes this data to the microcontroller. The microcontroller then processes this data and calculates if the obstacle is close enough. If the obstacle is not that close the circuit does nothing. If the obstacle is close the microcontroller sends a signal to sound a buzzer. It also detects and sounds a different buzzer if it detects water and alerts the blind. The system has one more advanced feature integrated to help the blind find their stick if they forget where they kept it. A wireless rf based remote is used for this purpose. Pressing the remote button sounds a buzzer on the stick which helps the blind person to find their stick. Thus this system allows for obstacle detection as well as finding stick if misplaced by visually disabled people.

Contents

5 Validations and Testing 36

6 Conclusion 42

List of Figures

List of Tables

Chapter 1

Introduction

1.1 Project Overview

Technology keeps surprising us with it is rapid and huge development that serves community in many sectors**.** Blind important part of society, and we must stand with him and we share in difficulties it faces, our belief in the principle of one body to understand our concern .The project scope consists of two parts, hardware and software design. For hardware part, it mainly consists of ultrasonic sensors, global positioning system, vibrating motor, speaker, Arduino UNO, Bluetooth module, LED indicator, LDR and other components to make RF sender and receiver circuits. For software part, C programming language (Arduino language) is used to control the hardware input and output, and an Android application is designed to help the user to set the path and send it to the Arduino for further processing.

1.2 Motivation

The project idea is not the first of it is kind, but we are concerned in developing with special needs in the community to provide a service for the visually impaired and blind, even fend for themselves and to help them walk the roads alone without exposure to injury and without waiting for the aid of others, and also to avoid roads that have become full of potholes and bumps risks. Stick smart to the blind project is a modern approach, and it is improving and getting wider and more efficient every day. There will always be new things that can be built upon this system.

1.3 Project Objectives

The main objective of this project is to design a smart stick for blind people to increase the mobility of a visually impaired person and to implement a navigation system. To increase the mobility ability, ultrasonic sensor is used to sense obstacles and alert the visually impaired people through vibration and auditory feedback. For navigation system, global positioning system is used to give direction and distance to the destination through audio output.

The project Objectives can be summarized as the followings:

1. Build Walking Stick fully automated, easy to maintain, cheap and its very comfortable to use. The power consumption is low and can be operated easily.
2. Ultrasonic sensor is used to sense obstacles and alert the visually impaired people through vibration and auditory feedback.
3. Use Infrared sensor to detect upward and downward stairs.

4. Calling the Stick to help the blinds persons to find the Sticks if it is far from him in the form of remote.
5. Speech warning message and the vibration motors are activated when any obstacle is detected.

1.4 Description of the Project

The purpose of the project is about designing and implementing a smart cane for visually disabled people for improved navigation. The smart stick is integrated with ultrasonic sensor along with light and water sensing. Our proposed project first uses ultrasonic sensors to detect obstacles ahead using ultrasonic waves. On sensing obstacles the sensor passes this data to the microcontroller. The microcontroller then processes this data and calculates if the obstacle is close enough. If the obstacle is not that close the circuit does nothing. If the obstacle is close the microcontroller sends a signal to agitate a buzzer. It also detects and sounds a different buzzer if it detects water and alerts the blind. The system has one more advanced feature integrated to help the blind find their stick if they forget where they kept it. A wireless RF based remote is used for this purpose. Pressing the remote button sounds a buzzer on the stick which helps the blind person to find their stick. Thus this system allows for obstacle detection as well as finding stick if it is far from him.

1.5 Problem Statement

285 million people are estimated to be visually impaired worldwide: 39 million are visually impaired and 246 have low vision. [1]
In Palestine, we could not find an accurate percentage of the visually impaired people here but we believe that it is a high one because of occupation and wars.
Majority of visually impaired people are using a conventional cane to aid in navigation. The limitation of conventional canes is that they can only be used to gain information about the environment by touching the objects with the tip of the cane.
Besides, white cane also does not have the ability to guide the user to travel to desired location. Visually impaired people might get lost and face some risk when they need to travel. They need to depend on people to bring them to a certain location or they can only travel in a place they are familiar with.

Some of the problems faced by visually impaired people:

- Can’t walk easily on their own.
- Suffer from obstacles.
- Difficulty reaching a certain place.

1.6 List of Requirements

- Warning the visually impaired person of any obstacles in his way such as walls, holes and stairs using vibratory feedback. Where the intensity of the vibration will vary depending on how far away the object in front of the user.
- Helping the visually impaired person to find the cane if it is lost from the user within the range of home, market or work, also this may help him to locate it when it has been dropped from his/her hand using small remote locator.
- Providing LED indicator that helps the ordinary people to recognize visually impaired people in the dark.

1.7 Expected Results

The following are the expected results of the project

1. Control the cane function via the microcontroller.
2. Cane detects obstacles within a certain distance and alarm the impaired person.
3. Locate the cane when it is lost.

Chapter 2

Background

2.1 Overview

In this chapter we will introduce the theoretical background of the project, litera- ture review of stick walking for blind systems, also a description of hardware components used in the system.
For hardware part, it mainly consists of ultrasonic sensors, vibrating motor, speaker, Arduino UNO, Bluetooth module, LED indicator, LDR and other components to make RF sender and receiver circuits.

2.2 Theoretical Background

This section will provide some information about some of the technologies used in the project.

Sensors

A sensor is device that detects and responds to some type of inputs from physical surrounding environment. Input such light, heat, motion, obstacles, moisture, …ect. The output is generally a signal that converted to human-readable form.

Arduino UNO microcontroller

Microcontroller is used to accept conditioned inputs from sensors, process the input, then processed the required output. The Arduino UNO microcontroller is a low cost, easy to learn and used as controller for our project. Programming Arduino UNO microcontroller can be using many programming languages such as C language.

Ultrasound frequency

The ultrasonic sensor used in this project is HC-SR04. It uses sonar to determine the distance to an object. This sensor can detect an object up to 2cm to26.
400 cm in 15 degrees. Its sensitivity can be up to 3mm.

2.3 Literature Review

There are lots of studies and projects that handle and implement the wireless health monitoring technology. All of them outside our local community. We read some of them and they were very helpful.
Here is a review of some of what we read:

1. Study done by (Jay ant, Pratik and Mita, about a white cane is a long stick that is used by visually impaired people for mobility purpose and to know the environment they are travelling through. The first white cane is designed after War World I [2]. White cane is made from aluminum or fiberglass and with metal tip or nylon at the one end for a person to hold. There are 4 types of white cane. The first type of white cane is long cane. The length of this type of cane is the longest. A long cane is the most commonly used by visually impaired people as it is the most basic, changeable and low cost of maintenance. The second type is guide cane. Guide cane is much shorter than long cane where it is only to the waist of the user. Hence, it has lower mobility function. It mainly focuses on the lower part of the user where it focuses on the diagonal position of the guide cane. It can be used to detect holes, stones and curb. Third version of white cane is identification cane also named as symbol cane. This type of white cane is not designed for mobility purpose as it is designed to remind public that the user is visually impaired people. The design of this white cane is for public to lend their hand to visually impaired people. The last type of white cane is a children's cane or kiddies cane. The purpose of designing this type of white cane is for children's usage. It has similar properties just like long cane [3].
2. Study for Voice operated outdoor navigation system for visually impaired persons done by Somnath and Ravi (2012) [4]. Obstacle detection and voice circuit. This system works by fitting a camera on the persons head, the camera will be use an algorithm to identify the highs and obstacles in front the blind person. This system also contains ultra-sonic sensors to detect the obstacles. Furthermore, this system includes GPS system is to reach the required destination.
3. Another study done by (Sung, Young, Kim and IN, 2001) [5] for developing an intelligent guide stick for blind people used an intelligent CPU called MELDOG which uses artificial intelligence. It can identify the accurate position of obstacles using ultrasonic sensors and laser sensors. In order to identify the position the "map matching technique" was used by using the ultrasonic sensors. This system includes a DC motor controller which connected to the encoder. When the wheels rotate 18 degree the infrared sens ors attached to both wheels will transmit the signal to the CPU in order to provide a location update. This system is an accurate detecting system can provide the user continuous update for detecting the obstacles with detection angle between 0 degree to 18 degree. However, this system is expensive and is complex in designing. It is heavy compared to other similar system. The weight of the system is around 5.5 Kg. The detection distance for the system is very low which is around 87.5 cm to 105 cm.

2.4 Hardware Description

In this section we illustrate the hardware components we will use to build the system, why we choose them and how some of them work.

2.4.1 Sensors

2.4.1.1-Ultrasonic sensor
Functions for detecting objects and responds with distance measured. Ultrasonic sensor uses frequency in order to detect objects. The frequency used for detecting objects is around 20 kHz to 100 kHz [4]. It is mostly applied in ambient noise level, leak detection and material testing. The ultrasonic sensor is highly used as it is cheap, simple design and efficient.

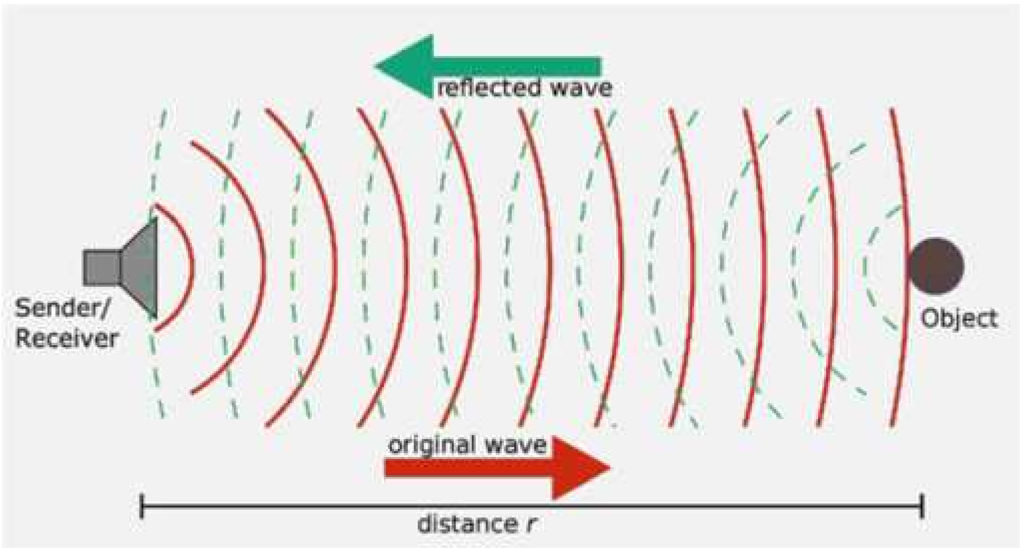


Figure 2.1: Sonar illustration shows the operation of ultrasonic sensor to send and receive sonar to detect object.
Ultrasonic sensor consists of wave producer, counter mass, amplifier and radiation section. Ultrasonic waves attenuated more frequently, which make it, become a better for directivity than other kinds of waves.

Electrical Parameters	HC-SR04 Ultrasonic Module
Operating Voltage	DC-5V
Operating Current	15mA
Operating Frequency	40KHZ
Farthest Range	4m
Nearest Range	2cm
Measuring Angle	15 Degree

Table 2.1: Ultrasonic Feature

2.4.1.2 Water sensor
The water sensor is used for water indication electrodes are fitted at the bottom of the stick these electrodes are sensing water and conveying information to blind people.

Figure2.2: water sensor

2.4.2 Global Positioning System (GPS)

Global positioning system (GPS) is a satellite-based navigation system that stands from satellites that orbit in the space. The GPS system is able to provide three dimensional positioning, time and location for navigation purpose. GPS is mainly used in five purposes: navigation, tracking, location, mapping and timing. GPS is able to provide information in all time and all types of weather. GPS system consists of three main segments. The first segment is satellite segment. The satellite segment is designed to have at least four satellites that function to receive signals at any moment. Hence, the GPS receiver is able to provide graphic information in three dimensions in order to determine the location stated. Those signals are transmitted at very high frequency. Basically, satellite consists of atomic clocks, computer, radio transmission system, solar panels, batteries and other components. The second segment is control segment. Control Segment stands from three main stations, which are Master Control Station, Ground Antenna Station and Monitor Station. Satellites will send the navigation signals to monitor stations and then send to master control station for further processing and ended at ground antenna station. The ground antenna station also functions as routine checking satellites system, updating software and regulate satellite's orbit. The third segment is user segment. User segment consists of two categories, military usage and civilian's usage. Civilian can use GPS in order to determine location and timing.

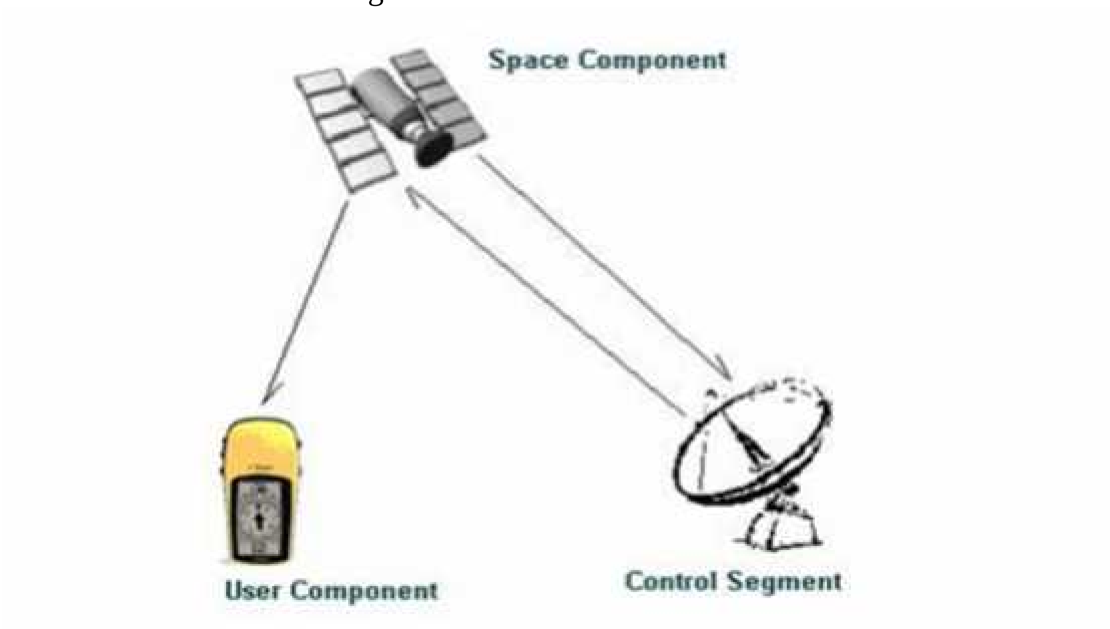


Figure 2.3 Three core segment of GPS system

Figure 2.3 shows the operation of three main segments in GPS system. GPS system works as shown in

2.4.3 Microcontroller Board

The Microcontroller is the brain of the system. It operates the sensors,analyze the data and audible alarms to the user if any parameter out of the normal range and alerts user if there any problem with the system.

2.4.3.1-Arduino UNO

Arduino UNO is the microcontroller that is used in this project. It is built based on ATmega328 in AVR 8 bit RISC architecture. It has 6 analog inputs, 14 digital input output port, a USB connection, 16MHz ceramic resonator, power jack and an ICSP connector. It consists of 1 KB of EEPROM memory which can be read and written. Communication in Arduino UNO is using UART TTL serial communication.

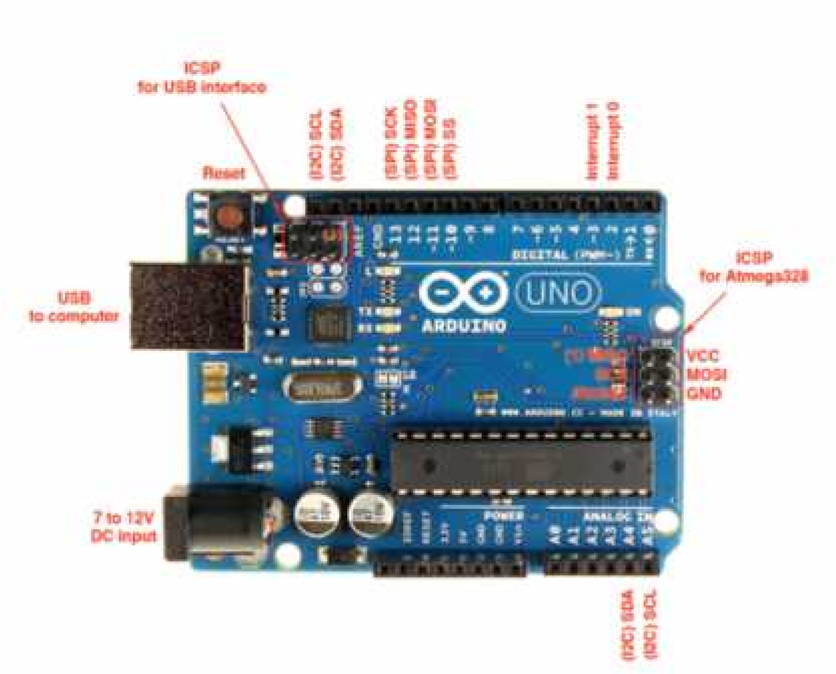


Figure 2.4: Arduino UNO

Figure 2.4 shows the input and output ports and features that are built in the Arduino Uno.

Hardware Features (Uno)

Microcontroller	ATmega328p
Operating Voltage	5V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC current per I/O Pins	40mA
DC current for 3.3V Pin	50mA
Flash Memory	32KB
SRAM	2KB
EEPROM	1KB
Clock Speed	16MHz
ICSP Header	In System Programming, used when you want to bootloader, you'll need an AVR-ISP

Table 2.2: Arduino UNO Feature

2.4.4 Buzzer

A buzzer is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers include alarm devices, timers and confirmation of user input such as a mouse click or keystroke.

Figure2.5: Buzzer

2.4.5 LED

A light-emitting diode (LED) is a semiconductor light source. LEDs are used as indicator lamps in many devices, and are increasingly used for lighting. When a light-emitting diode is forward biased (switched on), electrons are able to recombine with holes within the device, releasing energy in the form of photons.

Figure2.6: LED

2.4.6 DC Vibration Motor

This is the type of DC vibration motors used in mobile phones. It requires a voltage supply of 1.3 v to 3 v with current around 125 mA. This type of motors can be programmed to control the speed of it by using the PWM (Pulse Width Modulation) method. The speed of the motor is 13500 rpm and the diameters of the motor are 4 mm to 10 mm and the length is 2mm to 15 mm.

Figure 2.8: Vibration Motor

2.4.7 Battery

Figure2.9: Battery

2.4.8 Power control

Power control, broadly speaking, is the intelligent selection of transmitter_power output in a communication_system to achieve good performance within the system.

Chapter 3

System Design

3.1 Overview

This chapter illustrates the conceptual design of the system; it also shows a block diagram of it is components, flow chart of the system and finally software requirements.

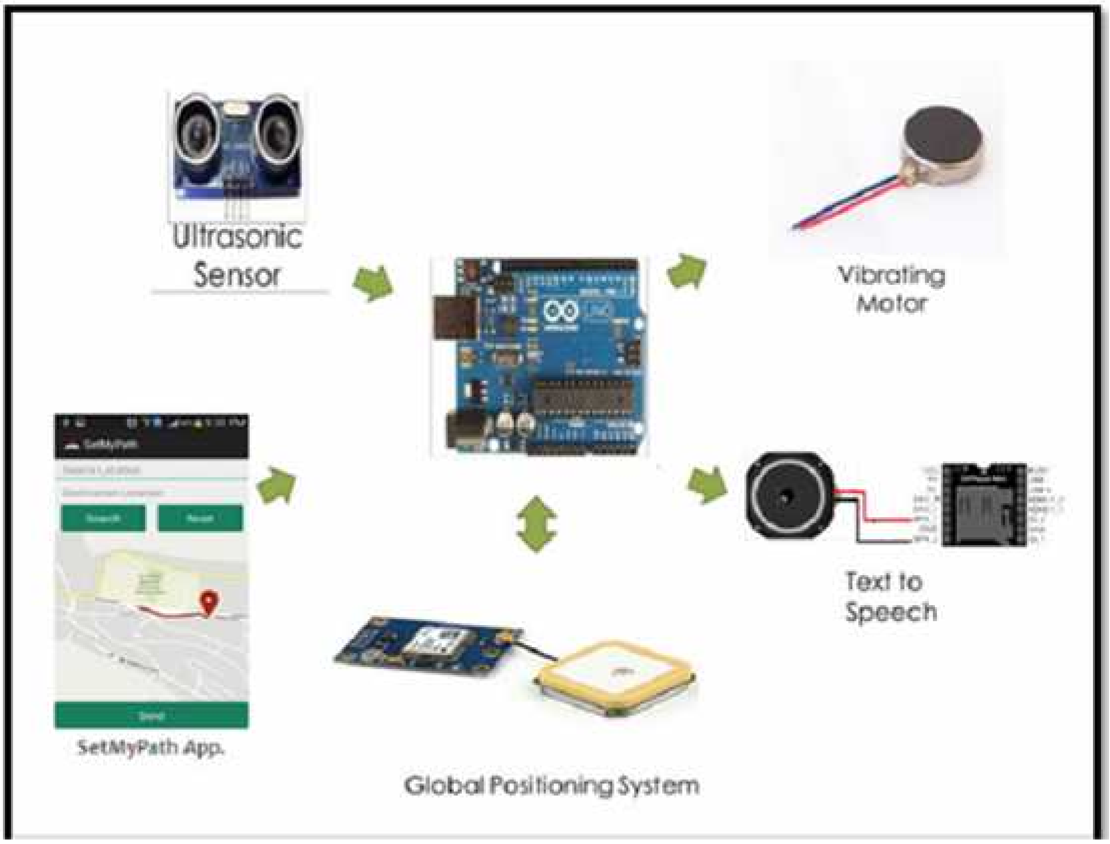


Figure3.1: Hardware component

Figure 3.1 shows that the overall flow of the system. The input of the system consists of signal from ultrasonic sensor and coordinates of a location. Arduino UNO will interface with GPS system to get the directions. The signal from ultrasonic sensor will be sent to vibrating motor. The result of navigation system will be sent to the text to speech player.
The project also contains other features for another purpose: RF transmitter and receiver circuit and the LDR sensor circuit.

2.5 Brief Description of the System

The project is designed to guide a visually impaired person to walk and avoid bumping into obstacles. Low cost ultrasonic rangefinders along with a microcontroller is used to measure the distance to obstacles and if they are close enough provide a feedback to the user in form of beeps or vibrations.

The project is made on a small single layer PCB. The sensors are not mounted on the PCB but they are mounted on front of the stick and connected to the main board using wires.

3.3 System Diagrams

Figure 3.2 shows a block diagram of the system

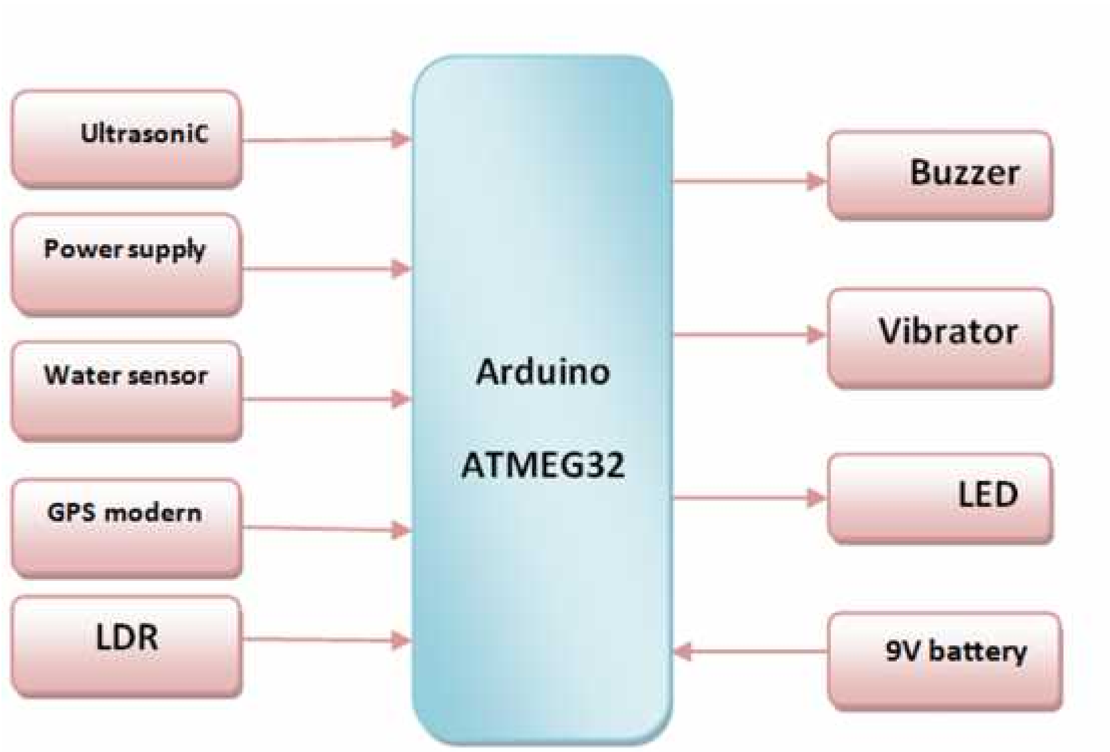


Figure 3.2: System Block Diagram.

Figure 3.3 is a description diagram of the system

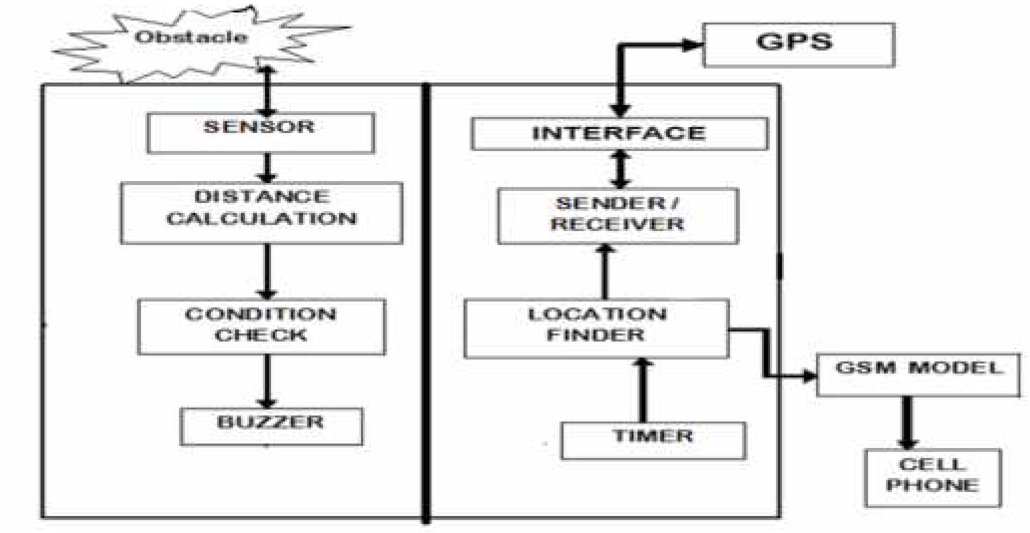


Figure 3.3: System Description Diagram.

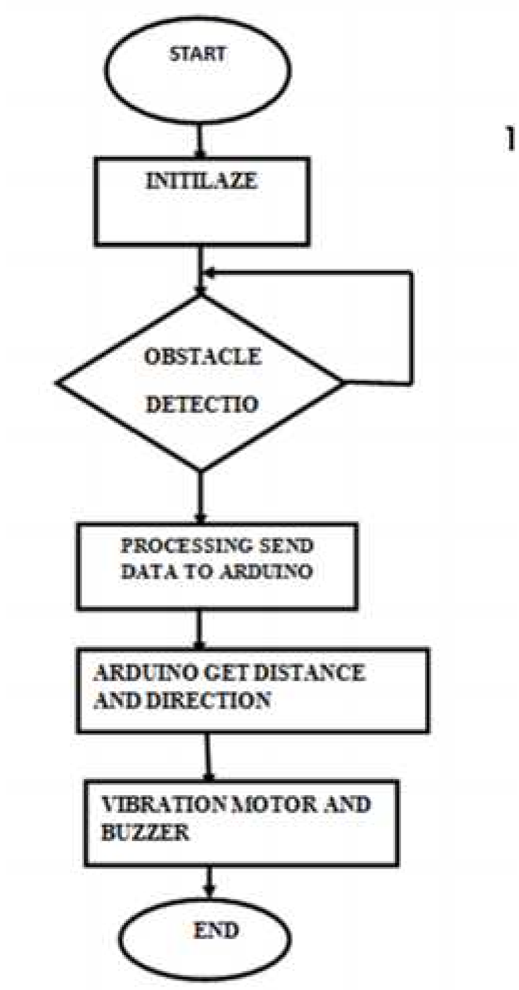


Figure 3.4: System Flowchart

3.4 System Flowchart

Figure 3.4 explain the activity of the system through a flowchart.

Chapter 4

Software Implementation

4 Overview

In this chapter I will explain implantation steps of system software including Obstacle detection system, led indicator system and transmitter and receiver circuit

4.1 Obstacle Detection System

Obstacle detection system is designed by using ultrasonic sensors. Implementation of obstacle detection system in smart cane is important as it is used to detect obstacles in front of visually impaired persons; so many obstacles can be avoided before the user comes within close proximity of an obstacle.

4.1.1 Ultrasonic Sensor Performance

The ultrasonic sensor used in this project is HC-SR04. It uses sonar to determine the distance to an object. This sensor can detect an object up to 2cm to 400 cm in 30 degrees. Its sensitivity can be up to 3mm.

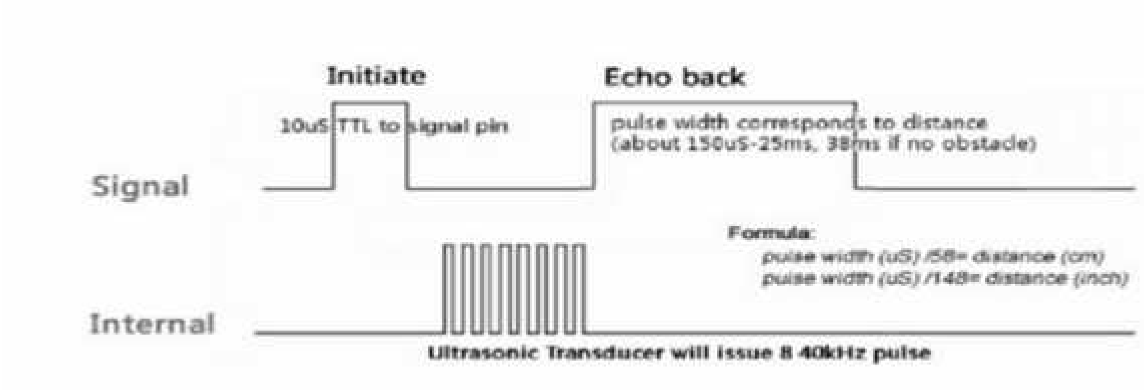


Figure 4.1 : Timing diagram

Figure 4.1 shows the timing diagram of HC-SR04. The operation starts when HC-SR04 receives a high pulse and hence initiates the sensor. Every time, eight cycles of ultrasound at 40 kHz is sent to detect the presence of obstacle.

4.1.2 Ultrasonic Sensors Calibration

Two ultrasonic sensors are used 0 one for indoor environment that mean for detecting low obstacles which would be placed on the bottom of the cane pointing forward to detect objects directly ahead. The second one is for outdoor environment that used to detect mid-height obstacles which would be placed on the middle of the cane.

4.1.3 Flow of Obstacle Detection Design

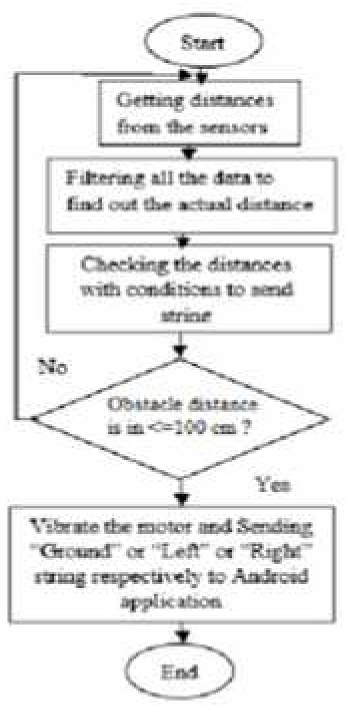


Figure 4.2: Flowchart of obstacle detection (Outdoor) and (Indoor)

Figure 4.2 show the operation and flow of ultrasonic sensor on obstacle detection in outdoor mode that can detect an object at a maximum distance of 2.5 meters. Figure 4.3show the operation and flow of ultrasonic sensor on obstacle detection in indoor mode which is for objects that are as far as 1 meter away.
When there are no obstacles detected in the range, the ultrasonic sensor will keep on detecting and sense for obstacles. When there is an obstacle detected the Feedback Mechanisms will work to give the tactile and auditory feedback.

4.1.4 Feedback Mechanisms

After obstacles are detected by the sensors, their distance must be communicated to the user. Since the first ultrasonic sensor detects objects at further distances, it provides more frequent feedback to the user. Therefore, we determined that silent feedback, detectable only to the user, would be ideal. A simple and silent feedback mechanism that can easily be detected is vibration.
The vibration motor was positioned beneath the thumb of the user, to provide noticeable feedback.
To control the vibration motor strength we control the delay between the vibrating ON and OFF, when the delay is large then the strength of the motor is larger than with less delay since the ON period will be longer than the OFF period as shown in the code below.

```
void vibrate(int intensity )
{
  digitalWrite( VIBRATION_PIN, HIGH );
  delay(intensity);
  digitalWrite( VIBRATION_PIN, LOW );
}
```

Figure 4.3: Control Vibration motor strength

However, low objects below the sight of the first ultrasonic sensor must be detected
ultrasonic sensor. This is only meant to provide the user with with the second
contact an obstacle. It should therefore occur feedback a short time before they will
action by the user. less frequently, but also will require more immediate
Consequently,

4.2 LED indicator System

Led indicator system is designed by using LDR sensor “Light Dependent Resistor” to the LED turn ON when it is dark that helps the ordinary people to recognize make visually impaired people in the dark.

4.2.1 Flow of LED indicator Design

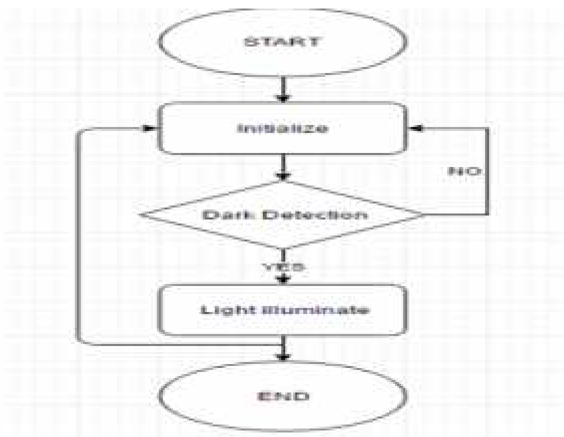


Figure 4.4: Flow chart of LED indicator

Automatic dark detector senses darkness. As the light level decreases and LDR meets the maximum threshold resistance, the circuit automatically switches on the LED.

4.2.2 LDR "Light Dependent Resistor"

This LDR circuit shows how you can make a light detector. An LDR or "Light Dependent Resistor" is resistor where the resistance decreases with the strength of the light (Dark = high resistance).

Light Dependent Resistors (LDR) is also called photo resistors. They are made of high resistance semiconductor material. When light hits the device, the photons give electrons energy. This makes them jump into the conductive band and thereby conduct electricity.
Figure 4.6 show the schematic for LDR circuit.

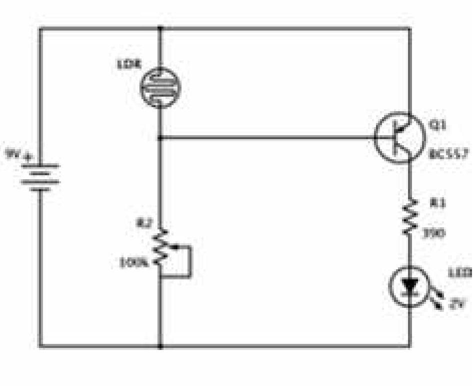


Figure 4.5: The schematic for LDR circuit

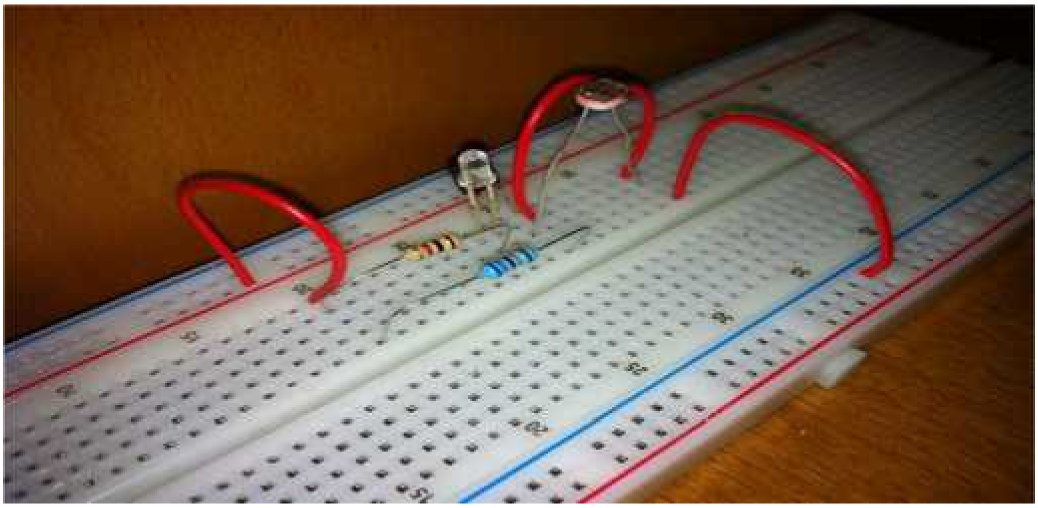


Figure 4.6: LDR circuit

4.3 RF Sender and Receiver System

4.3.1 Sender and Receiver System goal

The goal of this system is to make an RF sender and receiver circuits. This can help the visually impaired person to find the cane if it is lost from him/her within the range of home or work.

4.3.2 System Theory

The modules RT4 and RR3 range up to 100m without obstacles. The RT4 and RR3 of frequencies: 315MHz, 418MHz and 433,92MHz. The modules work in bands frequency 433,92MHz (RT4 and RR3 modules used to create our project work in the must have frequencies identical to that there may be a communication between the transmitter and receiver .The bandwidth (for data transfer) module RT4 is 4 KHz, RR3 receiver module can receive since the module RR3 is 2 kHz. Therefore, for the data correctly, RT4 transmitter must be limited to transmitting data at a rate lower than or equal to 2 KHz [6] . For that can transmit data digitally and following a certain pattern through the carrier RF modules RT4 and RR3, we use the famous and useful ICs MC145026 (Encoder) and MC145027 (Decoder).

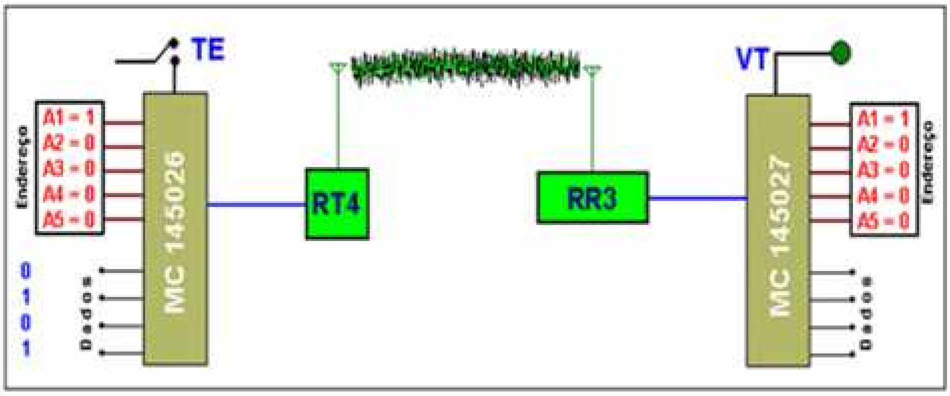


Figure 4.7 : Transmitter and Receiver diagram

The MC145026 encoder sends the bit address / data serially to the transmitter module pin has been taken low (0v). In turn, **the RT4 module** transmits the so that the TE modulated bits via the carrier Radio Frequency.

The RR3 module captures data and transfers them to **the MC145027** decoder which comparison in the bits of the received address with the bits of the address of makes a the addresses are equal, the data bits are available on pins your own configuration. If (D6, D7, D8 and D9) and VT pin is driven to a high level.

The VT pin only remains active for a while stating that an item has been recognized and is available.

Already the data pin retains the latest information. This is possible because these pins are connected to a latch (one type of elementary volatile memory). These data remain on the latch until new data is submitted and accepted, or the power supply is interrupted.

NOTE that the decoder and encoder addresses must be the same and are teetering on the same .frequency (choose the values of the capacitors and resistors as it issued by the manufacturer) in order to work as expected .

4.4 System Tools

4.4.1 Software tool

In order to print the circuits in printed circuit board printer we should first design program which stands for, Easily Applicable Graphical Layout them in EAGLE CadSoft Computer GmbH and is a flexible, Editor. It is designed and developed by (EDA) application with expandable and scriptable, electronic design automation schematic capture editor, printed circuit board (PCB) layout editor and computer-aided manufacturing (CAM) [7].

4.4.2 Hardware tools

In order to build the transmitter and receiver circuits we relied on the following circuit Note that for the MC145026 ICs / 27 work as expected, it is important to choose the capacitors and resistors shown in the circuits below, issued by the values of the manufacturer. Here in our project, we chose the frequency 1.71 KHz because this frequency does not exceed the limit of the bandwidth of RR3 receiver module, which is 2 KHz.

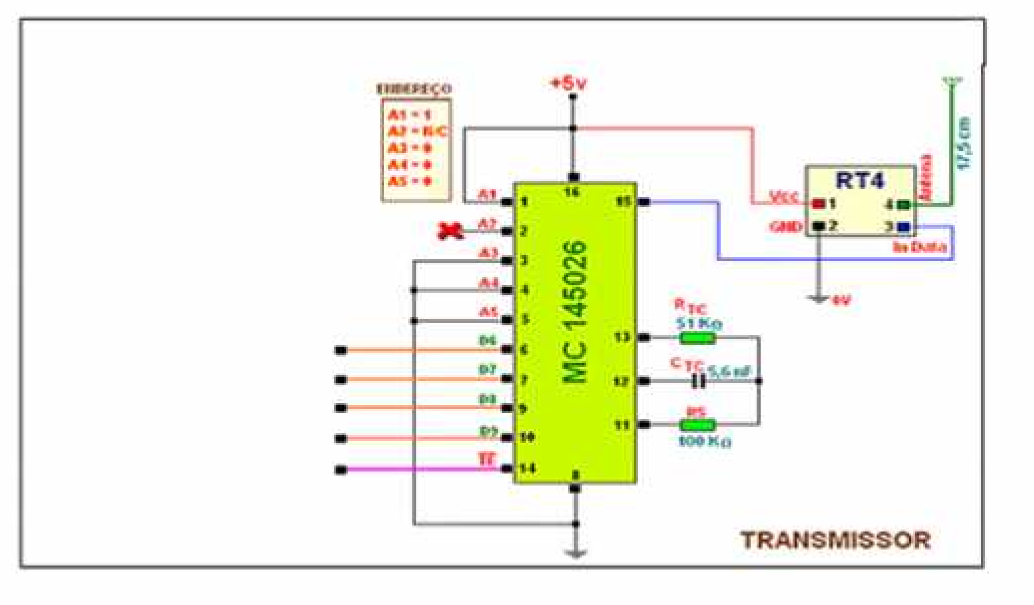


Figure 4.8: Transmitter Circuit

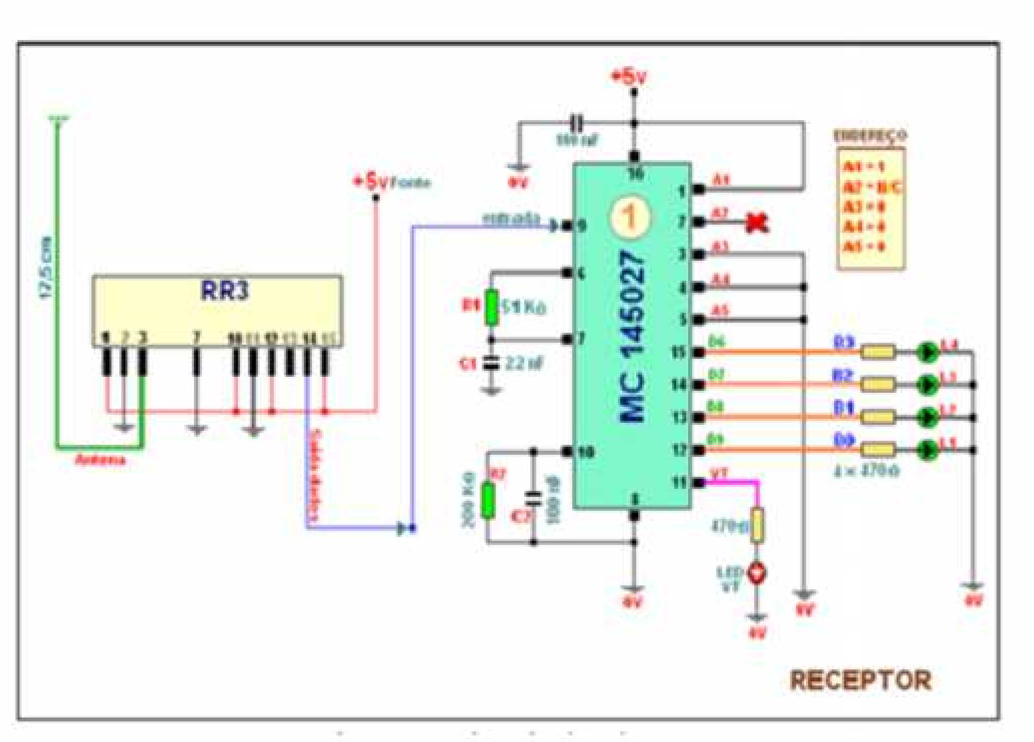


Figure 4.9: Reciver Circuit

Figure 4.10 shows how we use one decoder MC145027 to be able to provide 8-bit . BUT in our case the circuit does not work well because the output that provide by the decoder MC145027 was not able to drive the BUZZER load SO we did a little bit modification in the above circuit to work well as the following circuit shows:

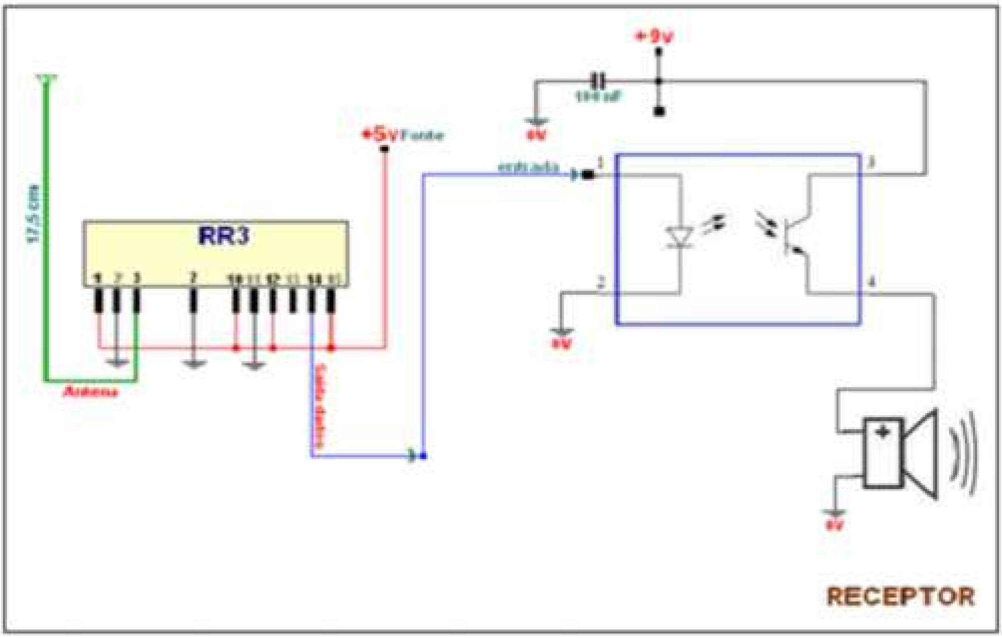


Figure 4.10: Receiver circuit – Diagram

Since the output of the decoder MC145027 (Serial Data input) was able to drive the LED, we used opto-coupler IC that is a combination of an LED and a phototransistor.

To send a signal, the transmitting side powers the internal LED, just as you would power a regular LED. This lights up and causes the phototransistor on the other to start conducting current. You can think of it as kind of a switch at this point, and use it to TURN ON the buzzer.

4.4.3 Design Development

Part1 Testing the circuit

In order to make sure that the circuits are work well we first tested the circuits in white boards .

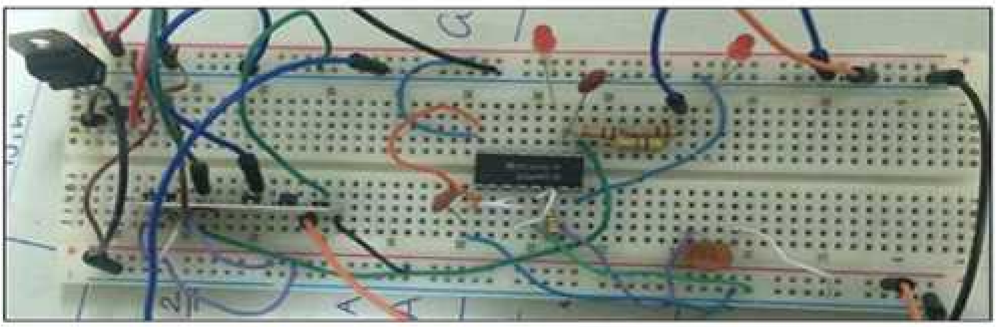


Figure 4.11:Receiver circuit – TEST

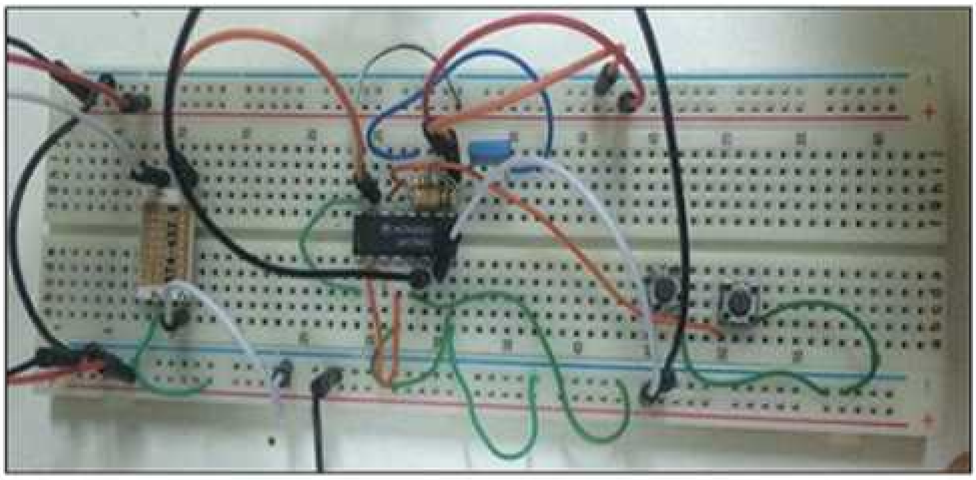


Figure 4.12: Transmitter circuit – TEST

Part2 PCB design

First, design the schematics of both transmitter and receiver circuits in EAGLE .

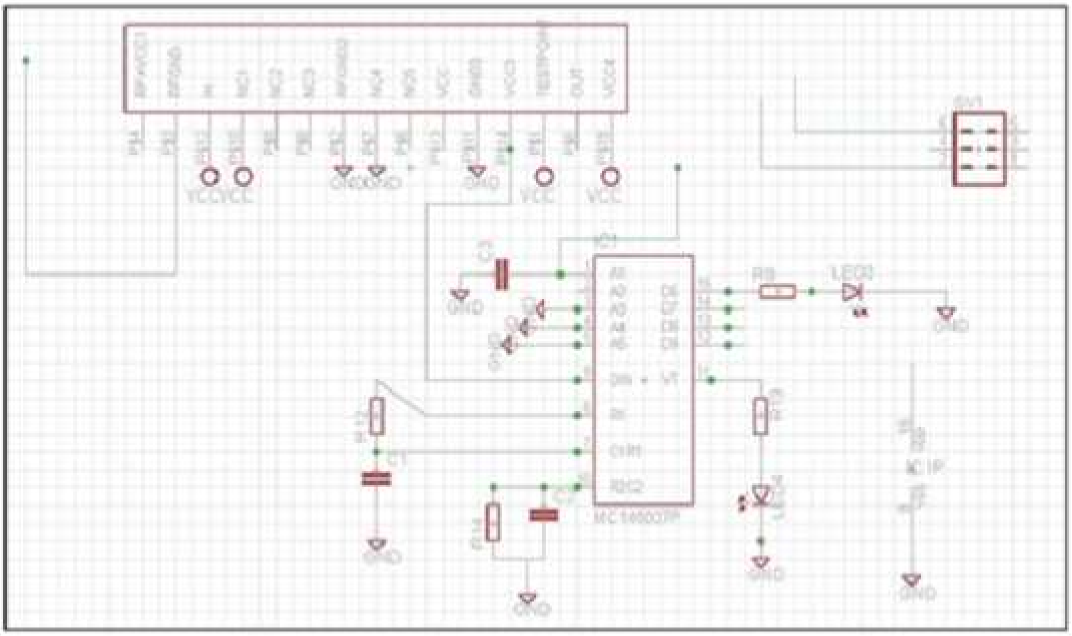


Figure 4.13: Receiver circuit – Schematic

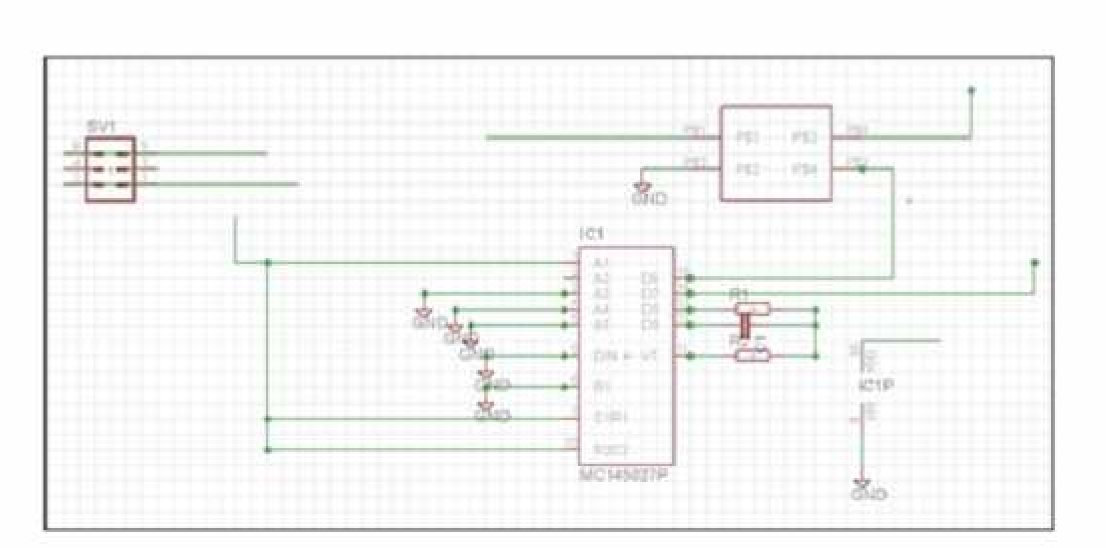


Figure 4.14: Transmitter circuit – Schematic

Then, covert these schematics into PCB

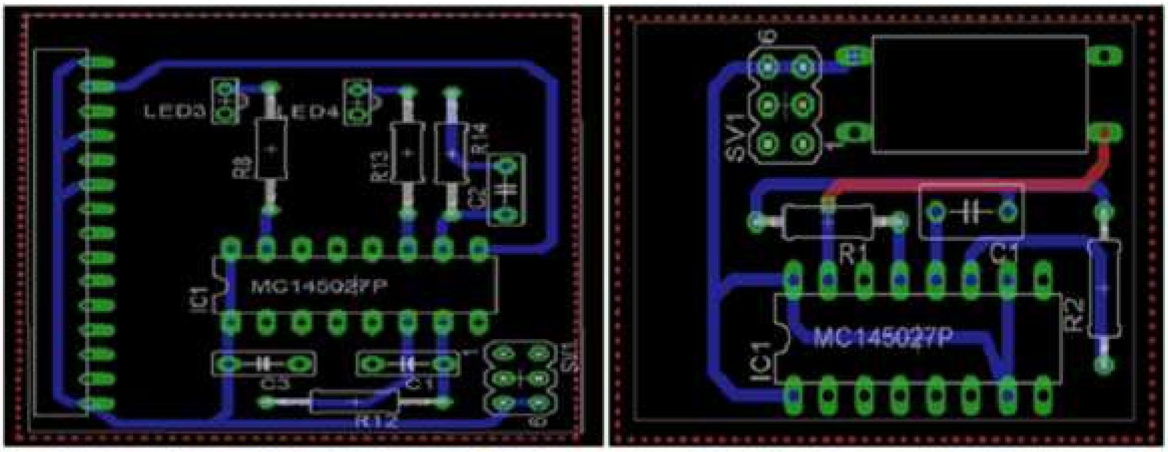


Figure 4.15: PCB Schematic - receiver and transmitter circuits

Finally, print the above circuits in the PCB printer to get the desired PCB.

Figure 4.16: PCB - receiver and transmitter circuits

Part3 Installation of elements on PCB

The final step is to install the components in the printed circuit boards.

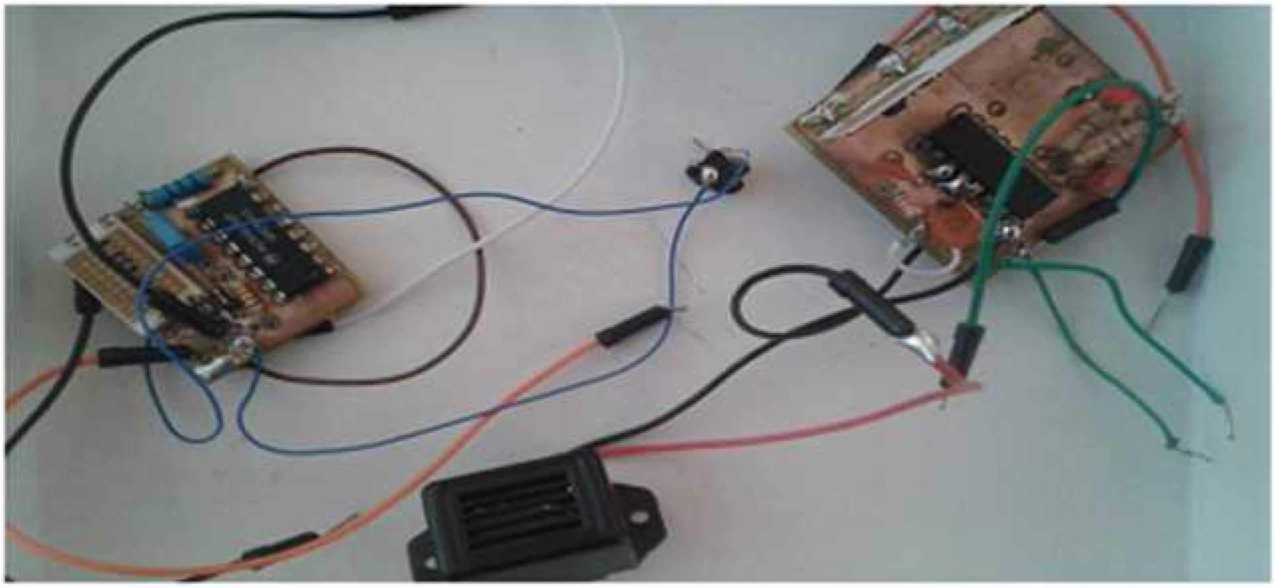


Figure 4.17: Transmitter and receiver circuits

Chapter 5

Validation and Testing

5.1 Overview

In this chapter I will show and explain how I tested Smart Cane Network and how I operated each sensor. Mat lab code validation plus the whole system validation.

5.2 Mobility Systems

5.2.1 Obstacle Detection System

HC-SR04 is used to detect the existence of an obstacle. When the ultrasonic sensor detects the existence of an obstacle, it will send feed back to the visually impaired person.

Using New Ping Library to calculate the distance of the obstacles, that library provide many features such that:

- ✓ Ping sensors consistently and reliably at up to 30 times per second.
- ✓ Timer interrupts method for event-driven sketches.
- ✓ Built-in digital filter method ping median (which Do multiple pings where the default is 5, discard out of range pings and return median in microseconds) for easy error correction

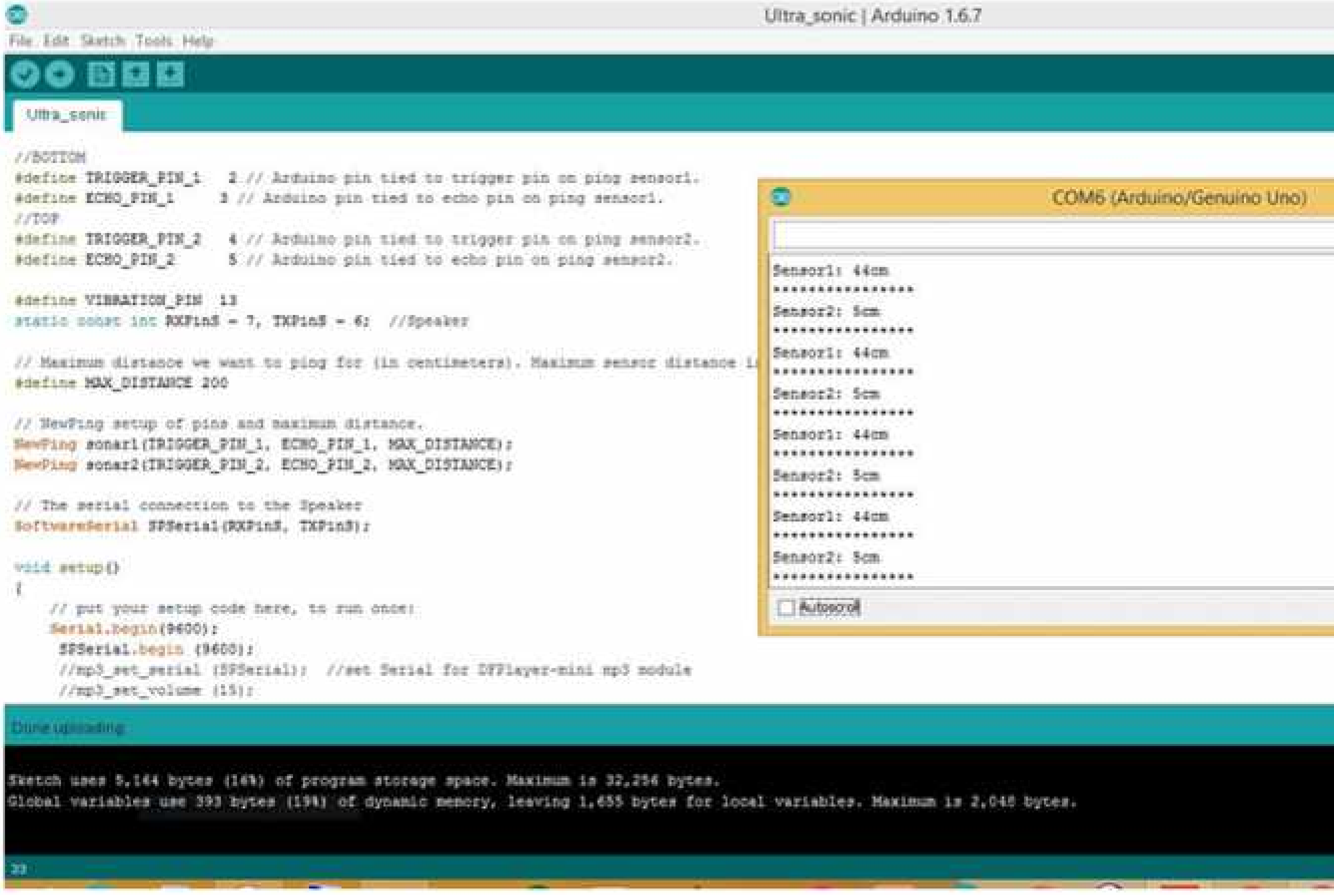


Figure 5.1:Distances detected from HC-SR04 sensor

Figure 5.2: Sensor detected distance versus actual measured distance

Figure 5.2 show the differences between ultrasonic sensor measurement and actual measurement between the obstacle and ultrasonic sensor. The error between the result of ultrasonic sensor and measured values is small that is 0.8 cm.

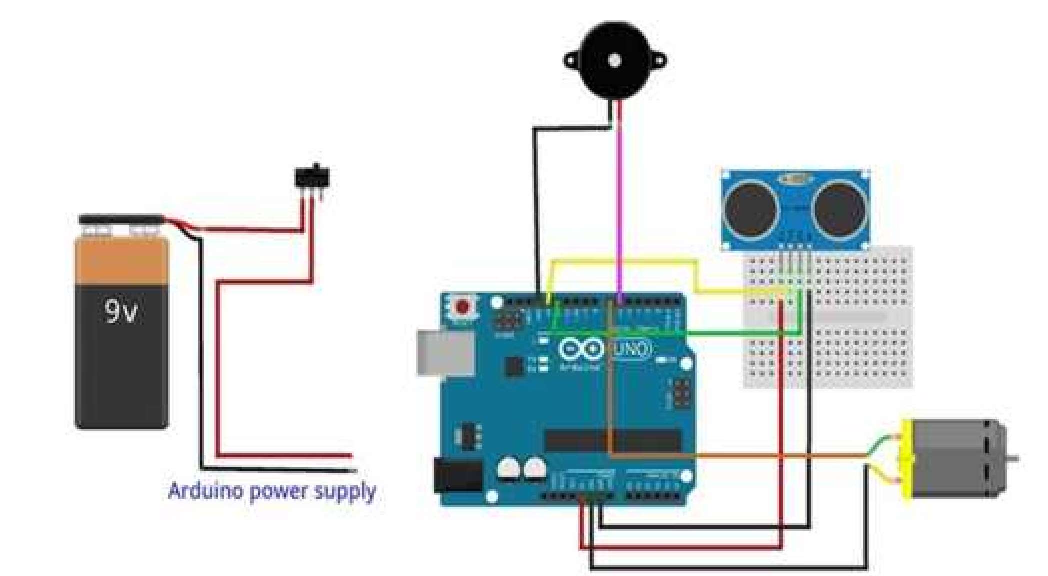


Figure 5.3: Connection of all system

GPS is used to obtain the real time coordinates of a location. Figure 5.5 shows the coordinates obtained from the GPS receiver. The result shows the current location of the GPS receiver. By obtaining current coordinates, calculation to desired location can be proceeded. The calculation will be conducted using way-points technique. It mainly focuses on two calculations that are distance to destination and angle to destination.

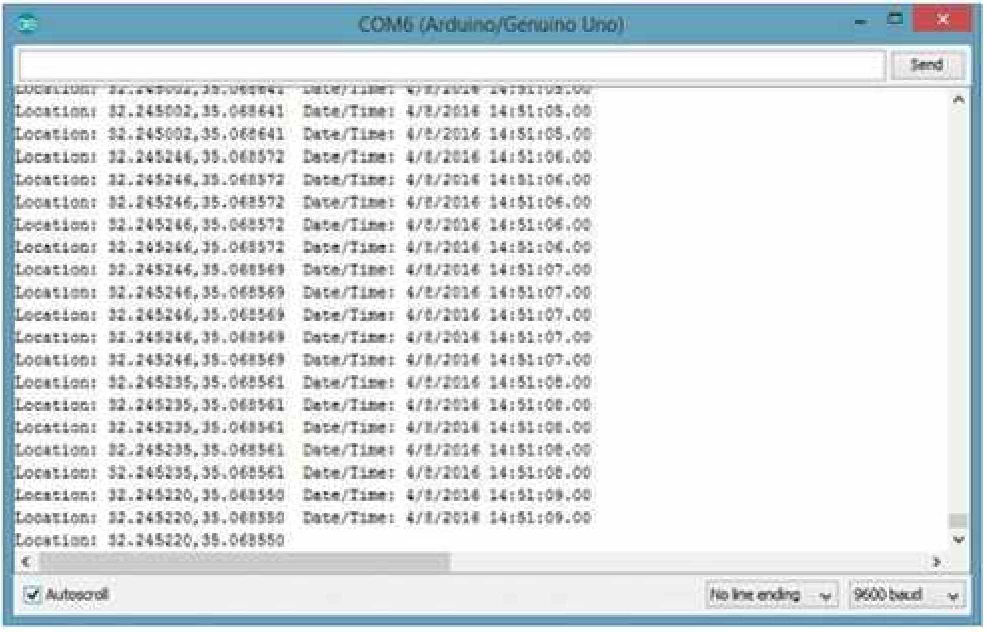


Figure 5.4: Current coordinates obtained from GPS

Way-points techniques can be used to calculate the distance and direction to the desired location. Figure 5.6 shows the output.

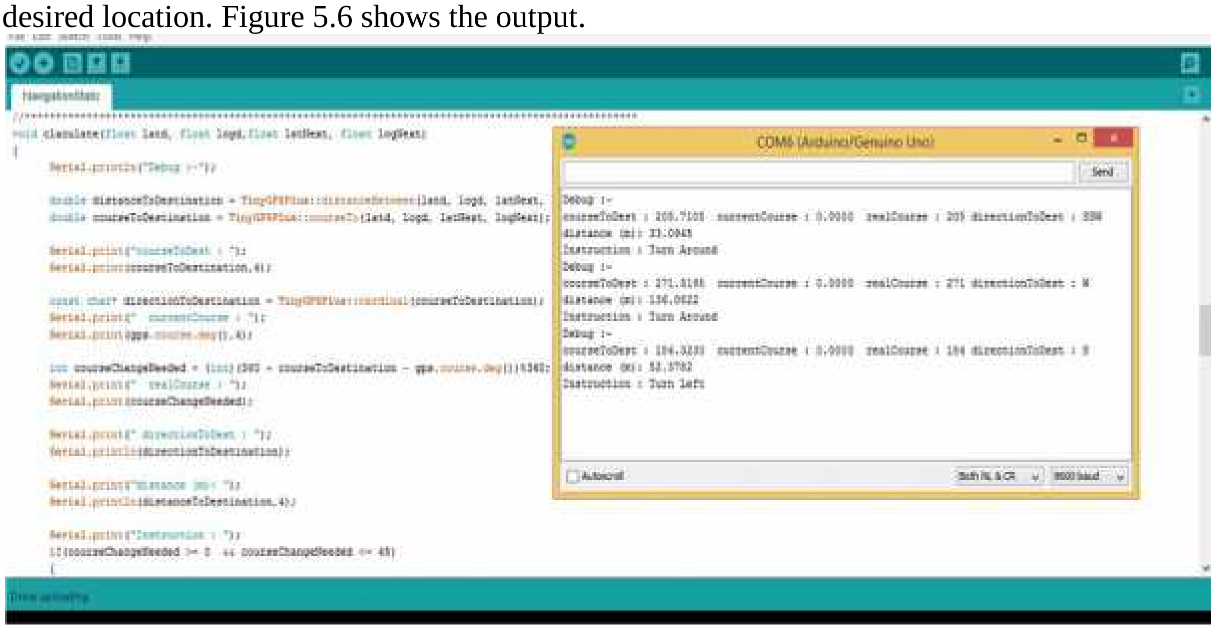


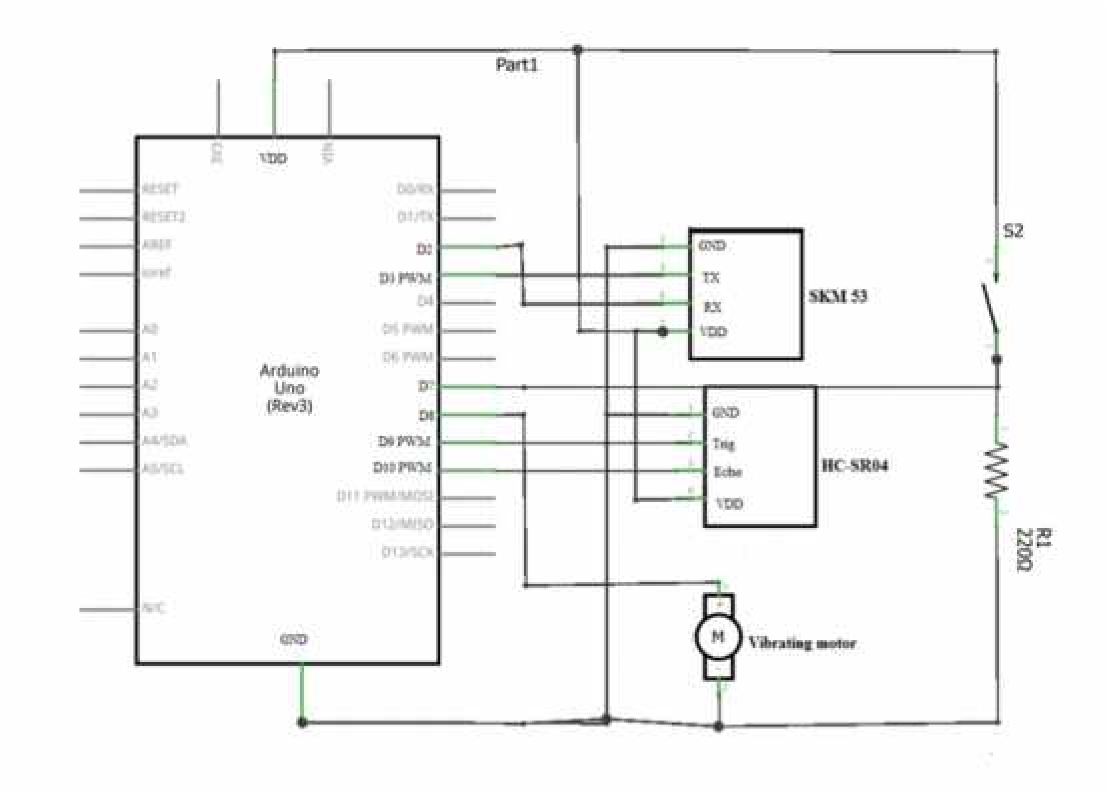
Figure 5.5: Result of way-points calculation

5.3 RF Sender and Receiver System

The transmitter and receiver circuits work very well on 433 MHZ frequency the range is approximately 400 meters. SO the visually impaired person will be able to locate the cane like home, work or market by press the button on the transmitter circuit and follow the buzzer sound to locate the cane.

5.4 Overall System Design

Figure 5.6 shows the schematic diagram of the whole project.



.

Figure 5.6: Schematic diagram of overall system design

Also, the system contains the locator circuit that used RF transmitter and receiver circuit that does not interface with the arduino since we used circuits, and the LDR relay that acts as switch to provide power to the circuit when the LDR detects dark .

NOTE: Even though pins 0 and 1 are specifically designed for use as a “hardware serial port” or UART we do not use them in our project, because we don’t want to waste the only UART these low-end AVR processors have. Arduino’s UART is hardwired to the onboard USB connector, and we like to keep it connected to the computer for debugging.

Chapter 6

Conclusions

6.1Overview

In this Chapter I will conclude the challenges in my project , the final results from this project and I will propose the future work that can be added to it .

6.2 Challenges

I faced many challenges in this project; we mentioned some of them as follows:

1. The project hardware components are not all found.
2. I did not find the water sensor which I want.
3. The project financial support was not enough.
4. No internet network in my home, so and that issue affected the project badly.

6.3 Conclusion

As a conclusion, this project includes the combination of ultrasonic sensor, global positioning system vibrating motor, Arduino UNO and android application to build smart cane for the visually impaired people. Two main objectives of this project that are to increase the mobility and also to enable navigation system had been successfully implemented.

To increase the performance of mobility for the visually impaired people, ultrasonic sensors and tactile and auditory feedback are used. Visually impaired people will realize the existence of an obstacle before contact with it. It helps to increase the efficiency for visually impaired people to travel and also increases the safety. Implementation of a global positioning system enables a visually impaired person to move to an unfamiliar place without human guidance.

The hardware and software of the project had been successfully integrated and worked to meet the requirements. The prototype of a smart cane is built and the function meets the objectives of this project.

6.2 Future Work

Some future works are suggested and recommended in order to improve the smart cane. The accuracy of the obstacle detection can be increased. Therefore, the sensitivity of the ultrasonic sensor and vibrating strength of a vibrating motor should be improved. Moreover, the vibrating strength of the vibrating motor should be more obvious for a visually impaired person to feel a large difference between near and far obstacles. The navigation system can be improved by using speech recognition application so the visually impaired user can tell the application the destination address without needing the help of anyone to draw the path the application did.

.

Appendix

References

[1] Anon, n.d. Electronic Walking Stick for the Blind, s.l.: s.n.

[2] Hoydal & T.O, 1991. An alternative mobility aid for the blind: the `ultrasonic cane'. [Online]. Available from: http://ieeexplore.ieee.org/xpl/login.jsp?reload=true&tp=&arnumber=154627&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxpls%2Fabs_all.jsp%3Farnumber%3D154627. [Accessed: 27 th March 2013].

[3] FRENKEL, R., 2008. CODED PULSE TRANSMISSION AND CORRELATION FOR ROBUST. Amherst: University of Massachusetts.

[4] Kang, S. J., Ho, Y., K. & Moon, I. H., 2001. Development of an Intelligent Guide-Stick for the Blind. Seoul, Korea, IEEE March 2013].

[5] koley, S. & Mishra, R., 2012. VOICE OPERATED OUTDOOR NAVIGATION SYSTEM FOR VISUALLY IMPAIRED PERSONS.

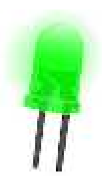
[6]: Welsh, R. L. and Blasch, B. B. Foundations of orientation and mobility. American Foundation for the Blind New York. 1980.

[7]: Hersh, M. and Johnson, M. A. Assistive technology for visually impaired and blind people. Springer. 2010.

[8]: http://www.rogercom.com/pparalela/LptWireless.htm

[9]: http://www.cadsoftusa.com/download-eagle/

[10]: http://www.movable-type.co.uk/scripts/latlong.html



LED

Push bottom

Arduino

Water sensor 1

Ultra sonic sensor

Battery1

Vibration motor

Buzzer

GPS

Figure 3.5: The components of the system