Seminar Report

on

Smart Walking Stick for the Blind

Submitted to

St. Xavier's Technical Institute, Mahim

In partial fulfillment of requirements for Diploma in

Electronics and Telecommunication Engineering by

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This is to certify that **Oswin Alex (1903003), Kedarvanshikumar Arekar (1903004), Nathan D'Silva (1903007) and Stef Jenesh Kumar (1903029)** have satisfactorily completed the Seminar work entitled **Smart Walking Stick for the Blind** in partial fulfillment of the Diploma in Electronics and Telecommunication Engineering course as prescribed by St. Xavier's Technical Institute, Mahim, Mumbai for the academic year 2021-2022.

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ABSTRACT

Blindness, this hindrance makes numerous challenges in their daily exercises, such as walking, socializing, and traveling. This research aims to implement a Smart stick that will view the image of opportunity and certainty. The proposed smart stick is planned with an obstacle identification module, a global positioning system (GPS), pit, water detection, and a global system for mobile communication (GSM) to perform their daily activities quickly. The impediment identification module utilizes an ultrasonic sensor alongside a water level sensor to distinguish the obstructions that. An Arduino UNO is used to advise the user about the barriers and sends notifications using a buzzer. The current location of the blind person is located using GPS and GSM modules. The stick activates an alert system in case of loss and a RF transmitter receiver to help the person find his stick if he loses it. Such a stick will be a blessing for blind people having a positive impact on science and technology.

***Keywords*:** Optic, Smart Stick, obstacle, ultrasonic sensor, GPS, GSM, RF transmitter and receiver

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CHAPTER 1

1. INTRODUCTION

Blindness is a very common disability among the peoples throughout the world. According to the World Health Organization (WHO) 285 million people are visually impaired worldwide, 39 million are blind and 246 have low vision. About 90% of the world's visually impaired live in developing countries. Visually impaired persons have difficulty interacting and feel their environment. Vision is the most important part of human physiology as 83% of information human being gets from the environment is via sight. Physical movement is a challenge for visually impaired persons and they are not able to move freely from one place to another. The oldest and traditional mobility aids for persons with visual impairments are the walking cane (also called white cane or stick) and guide dogs. The drawbacks of these aids are range of motion and very little Information conveyed. With the rapid advances of modern technology, both in hardware and software front have brought potential to provide intelligent navigation capabilities Over the last decades, research has been conducted for new devices to design a good and reliable system for visually impaired persons to detect obstacles and warn them at danger places. Smart walking sticks are specially designed to detect obstacles which may help the blind to move safely. The alarm will keep the user alert and considerably reduce accidents. This system presents a concept to provide a smart electronic aid for blind people, both in public and private space. The Smart stick will be integrated with an ultrasonic sensor, GPS module, GSM module, a buzzer and RF Transmitter and receiver. the ultrasonic sensor will help in detecting the obstacles in his route and he will be alerted with the help of the buzzer the GSM and GPS will update the location of the user to his caretaker or family and the RF transmitter and receiver will help in finding the stick if it is misplaced.

1.1 Motivation:

This project was made with the motive of helping blind people. The Rapid development in science and technology has given us many options/opportunities to develop devices/products that will help them travel safely. Although it may not be as effective as giving them vision, it will be more effective than the methods/measures used nowadays.

1.2 Challenges:

Challenges and difficulties faced by impaired people are a lot compared to a normal person in day-to-day activities. For example, going to a workplace or for a stroll it's very difficult as well as time consuming as they have to check for any obstacles, then to stay on the correct route and many more therefore this smart stick will be very helpful for the them

1.3 Objective:

To help the visually impaired to navigate on their own by developing an effective system that will help them travel independently.

1.4 Organization of Report:

It is divided into 5 chapters

Chapter1: It gives an Overview about the Project and also talks about the motivation, challenges, objective of the project.

Chapter 2: Is the literature survey of the project by reviewing the papers done by others and we noted down their conclusion and accuracy which helped us in creating an efficient and effective system.

Chapter 3: It deals with the methodologies of the project which contains the block diagram, working of the project and it also gives an overview about the connections done through the Schematic diagram along with System requirements

Chapter 4: it deals with the work done, system implementation, Result analysis.

Chapter 5 It gives the conclusion of the project and also mentions the future scope of the Project.

CHAPTER 2

LITERATURE SURVEY

Sr.no	Paper	Method	Conclusion and accuracy
1	D Sathya Nithyaroopa, Betty, Santhoshini Sabharinath, J. Ahanaa, "**Smart Walking Stick for Blind Person**", International Journal of Pure and Applied Mathematics Volume 118 No. 20 2018, 4531-4536.	The system consists of Ultrasonic sensor, Raspberry pi and a headphone attached to it. The raspberry pi is the central controller of the system.	They have only used an ultrasonic sensor which was programmed using Raspberry pi 3. This system is expensive and inadequate
2	Prof. Harish HM, "**ARDUINO BASED Intelligent Walking Stick for Physically Impaired Person**"	The ultrasonic sensor is used to detect the presence of obstacles and calculates the distance between the source and destination. Light sensor is used to detect the presence or absence of light. Water sensor is used to detect the presence of water. Anti-theft protection. Warning through voice and vibration.	The system consists of light sensor and water sensor which we think is unnecessary and will only add the number of features and increase the load on the Arduino.
3	Deepika S Divya B.E Harshitha KKomalaB.K Shruthi PC,**"Ultrasonic Blind Walking Stick**". International Journal of Advance Electrical and Electronics Engineering (IJAEEE) Volume-5 Issue-62016 ISSN(Print): 2278-8948	Some more applications like vehicle detection, slippery floor on-coming vehicle detection and fire or smoke alarm can also be included. One more application is for the family members to gain access to the blind person's location through the server whenever needed. Also use of RFID tags will transmit the location information automatically to the PCB unit when the intelligent stick is in its range.	The main component of this system is the Radio Frequency module which is used to find the stick if it is misplaced around. The transmitter keeps on sending signals upon pressing a key. These signals are received by the receiver which then sends signals to the microcontroller which in turn causes the beeping of the buzzer.

4	Vijayalakshmi Badre ,RomaChhabria,Tanmay Kadam and Kritika Karmachandani, "**Ultrasonic blind walking stick with voice playback** "International Research Journal of Engineering and Technology Volume: 03 Issue: 04 |Apr-2016, e-ISSN: 2395 – 0056 p-ISSN: 2395-0072	This system consists of microcontroller, a dc motor, an ultrasonic ranging module, IR sensor, a GPS with memory card which will be used to store different locations, voltage regulator and a MP3 audio module the user can use voice commands to input the desire location this system will even provide the speed of the user and distance in between the location of the person and his destination. The system is based on Normal ultrasonic sensors and ATMEL Microcontroller. It operates with two rechargeable batteries. It can be recharged using a USB cable Or AC adapter. The control unit is program	This system provides a voice guide for the user but it is not very accurate. The accuracy of The GPS signal needs to be improved because it only can be controlled within 5 meters radios. The system is based on Normal ultrasonic sensors and Atmel Microcontroller
5	K.S.Manikanta, T. S. S. Phani2 , A. Pravin, "**Implementation and Design of Smart Blind Stick for Obstacle Detection and Navigation System**", International Journal of Engineering Science and Computing, August 2018	Ultrasonic sensors, Buzzers, GPS module, vibration motors which are Programmed using the Arduino.	The GPS feature can be a good addition to the Project as the user can share his location if he finds himself in trouble or any discomfort and then the sensors are used to avoid obstacles in the way and help the person navigate with ease
6	Antara Ghosal, Anurima Majumdar, Palasri Dhar, Adrija Kundu, Avirup Mondal "Smart Stick for Blind using IoT", IJIRT | Volume 7 Issue 5 | ISSN: 2349-6002 October 2020	The proposed smart stick for blind system uses ultrasonic sensor, IR flame detection sensor, water detecting sensor, a 2-megapixel camera, DC power supply source (9V).	It uses an advanced feature a system like VOICE or Soundview which is uses a camera or stereo video cameras through which it captures. This can be addition in the project but there is a lot of time delay as it will capture it then process it and then give the feedback. Which might also not be very accurate.

7	D.Siva kumar, M.Prem Anand, K.Deepan Raj, P.Thalapathi Raj, R.Yashwanth, S.Yogesh,"**Electronic Stick for Visually Impaired People With buzzer alert",** Volume-7, Issue-6S5, April 2019, ISSN: 2277-3878.	Sensors are used which are controlled by the Arduino.an also a rf transmitter receiver is used	Rf transmitter and receiver feature can be used if the person's stick gets lost this feature can help him find the stick.

8	Manoj Kumar, Rohit Verma , Mukesh Kumar,Shekhar Singh andThakurendraSingh" **Ultrasonic based smart blind stick for visually impaired person**", Vol. 6, Issue 3,March 2017, ISSN (Print) : 2320 – 37652278 – 8875	The system elements consist of various subsystems. The sensor-based circuitry consists of sensors such as ultrasonic sensors. The feedback system has a motor interface. The Microcontroller, control buttons and power circuitry (preferably battery-based) are the crucial systems.	This system also consists of number of sensors which will just add the no of sensor and load on the sensor
9	Amit Thakur,Anita Gehlot.Rajesh Singh, "**Smart Blind Stick for Obstacle Detection and Navigation System**". Journal of Emerging Technologies andInnovative Research (JETIR) 2018 JETIR October2018,Volume5, Issue10 ISSN-2349-5162.	The system consists of Arduino Uno RE, Ultrasonic sensor Transmitter and Receiver and GPS and GSM system	GPS and GSM systems as the user can share his location if he finds himself in trouble or any discomfort and then the sensors are used to avoid obstacles in the way and help the person navigate with ease.It should be able to handle wide range communication

2.1 Statistics:

India, world's second largest population, has the distinction of being the home of the world's largest number of blind people. World Health Organization (WHO) statistics revealed that approximately 63 million people in India are visually impaired, and of these 8 million people are totally blind. The number of blind persons in India in 2000 was estimated to be 18.7 million. The projected number of blind persons in India would increase to 24.1 million in 2010 and 31.6 million 2020.[14]

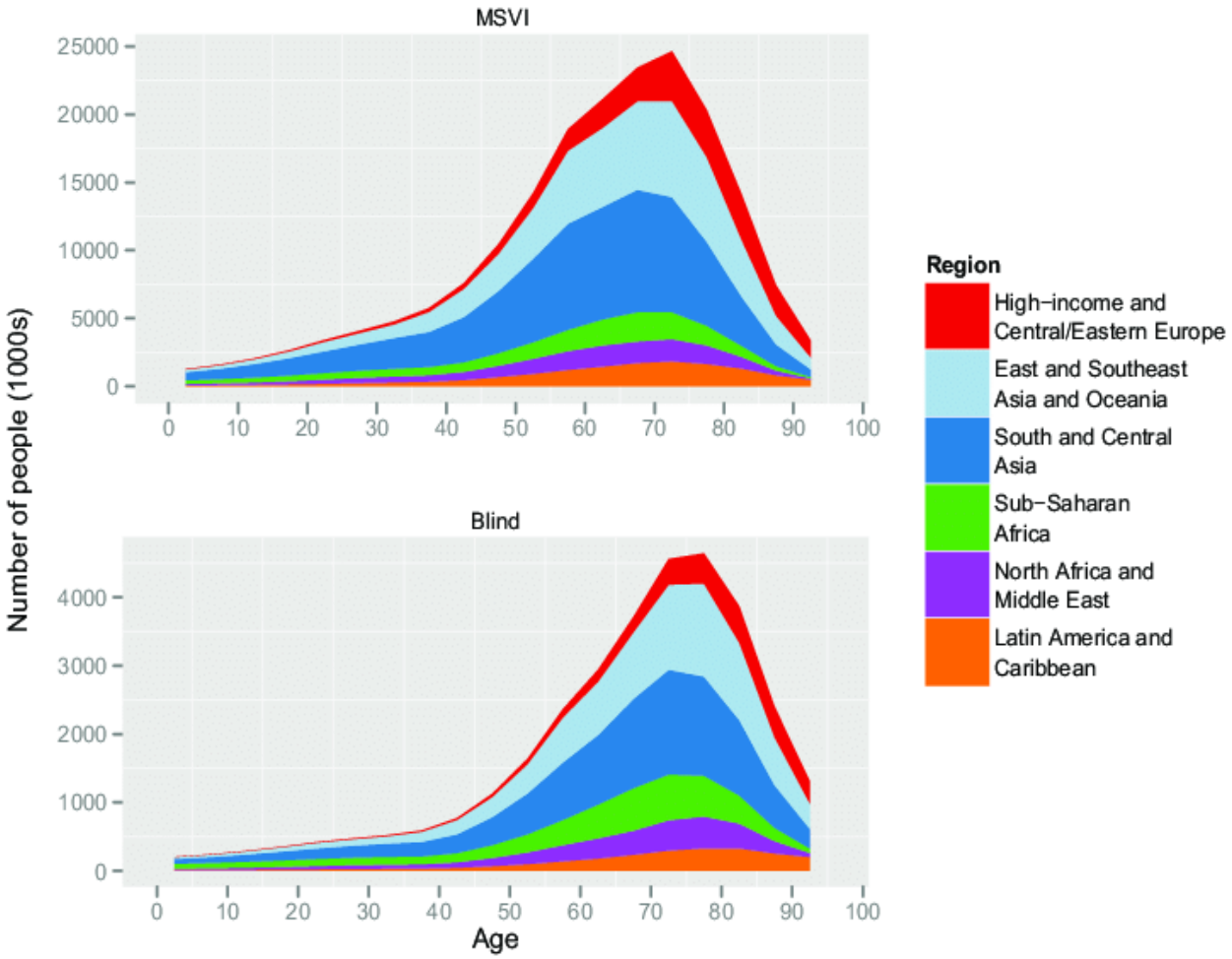
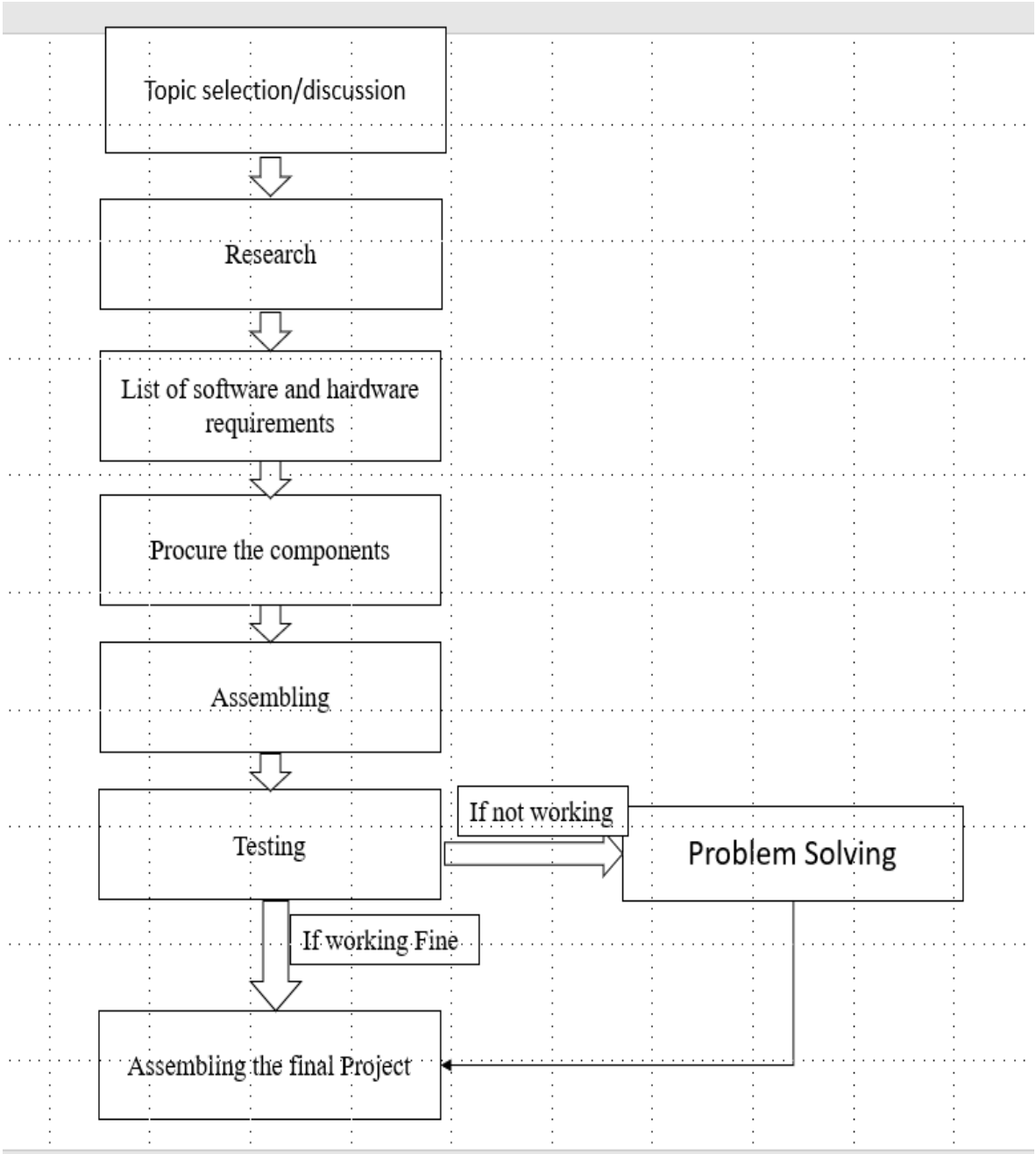


Figure 1: Number of Blind People Globally and in India and Age Group [14]

FLOW OF THE PROJECT



Chapter 3: METHODOLOGIES

3.1 BLOCK DIAGRAM

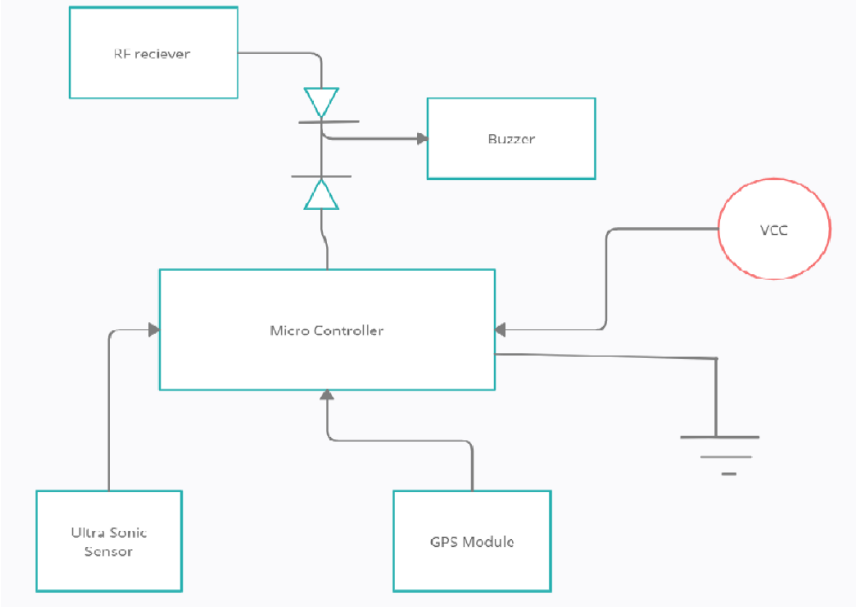


Figure 2: Block diagram

The Smart stick is integrated with an ultrasonic sensor, GPS module, GSM module, a buzzer and RF Transmitter and receiver. So, our proposed system first uses the ultrasonic sensor to sense or detect any obstacles around. If it detects any obstacle or the sensor then passes the information to the microcontroller and then the microcontroller will turn on the buzzer and alert the user. The system has one more feature integrated to help the blind find their stick if they forget where they kept it. Wirelessly. And then there is one more advanced feature, the GPS module which will help the user to send his location to his family or his caretaker if he finds himself in any trouble or difficulty. All the components are connected to microcontroller except RF transmitter and receiver the RF receiver will be directly connected to the buzzer if the stick gets lost the user, then can press the button at the transmitter end and then the receiver end will turn on the buzzer and then the user can find his stick. All the components are connected to microcontroller except RF transmitter and receiver the RF receiver will be directly connected to the buzzer if the stick gets lost the user, then can press the button at the transmitter end and then the receiver end will turn on the buzzer and then the user can find his stick.

3.2 SCHEMATIC DIAGRAM

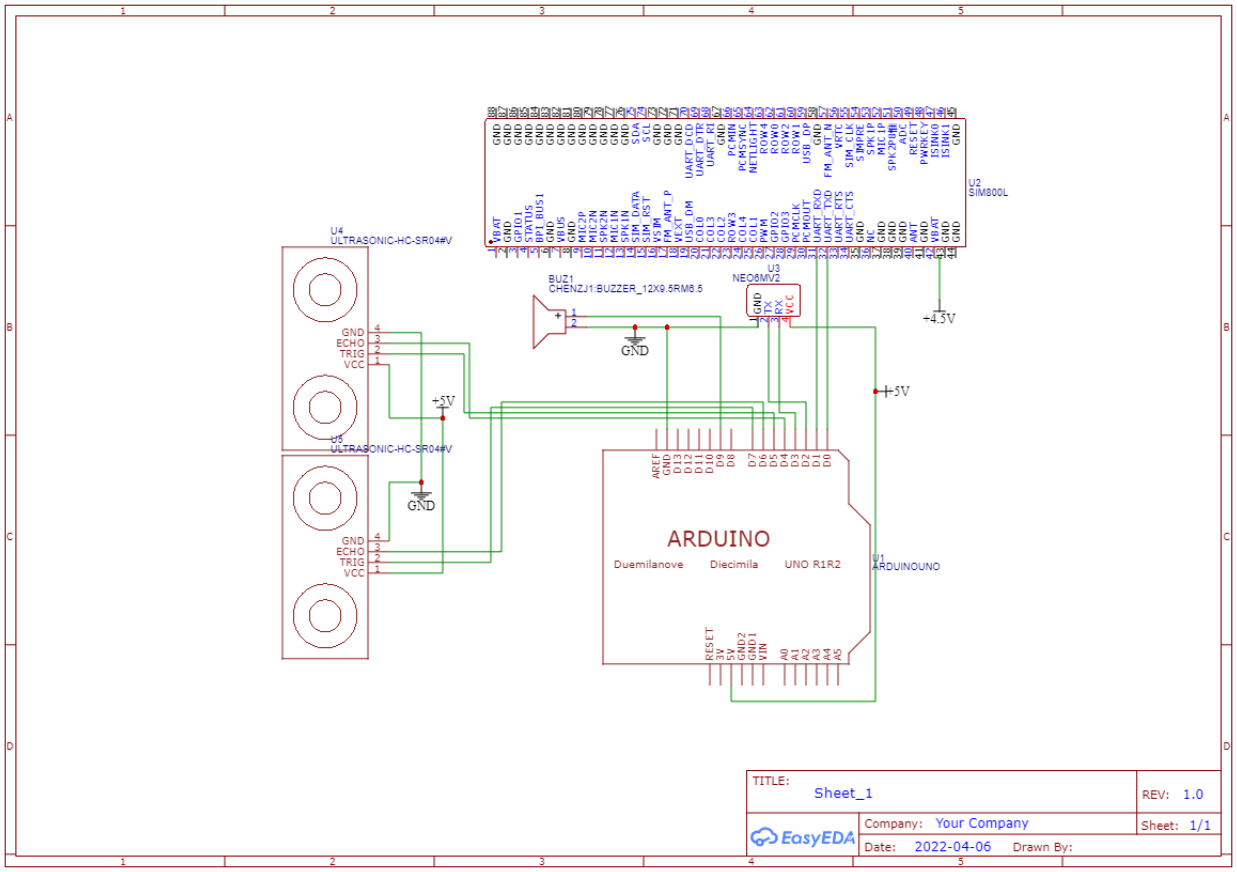


Figure 3: Schematic diagram

The above schematic gives an overview about the connections that are going to be done with all the components that are mentioned in the project

3.3 SYSTEM REQUIREMENTS

Hardware Requirement:

3.3.1 Arduino UNO

Figure 4: Arduino UNO

Arduino UNO is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.[6]

3.3.2 Ultrasonic Sensor HC-SR04

Figure 5: Ultrasonic Sensor

The HC-SR04 Ultrasonic Distance Sensor is a sensor used for detecting the distance to an object using sonar. HC-SR04 uses non-contact ultrasound sonar to measure the distance to an object, and consists of two ultrasonic transmitters (basically speakers), a receiver, and a control circuit. The transmitters emit a high frequency ultrasonic sound, which bounce off any nearby solid objects, and the receiver listens for any return echo. That echo is then processed by the control circuit to calculate the time difference between the signal being transmitted and received.[6]

3.3.3 GPS Module NEO-6M

Figure 6: GPS Module Neo-6M

The NEO-6M GPS module is a well-performing complete GPS receiver with a built-in 25 x 25 x 4mm ceramic antenna, which provides a strong satellite search capability. With the power and signal indicators, you can monitor the status of the module. It is from a family of stand-alone GPS receivers featuring the high-performance u-box 6 positioning engines. These flexible and cost-effective receivers offer numerous connectivity options in a miniature.[6]

3.3.4 RF transmitter and Receiver (433 MHz)

Figure 7: RF transmitter and Receiver

The 433 MHz RF transmitter and receiver module is a pair of small RF (i.e. radio-frequency) electronic modules used to send and receive radio signals between any two devices. The transmitter module sends the data from the transmitter end and the Receiver module receives that data at the receiver's end. The Transmitter offers only one-way communication through operating volts of most of the microcontrollers and boards.[8]

3.3.5 GSM Module

Figure 8: GSM Module Sim 800l

SIM800L is a miniature cellular module which allows for GPRS transmission, sending and receiving SMS and making and receiving voice calls. Low cost and small footprint and quad band frequency support make this module the perfect solution for any project that requires long range connectivity. After connecting, the power module boots up, searches for cellular network and login automatically. On board LED displays connection state.[6]

Software requirement:

3.3.6 Arduino IDE

The Arduino Integrated Development Environment or Arduino Software (IDE), contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. He

Arduino integrated development environment (IDE) is a cross-platform application (for Microsoft Windows, macOS, and Linux) that is written in the Java programming language. It originated from the IDE for the languages Processing and Wiring. It includes a code editor with features such as text cutting and pasting, searching and replacing text, automatic indenting, brace matching, and syntax highlighting, and provides simple one-click mechanisms to compile and upload programs to an Arduino board. It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus. The source code for the IDE is released under the GNU General Public License, version 2.The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware. From version 1.8.12, Arduino IDE in windows 7 or newer.

CHAPTER 4

4.1 WORK DONE

In the literature survey that was done, we have reviewed around 12-15 papers. We noted down their conclusion and accuracy which helped us create an efficient system. For example, in the first paper we read “Smart Walking Stick for Blind Person”, they have only used an ultrasonic sensor which was programmed using Raspberry pi 3. This system is expensive and inadequate so through research we added more features so that the system becomes more efficient like GPS, GSM, RF transmitter and receiver, water detector circuit etc. For programming the board, instead of using the raspberry pie we will be using the Arduino UNO board which helps us fulfill our needs and is more cost effective.

We have also finalized the block diagram as shown above and made the list of the components that will be needed for the project. We purchased a few components but were a little delayed because of the Covid restrictions. We will however be purchasing it as soon as possible.

We have done some part of the software required for the project and the basic simulations needed for the testing of the hardware for example we have already made the RF transmitter and receiver kit, the assembling and the testing part will be done as soon as all the rest of the components are bought.

After procuring the components and also purchasing them within the decided budget to make it a cost-effective system. Firstly, we checked whether the components were working or not are there any faults present in them so first we check the Arduino which is the vital component of our project that was working perfectly fine and then we checked the other components and coded them individually like the ultrasonic sensor and we also modified its range as per our requirements. then we checked the GSM module which will be communicating our location to the caretaker or family member it gave us a few issues a connectivity problem it was not able to identify the sim card and then we troubleshoot it and found out that the there was an issue in the sim slot present in the module it was able to read the sim card, therefore, we exchanged it after that it was working fine. The GPS module was working suitably but it takes some time to connect with the satellite which is about 2-3 minutes after the testing of all the components.

The components were then interfaced with one another and it was then assembled altogether the code of the individual component i.e., the ultrasonic sensor was combined with the GPS GSM altogether in the Arduino and made into a one single unit

4.2 RESULTS

After we designed the Hardware and programmed the Arduino Uno, we did face certain issues with the GSM module it was unable to detect the sim card as it had a faulty sim slot as these GSM modules have cheap quality sim slot hence, we tried to correct it accordingly by soldering it but it didn't work and therefore we had exchanged the item. The GPS Module also had an issue The antenna attached to it was not soldered properly therefore we soldered it properly and it start functioning we tested the smart stick outdoor the ultrasonic sensor was able to detect the obstacles precisely. The GPS and GSM was also working by giving the accurate location of the user

Code Snippets:

1.Ultrasonic sensor code

Figure 9: ultrasonic code

2. GPS and GSM Interface with Arduino

Figure11: GPS and GSM interfacing with Arduino

```
// connect gps sensor


}

void textgps()
{

     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;
        }


}

 Serial.print("LATTITUDE="); Serial.println(lattitude,6);
 Serial.print("LONGITUDE="); Serial.println(longitude,6);
 lcd.print("LAT ");lcd.print(lattitude,6);
 lcd.setCursor(0, 1);
 lcd.print("LONG ");lcd.print(longitude,6);
 delay(1000);
// lcd.clear();
}
```

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Figure12: GPS and GSM interfacing with Arduino 2

3.Final testing on Breadboard

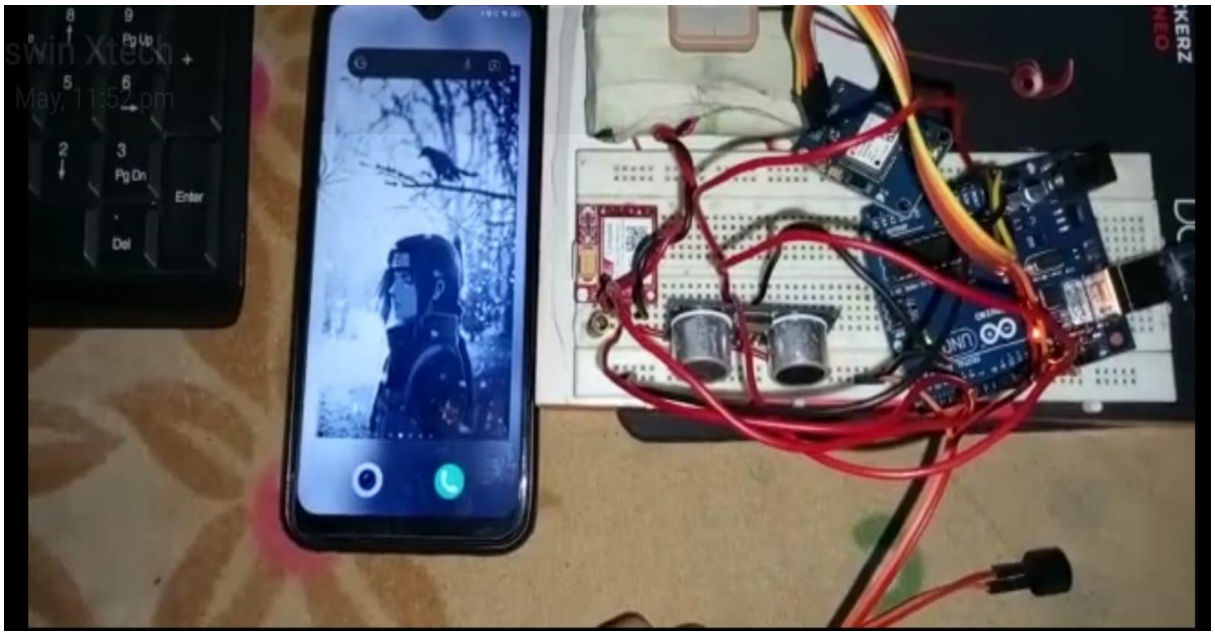

Figure13: Final testing before assembling it on the stick

4. Smart walking stick

Fig 14: Smart walking stick

CHAPTER 5

Advantages and limitations

5.1 Advantages:

The advantage of the system lies in the fact that it can prove to be a very low-cost solution to millions of blind people worldwide. The smart stick is a practically feasible product and convenient to carry around like any other walking stick. This could also be considered a crude way of giving the blind a sense of vision. As compared to methods used currently this system is a simple, efficient, configurable electronic guidance system for the blind and visually impaired persons to help them in their mobility regardless of where they are, outdoor or indoor. And it will also reduce the number of risks and injuries for the visually impaired persons.

5.2 Limitations:

However effective the system is, there are always some limitations, for example although it may help the user to travel safely and independently it will not be as effective or powerful as vision .it will only alert the user about the obstacles through the buzzer. But will not give information about what the obstacle is or how big it is moving etc. therefore by extra research and the development in science and technology we might be able to eliminate those problems as well.

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CHAPTER 6

CONCLUSION & FUTURE SCOPE

6.1 Conclusion:

The main aim of our Project was to create an effective efficient system for the visually impaired people so that they can travel with ease and safety. Though it may not be as powerful as vision, it can give a sense of safety and confidence to the user. All the studies which have been reviewed show that there are a number of techniques for making. An ultrasonic blind stick for blind people. The aim of this paper is to get familiar with the work done in making walking sticks smarter and more helpful. The literature related to this topic was reviewed and analysed. As technology improves these smart sticks need to be modified. The simulation results are expected for the ultrasonic sensors and water sensor in one microcontroller. A global positioning method to find the position of the user using the GPS, and GSM modules to communicate the location to a family member or the number registered on the GSM module or care giver. This project will help the visually impaired person to walk in public more easily and safely. With our safety features, we can reduce the risk of the visually impaired walking in public. The advantage of the system lies in the fact that it can prove to be a very low-cost solution to millions of blind people worldwide. The smart stick is a practically feasible product and convenient to carry around like any other walking stick. This could also be considered a crude way of giving the blind a sense of vision. In the future further modifications can be added to enhance the system. Such has a fall detection feature can be added to increase the safety of the user

6.2 Future Work:

With the rapid development in science and technology newer applications or features can be added to the stick to enhance it and make it for productive and efficient

1. A Gyroscope sensor can be added which will sense the angle of the stick and detect if the stick has declined or dropped which will trigger the alarm system.
2. A voice module can be added which will work together with the ultrasonic sensor which will detect the obstacles and will alert the user in the form of audio for example a Google Assistant or Siri. The basic commands that it will give for example will be Obstacle at right, obstacle at left etc. And many more features can be added to the stick through research and wants of the user

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