Smart Eyes

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Certificate

We hereby accept the work contained in this report titled: **Smart Eyes**, as a confirmation to the required standards for the partial fulfillment of the degree of Bachelors of Science in Software Engineering.

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Declaration

I hereby declare that this work, neither whole nor in part, has been copied from any source. It is further declared that I have prepared this report entirely on the basis of my personal efforts made under the sincere guidance of teachers especially my supervisor Dr. Usman Hashmi. If any part of this thesis is proved to be copied out from any source or found to be reproduction of some other, I will stand by the consequences. No portion of the work presented has been submitted in support of any application for any other degree or qualification of this or any other university or institute of learning.

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Dedication

I dedicate this project to my parents who have supported me throughout this degree in every way possible. I would also like to dedicate this project to my teachers and my supervisor Dr. Usman Hashmi without whom I would not have been capable of completing my project.

Acknowledgements

This project would not have been completed without the support of my parents, my teachers and my supervisor, without their constant support I wouldn't have been capable of completing this project. So I would like to express my gratitude to my parents for their never ending support. I am grateful to have Dr. Usman Hashmi as my supervisor who from the beginning of this project has supported me and helped me in any way possible and without his guidance this project wouldn't have been completed. I would also like to express my gratitude to my teachers and my colleagues who have helped me throughout this project.

Abstract

Any person who is suffering from visual imparity uses cane that helps them navigate where ever they want to go, the traditional cane cannot do anything other than just to guide the person. As the technology is progressing it is time to implement the technology to help the disabled people also. **Smart Eyes** is an Android app which by the help of and Arduino microcontroller will perform the functions that are required for the visually impaired person.

The Arduino code will be developed using the Arduino IDE and its coding is done in C++. While the Android will be developed using the Google Firebase, Maps API and the Bluetooth API. The Firebase will provide the database and the authentication service for the app. The Maps API will track the blind person and The Bluetooth API will establish a Bluetooth connection between the Android application and the Arduino Microcontroller using the HC-05 Bluetooth Module.

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Chapter 1 Introduction

1. Overall Description

1.1. Objectives

To design a smart walking stick with and android application so when used by a visually impaired person, this will perform features of the traditional white can and other smart features hence replacing the traditional white cane completely.

1.2. Problem Description

Any person who uses a traditional white cane it only helps them to avoid bumping into objects, As the technology is progressing it is time to update the cane as well.

1.3. Methodology

The intended approach is to not to make a GUI for the blind persons as a blind person has no use for a GUI rather they will only have to use onboard voice assistant in the android smartphone devices after that the only thing for which they will need to input will be form tapping on the screen which doesn't require a GUI also, The only GUI required for the application will be for the Emergency Contact from which that person will have to register and add his blind contact and then track his/her GPS Location. The blind persons will have a onetime registration which will be done by the developers. The Arduino will be connected to the Android app using Bluetooth, and will receive commands from the Arduino according to the sensors and will then generate the responding alert. Android API's are going to be used some of them are Bluetooth API, Android Telephony API and Geo-Location API. The App is being developed on Android API 27 which is for devices 8.1 but android devices running API 19 and higher will also be compatible.

1.4. Product Scope

The following are the System Features

FEATURE	DESCRIPTION
Collision Detection	Will detect any object that is in front of the person by using the sensors and then produce a warning.
Ditch Detection	Will detect if the ground beneath the stick is lower than the actual ground level and then produce a warning to warn the person.
Stick Locator	By using the Bluetooth of the stick and the Android Smart Phone a sound will be generated to tell the person where is the stick present.

Emergency SMS	By using the button that will be placed on the stick, when pressed it will send a command to the Android Smart Phone that will send a SMS to the Emergency Contact.
GPS Tracking	By using the GPS that is already in the Smart Phone the GPS Location will be stored on the Firebase Database, so the emergency contact will be able to check where the person is at that time.
Accident Detection	By using the Gyro-Sensor of the stick it will detect whether there has been an accident and then send an emergency message to the emergency contact.

Table: 1.1: Product Scope

1.5. User Classes and Characteristics

Following are the users and their characteristics:

- **Visually Impaired Person**

Is the end user who will use all the app features that are for the visually impaired people.

- **Emergency Contact**

Is the end user who will only use the app to register and add his/her blind contact in order to track them.

1.6. Operating Environment

The Operating Environment is Mobile Based; it can only run on Smart Phones which are running on Android.

1.7. Assumptions and Dependencies

We assume that the person using the system speaks English and has knowledge on how to operate an Android Smart Phone. We also assume that the Bluetooth devises of both Arduino and the Android are paired prior to using the app.

2. External Interface Requirements

2.1. User Interfaces

- **Visually Impaired Persons Interface**

There is no need for an interface for the visually impaired person. But and interface is made for the one-time registration, login function and Bluetooth connectivity.

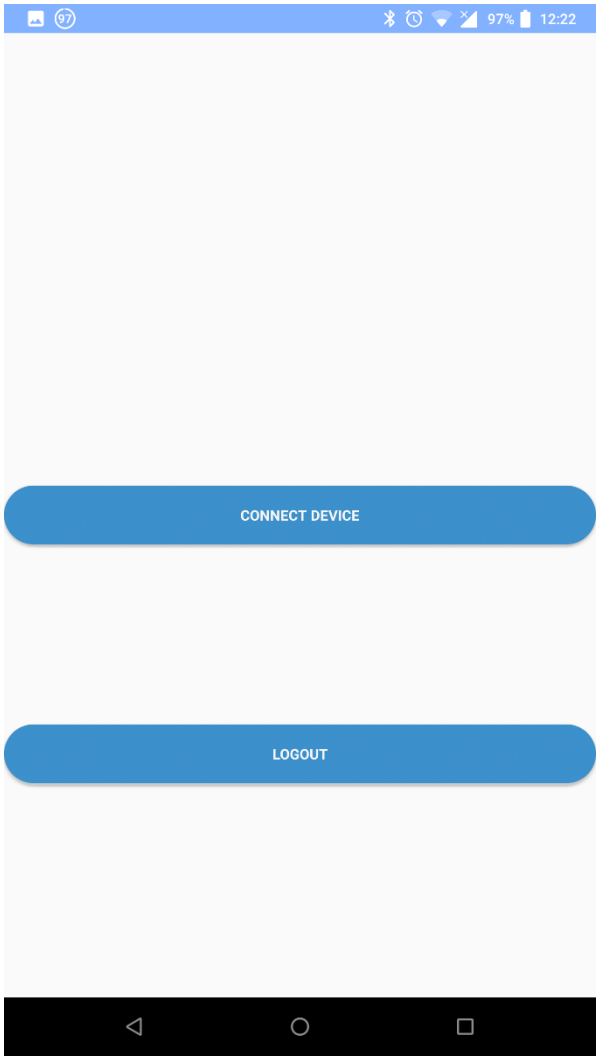

Figure: 1.1: Visually Impaired Interface

- **Emergency Contacts Interface**

The emergency contact will have an interface that will give him access to find the location of the person that is using the Tracking Function.

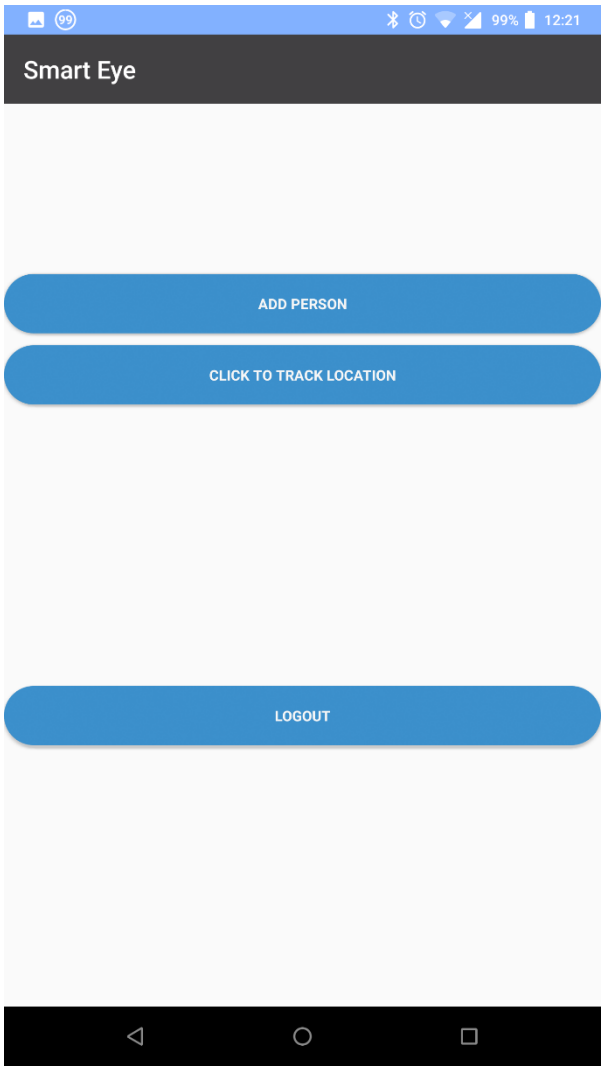

Figure: 1.2: Emergency Contact Interface

2.1.1. Hardware Interfaces

The requirements are

- Android Smart Phone
- Arduino UNO Microcontroller
- Ultrasonic Sensors
- Bluetooth Module
- Gyro-sensor Module
- Button
- Buzzer
- Potentiometer

2.1.2. Software Interfaces

Software Interfaces include JAVA that is used for the Android programming and C++ for the Arduino programming.

2.2. Nonfunctional Requirements

2.2.1. Performance Requirements

- The Bluetooth connection between the Android Smart phone and the Arduino should be permanent and constant.
- The Ultrasonic sensors should be accurate.
- Constant Internet connection on the Android Smart phone for reliable GPS Tracking.
- Mobile Network Sim with working SMS facility to confirm and verify the login password.

2.2.2. Safety Requirements

- The sensors should generate an alert for the on-coming object at least three feet before collision.
- The sensors should generate an alert for the ditch as soon as it finds the surface 5-6 inches below the ground level.

2.2.3. Security Requirements

- Only the emergency contact has the phone number of the blind person so only he/she can add and track them if anyone else adds them they would have to contact the development team to remove the specific person from the Firebase Database.

2.2.4. Software Quality Attributes

- The alert generated by the sensors should be notified immediately.
- The voice commands should be accurate so the person can understand.

2.3. Scenarios

Scenario 1:

A Blind person has purchased The Smart Eyes Walking stick and has downloaded the app, the smart eye team will then register the blind user using his/her name, email and phone number. Afterwards the app is ready to use. So it is assumed the blind person is walking down the footpath and on the footpath there are a few boxes placed by the construction team that are making a new building the blind person cannot see the boxes and cannot know that they are there until he/she runs into them so the smart eyes walking stick's sensor will detect if there is any object in front of the person and will then generate a warning so that the person can be cautious. The Blind person can set the distance he/she is comfortable with using the installed potentiometer, so that he/she can get the warning according to their preference.

Scenario 2:

The Blind person is in an emergency and has no time to access his phone to write a message or to call his emergency contact, so by pressing the button on the walking stick the Smart Eyes app will send an SMS to the emergency contact of the blind person with his/her GPS Coordinates that he/she needs help.

Scenario 3:

The Emergency contact cannot come in contact with his blind relative/friend and he/she is worried about their safety so by opening the smart eye app and logging into his/her account, they can track where is the blind person and can go and contact them or meet them.

Chapter 2 Related Work

2.1. Introduction

The literature review of Smart Eyes will provide an insight of all the work related to this project has been done and how is Smart Eyes different from the others.

2.2. Related Works (Walking Stick Using Arduino)

2.2.1. The Existing System

[1] The project was done in 2016 using Arduino Microcontroller and Ultrasonic Sensors. This system had only one feature which was object collision detection, the person was informed of the collision by using a buzzer. This system when it starts measuring the distance from any obstacle. There will be no alarm if the measured distance is more than 50cm. But, if it is less than 50cm the alarm will start by beeping the buzzer. As the object gets closer to the buzzer the beeping interval will also decrease. The closer the object is the faster the buzzer will beep

2.2.2. Limitations within Existing Techniques

This project is only done by using an Arduino microcontroller and a single ultrasonic sensor. This project only uses the Arduino microcontroller as for the entire function and as a result not many more features can be added onto it and as this is a device for the visually impaired everything has to be automated so even if we do want to add more features on the microcontroller we are restricted by the interface. This project also only has one feature that it can generate a sound by using the ultrasonic sensor that calculates the distance from the object.

2.3. Related Works (Straight Line Walk for Blind Android App)

2.3.1. The Existing System

[8] This app was developed in 2014 by ayrton12 on Android Platform, this application helps the visually impaired person to walk in straight line indoor and outdoor without GPS. It uses the devices compass to guide the blind person in walking.

2.3.2. Limitations within Existing Techniques

The app uses the Android Smartphones compass to help the person walk in a straight line weather its indoor or outdoor. This app only focuses on the direction in which the person is walking it doesn't give any warning if there is an object in the way nor does it have any other type of functionalities.

2.4. Related Works (Be My Eyes App)

2.4.1. The Existing System

[9] This app started its development in 2012 by Hans Jorgen and was completed in January 2015. This app helps the visually impaired person to connect with sighted volunteer individuals from all over the world in a live video call to help them perform their day to day tasks.

2.4.2. Limitations within Existing Techniques

The app uses the live video call which can be sometimes due unavailability of the internet. The call can also have poor performance if the blind person has a poor data plan.

2.5. Related Works (LookTel: The Money Identifier App)

2.5.1. The Existing System

[10] This app was developed in 2011 by NantWorks, this app helps the blind person to identify currency notes using the smartphones camera.

2.5.2. Limitations within Existing Techniques

The app can only identify the currency notes and perform no other day to day tasks of the blind person.

2.6. Related Works (TapTapSee: Identify Objects through photos)

2.6.1. The Existing System

[11] This app was developed by CloudSight Inc. TapTapSee is designed to help the blind and visually impaired identify objects they encounter in their daily lives. The blind person has to double tap the screen to take a photo of anything, at any angle, and hear the app speak the objects name back to you.

2.6.2. Limitations within Existing Techniques

This app can only identify day to day objects and not help him/her in navigation.

2.7. Proposed Improvements in Existing Works

As the related work uses either uses Android or Arduino but not both, the proposed system will utilize both systems and give the optimum performance. The proposed system will not only give collision detection, but will also utilize the person's smartphone to perform additional features as well that way the application can perform multiple tasks while utilizing both the Arduino microcontroller and the Android Smartphone, all the physical detection and physical access tasks will be performed by the Arduino microcontroller and all the software based tasks are performed by the Android Smartphone.

Proposed System Features

The features of the proposed system are:

- Collision Detection
- Ditch Detection
- Accident Detection
- Stick Locator
- Emergency SMS
- GPS Tracking

2.8. Summary

The Existing system used to make a smart walking stick is either by using Arduino or Android Application and both of them have features that are different from the other one, both will have something that is present in one and is not present in the other. Smart Eyes will finish this barrier to utilize both Arduino and Android Smartphone to provide overall functionalities. The hardware side will be handled by the Arduino and while all the software related functions will be done by the android application.

Chapter 3 System Design

3.1. Introduction

3.1.1. Purpose

In this section the design of the Smart Eyes will be explained.

3.1.2. System Overview

Smart Eye will be made by combining an Arduino Microcontroller and an Android Application, the Arduino will provide the result of the sensory data and the application will then respond to the sent request by the Arduino.

3.1.3. Design Map

The Design Map Includes the following:

- Sequence Diagram(SD)
- Use Case Diagram
- Entity Relationship Diagram(ERD)
- Data Flow Diagram(DFD)

3.2. Design Considerations

3.2.1. Assumptions

We assume that the person using the system speaks English and has knowledge on how to operate an Android Smart Phone. We also assume that the Bluetooth devises of both Arduino and the Android are paired prior to using the app.

3.2.2. Constraints

- Will work on Android Mobile Platform Only.
- Must have an active Bluetooth and Internet Connection.

3.2.3. Risks and Volatile Areas

- Visually Impaired people need to buy and learn how to use an Android Smartphone in order to use Smart Eyes
- The Visually Impaired people will need someone to sign-up and login for them and select the device that needs to be connected in order for the blind stick to work.

3.3. Architecture

The architecture will be explained by the following diagram:

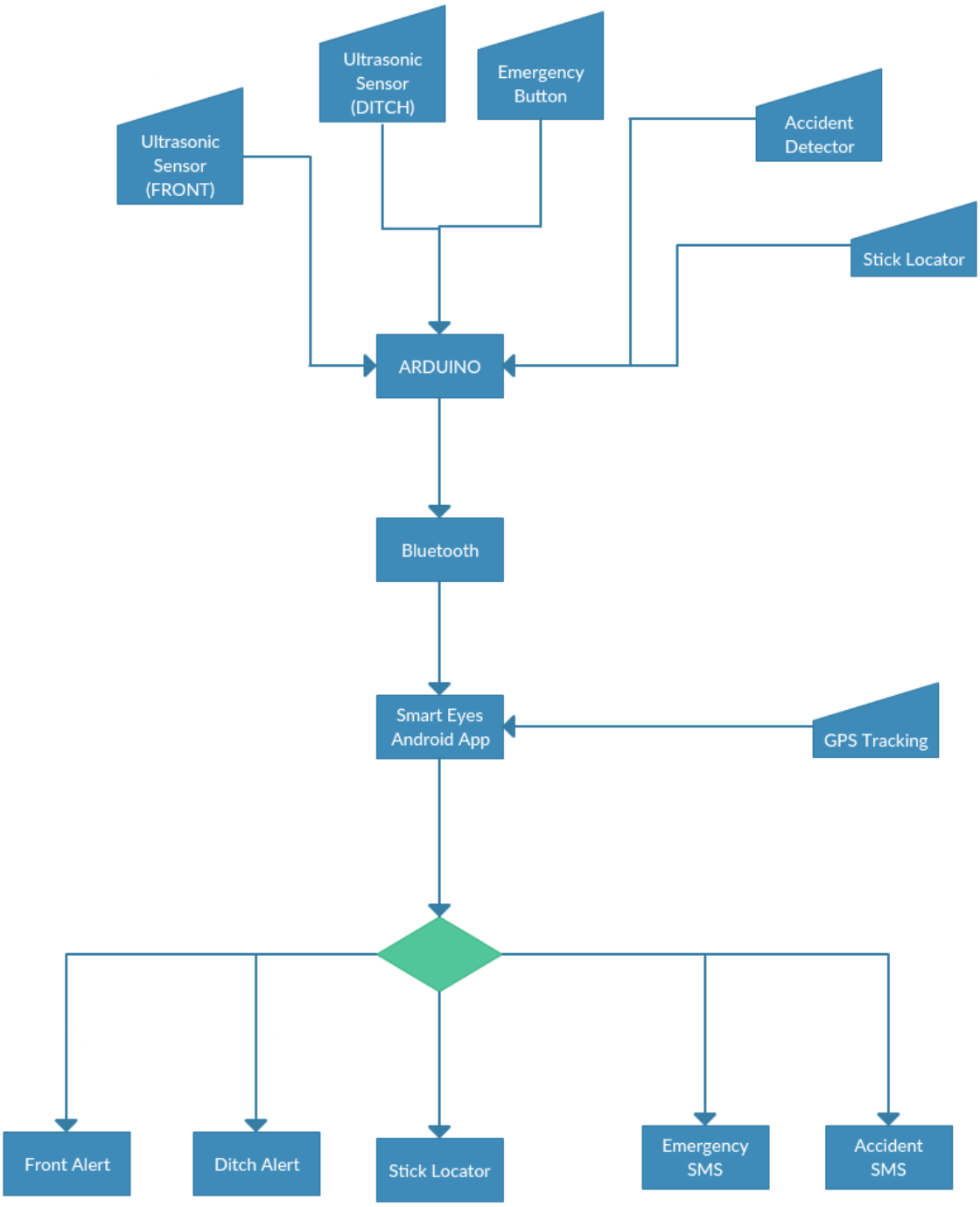

Figure: 3.1: Architecture

3.3.1. Overview

The Smart Eye system will be used by two persons the blind person and his/her emergency contact so when the blind person needs to use the app he/she would login or sign-up after that they would connect to the Bluetooth of the Arduino and then the app will start generating alerts. When the emergency contact needs to use the app they would first login or register after completing that they would need to add their blind contact by searching their phone number when the blind person is added they can then track their location.

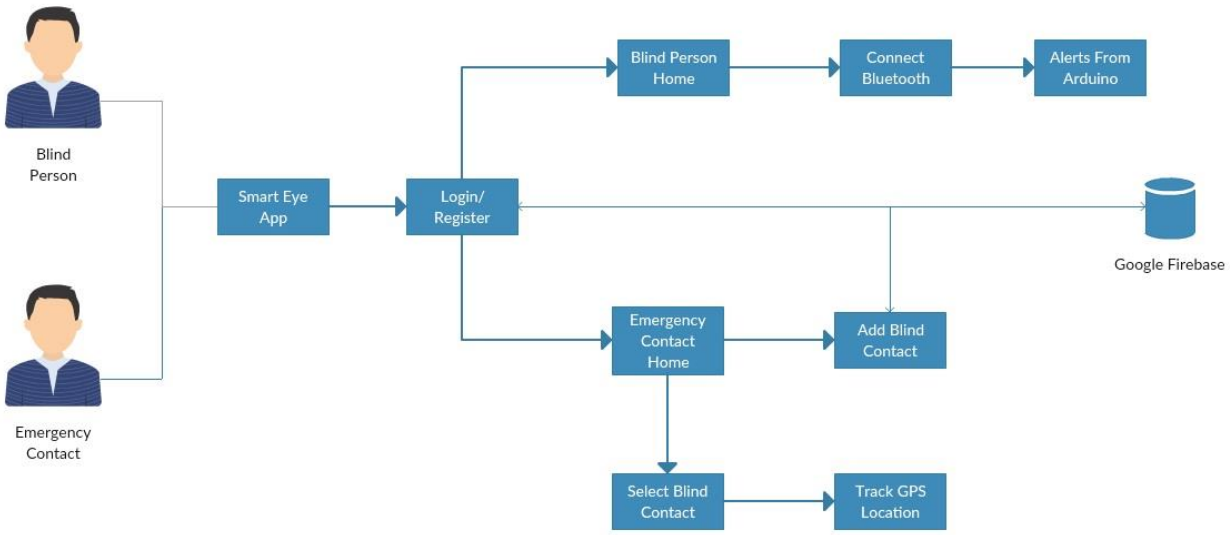

Figure: 3.2: Flowchart

3.3.2. Modules

Arduino

The Arduino will handle all of the hardware, using the sensors to get data and then process that data to get figures that will be sent to the Android App using Bluetooth.

Android App

The Android app will display all the data it got from the Arduino and will also provide other functionalities.

3.3.3. Strategy

The Android and Arduino were selected because Android is the most used mobile platform in the world and Arduino can be developed in the smallest of form factors. The Arduino programming of the sensors was done with ease as the sensors require very little code to get data from them. After getting the data from the sensors all it took was some conditional statements in an infinite loop that constantly get the data from the sensors and then process that information and then by using the Bluetooth pass it on to the Android App. In the development of the android app two things were taken into consideration that the Blind person doesn't need a GUI while the Emergency contact does need a GUI, but during the development it was found that in order for the emergency contact to access the information of the blind contact, the blind contact must also be registered to have a unique identification which can then be used to add the blind person into the list of the emergency contact so that they can track them. It was also found that the Bluetooth of the Android Phone and the Arduino all have different Bluetooth address and the same address cannot be used across all platforms so the Blind person will have to select the Bluetooth device from the paired devices list and then connect it so that it can get data form the Arduino. Which eliminates the fact that the blind person does not need a GUI, so a GUI was developed for the Blind Person as-well so that some which can be the developer, a friend or a relative of the blind person that can help him/her to connect the device but conditions were put in the app so that if the blind person presses the back key of the app accidently the app would not go immediately to the home screen instead a toast is displayed that if the user wants to go back he/she would have to press the back button again in order to go back. This was the strategy that was developed during the development of this project.

3.4. Database Schema

3.4.1. Tables, Fields and Relationships

The Database, Tables, Fields and Relationships are defined below.

3.4.1.1 Databases

Google Firebase is used for Database.

3.4.1.2 Tables

Following are the Tables that are used in Smart Eyes.

- User Table
- Blind Person Table

3.4.1.3 Fields

Following are the tables with their respective fields with some dummy data.

User Table

UID	EMAIL	NAME	PHONE	TYPE	LAT	LON	IMAGEURL	BLIND PERSON
2DUU20bgP0c3RbUXLzH178gxAT23	naeem@gmail.com	Naeem	"+923335459664"	Not Blind	0	0	""	YpEeaI2XG1Y1V7Becx8pmdBDXHt1

Table: 3.1: User Table

Blind Person

UID	NAME	PHONE
YpEeaI2XG1Y1V7Becx8pmdBDXHt1	Ahmad	"+923128222772"

Table: 3.2: Blind Person

3.4.1.4 Relationships

The only relationship required in these tables is between the Blind Person field of the Users table and the UID (User ID) in the Blind Person Table.

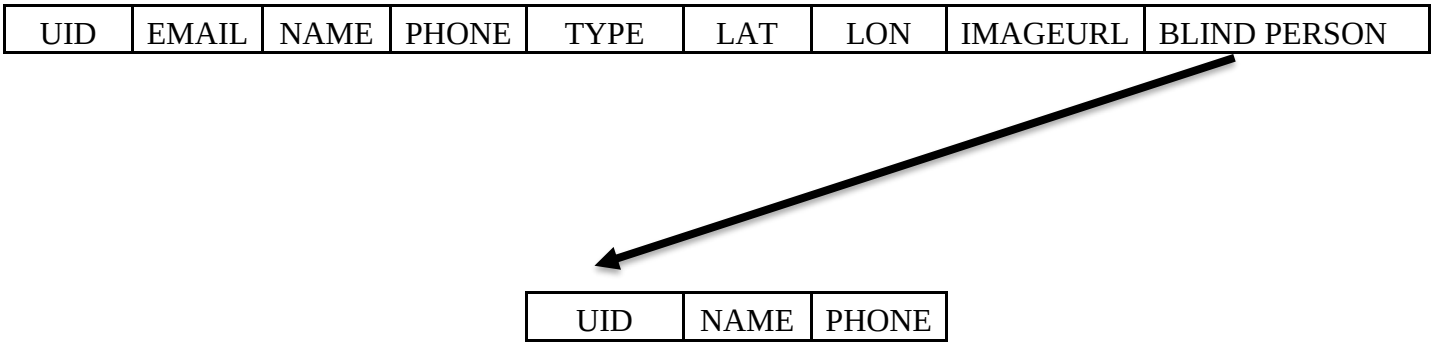

Figure: 3.3: Relationships

3.5. High Level Design

3.5.1. DFD (Data Flow Diagram)

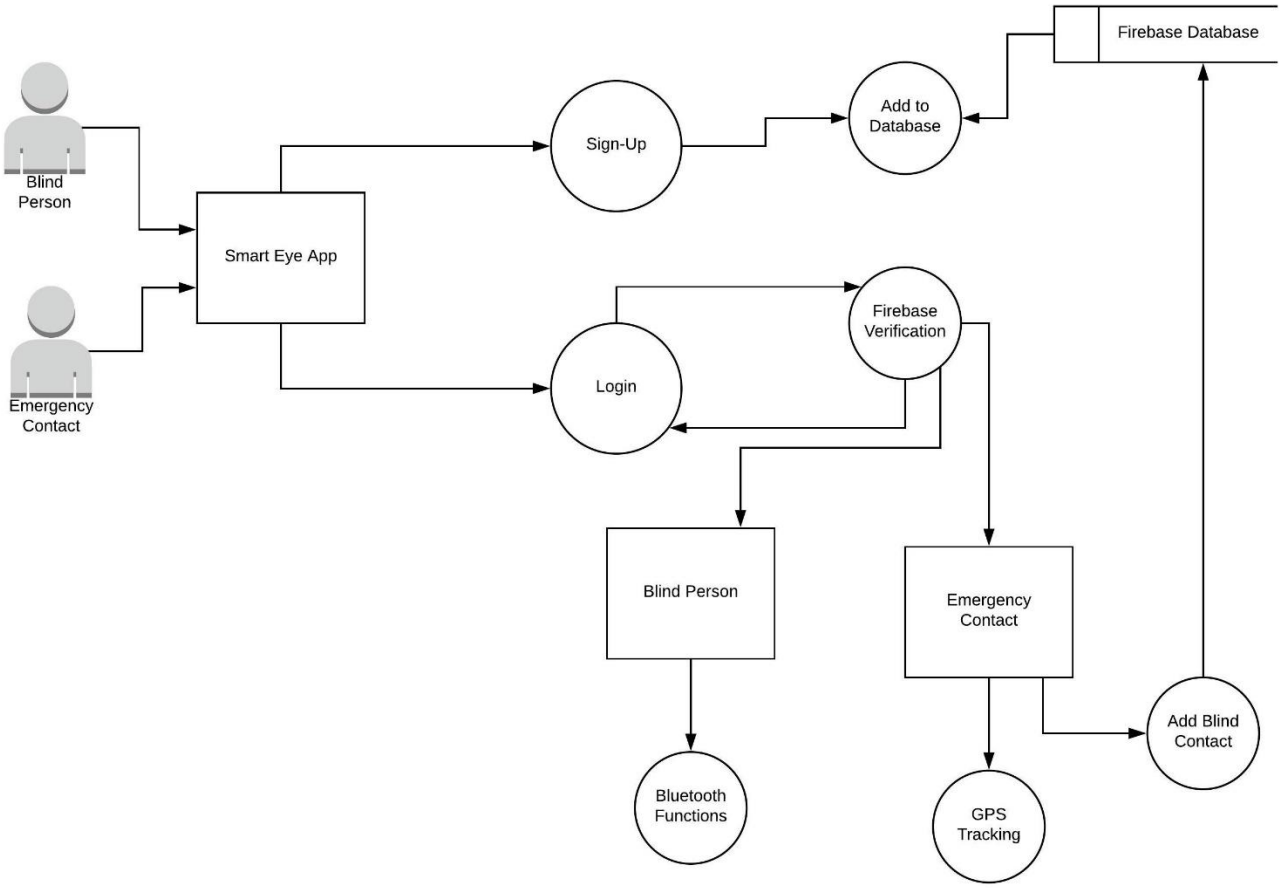

Figure: 3.4: DFD

3.6. Low Level Design

3.6.1. Use Case

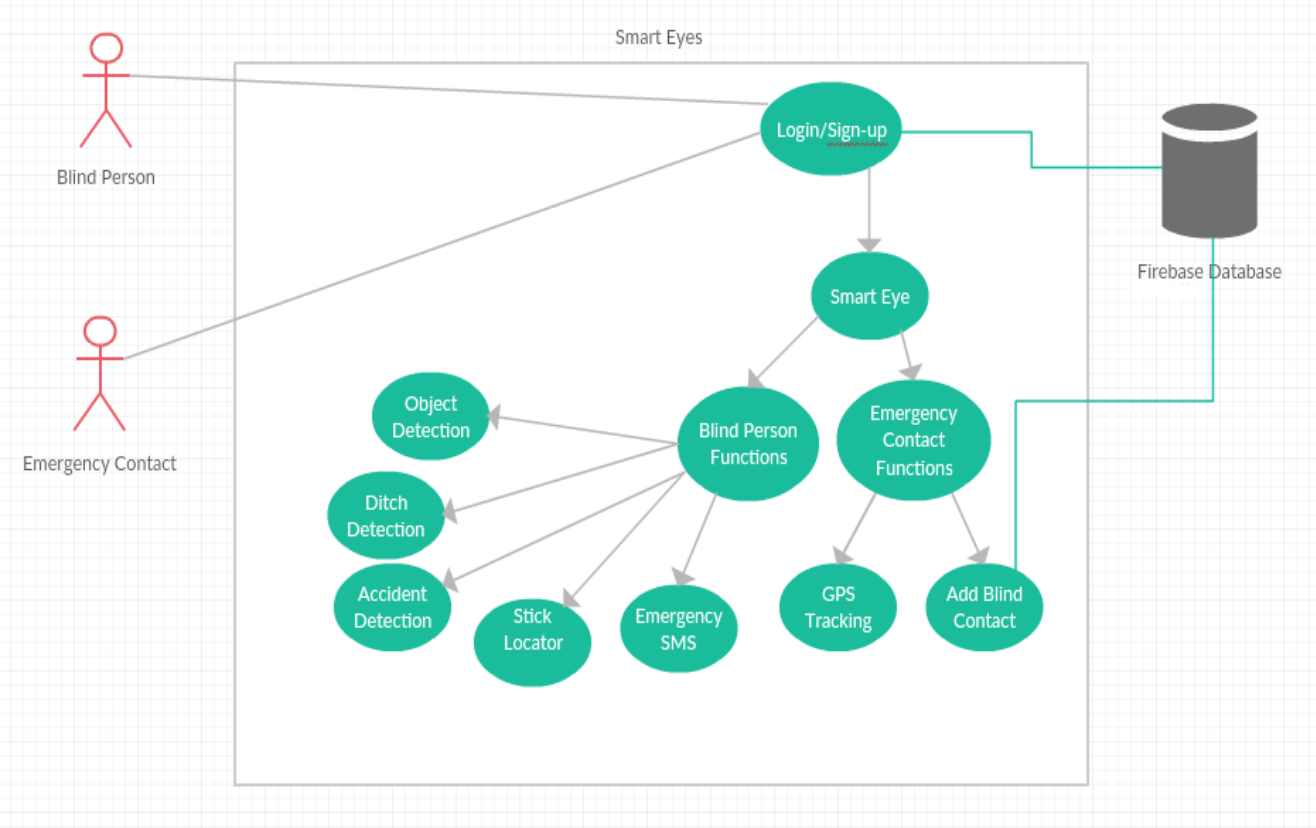

Figure: 3.5: Use Case

Use Case Name	Smart Eye All Operations
Actors	Blind Person Emergency Contact Firebase Database
Purpose	Detect Objects Detect Ditches Detect Accidents Stick Locator Emergency SMS GPS Tracking Add Blind Contacts Login and Sign-up
Overview	All the functions of the Smart Eyes are being performed in this use case.
Type	PRIMARY
Pre-condition	The System interface and all its components must be running without failure.

Table: 3.3: Use Case

3.6.2. Sequence Diagrams

Collision Detection

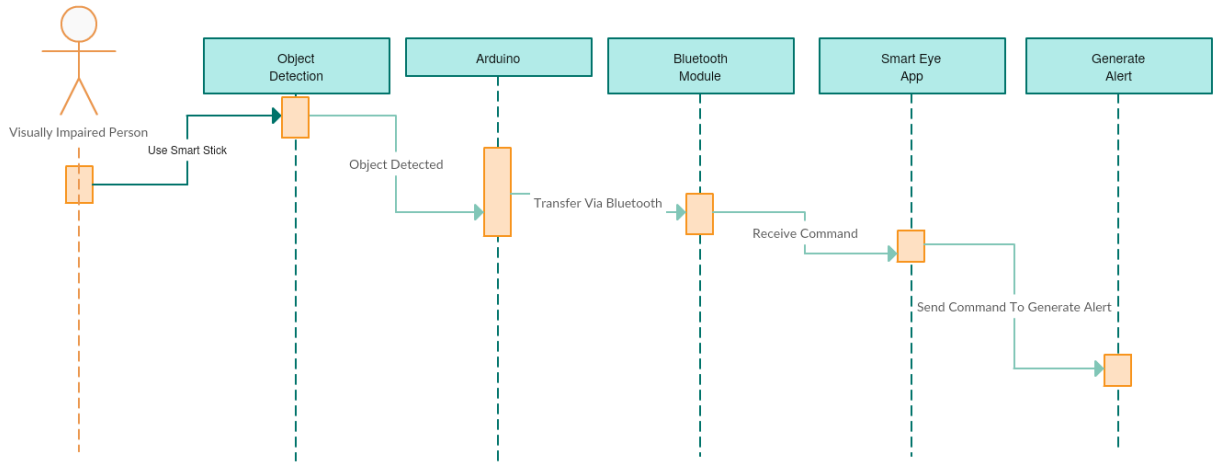

Figure: 3.6: Collision Detection Sequence Diagram

Ditch Detection

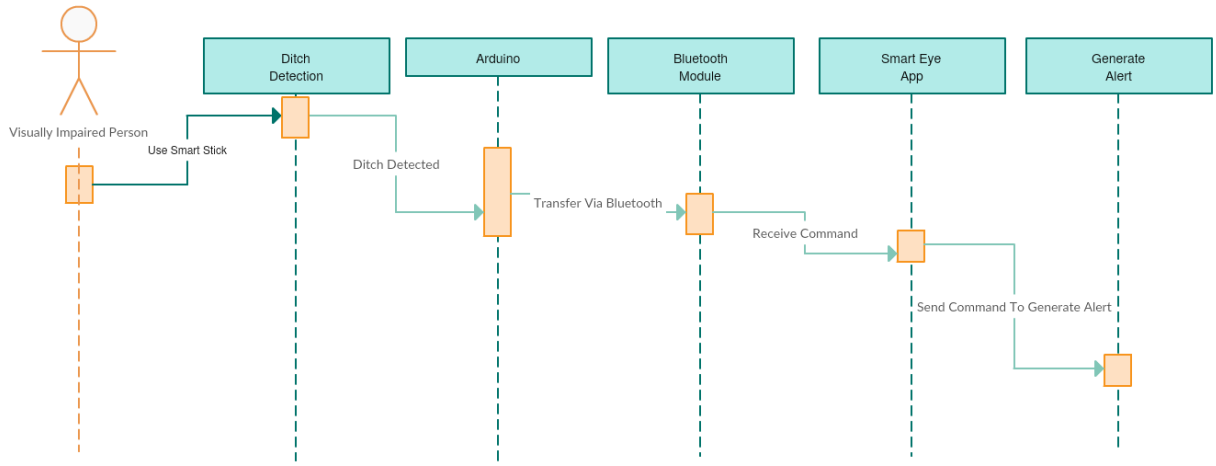

Figure: 3.7: Ditch Detection Sequence Diagram

Accident Detection

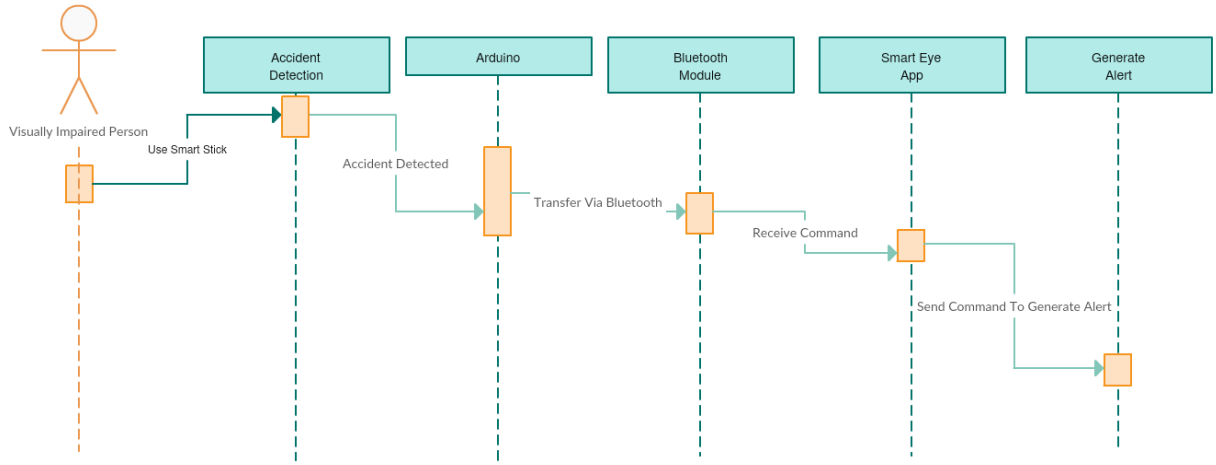

Figure: 3.8: Accident Detection Sequence Diagram

Emergency SMS

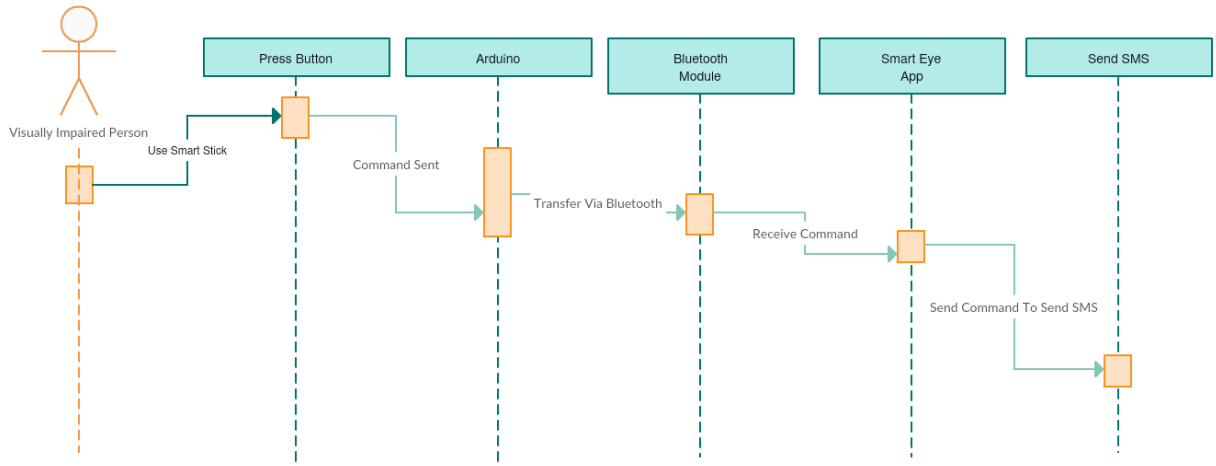

Figure: 3.9: Emergency SMS Sequence Diagram

GPS Tracking

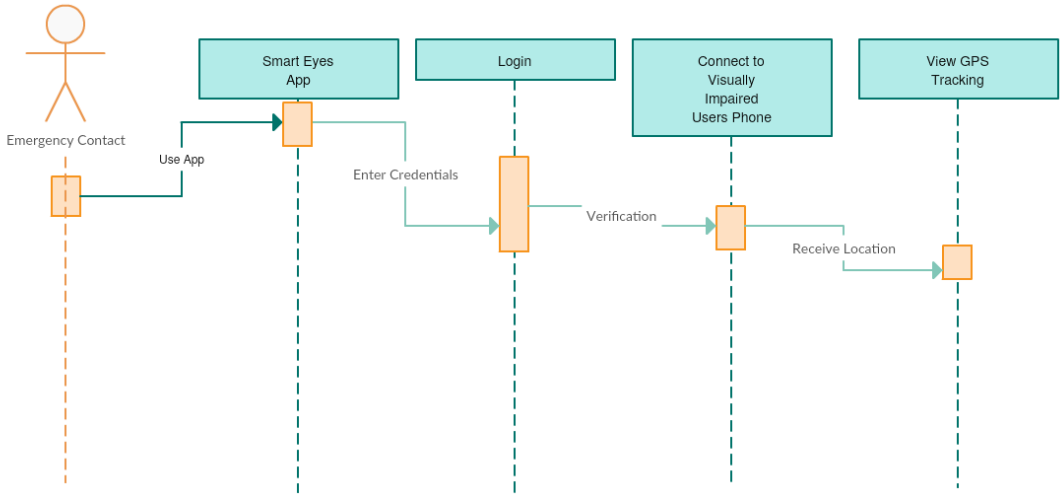

Figure: 3.10: GPS Tracking Sequence Diagram

Stick Locator

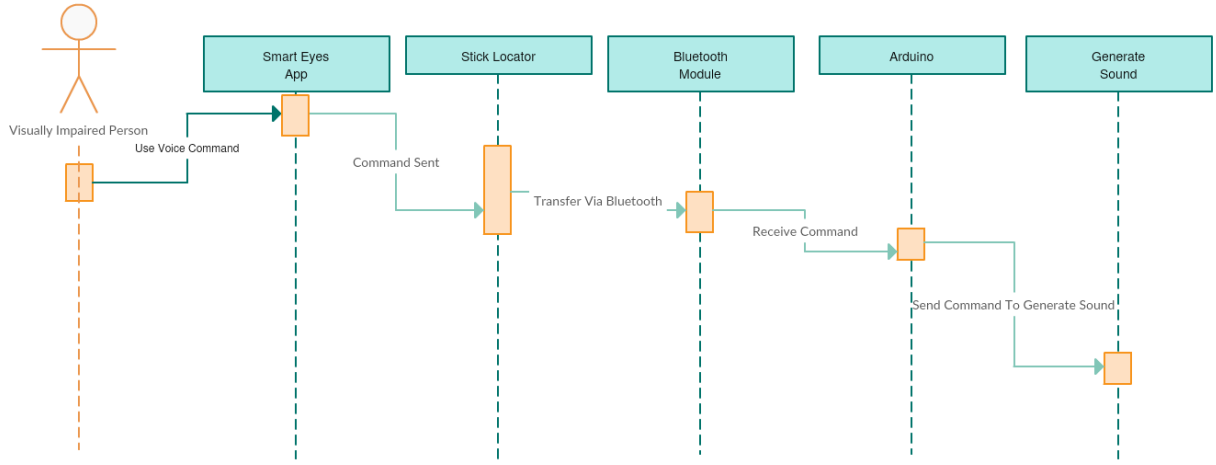

Figure: 3.11: Stick Locator Sequence Diagram

3.7. User Interface Design

3.7.1. Application Controls

Every one of the screens of the application have a typical minimalistic layout, with great shading plan no toolbars were required for this app just the vital buttons were included, to give the client a simple layout to utilize understanding.

3.8. Summary

The Smart Eye walking stick is a combination on both Android and Arduino, the hardware side of the system is handled by the Arduino and the Software side of the system is handled by the Android. All the sensors are connected to the Arduino and is linked to the Android app through a Bluetooth connection. The Data which the sensors are collecting is processing by the Arduino and then passed along to the Android application. The Android application has interfaces made for two people The Blind Person and The Emergency Contact. The blind person and the emergency contact would both be required to Login/Sign-up into the application. The Database of the system is being handled by Google Firebase. After the login of the users is complete the users can access their corresponding functions. The Blind person can connect the App to the Arduino so that the alerts can be generated. The Emergency contact can find the blind person using their phone number and then add them after adding them they can track them using the GPS Tracking function. The GUI of the system is made easy to use so that the users will have no problem navigating through the system.

Chapter 4 Implementation

5.1. Discussion

The Smart Eyes Walking Stick is going to be developed on two platforms Android and Arduino. Arduino which is to be coded in Arduino IDE using C++ Language while the Android is to be coded in Android Studio using JAVA Language. The database which is used in the Android is by Google Firebase. The Ultrasonic sensors, gyro sensor, Bluetooth module, push button, buzzer and potentiometer are all connected to the Arduino UNO and the Arduino will transmit the result of the data collected by the sensors. The Android application will generate all the results according to the received results. The Android application will also have Login and Sign-up features along with GPS Tracking feature. The Blind person will have to sign-up and connect the device once which will be done by the developers themselves. The Emergency Contact will also have to sign-up and register to add their blind contacts and to use the GPS Tracking activity.

5.2. Development Methodologies

Hardware Implementation

The following are the hardware components that are going to be used

Arduino Uno

Arduino Uno is a small microcontroller board. This board has set of digital and analog input and output pins that can be interfaced to get the required components working.

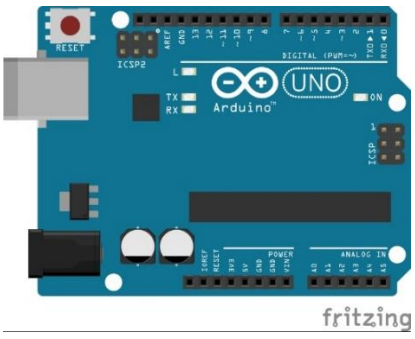

Figure: 4.1: Arduino UNO

HC-05

This is an easy to use Bluetooth module which is designed for transparent serial communication.

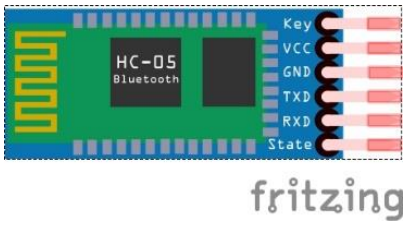

Figure: 4.2: HC-05

MPU-6050

The MPU-6050 is a 6-Axis Gyro Sensor, which means it will give output in 6 coordinates which are X, -X, Y, -Y, Z and –Z. By using these coordinates, we can determine in which direction the device is turning.

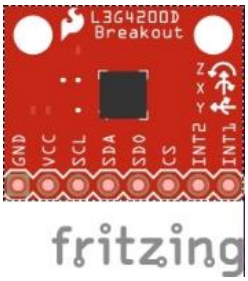

Figure: 4.3: MPU-6050

HC-SR04

The Ultrasonic Sensors will produce an 8 cycle sonic burst which will travel at the speed of sound, which will be bounced back from the object that will be in front of the sensor and the sensor will determine how far is the object.

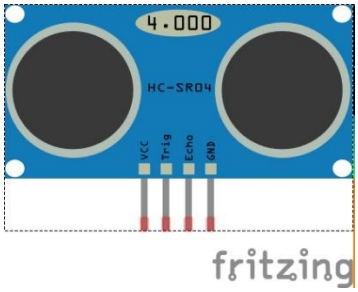

Figure: 4.4: HC-SR04

Potentiometer

A potentiometer is a simple knob that provides a variable resistance, which we can read and get the values which range from 0 to 1023. If the knob is turned Counter-Clockwise the output will decrease and if the knob is turned Clockwise it will increase the values.

Figure: 4.5: Potentiometer

Push Button

The push button is a traditional push button whose one pin is grounded and the second is put on an Arduino port so whenever the button is pressed the Arduino knows that something has been pressed.

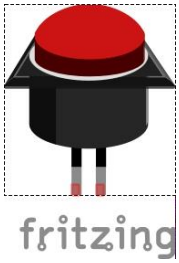

Figure: 4.6: Push Button

Buzzer

This is a common buzzer which is also connected with one pin on ground and the second on the Arduino wo when the Arduino will want to turn the buzzer on it will turn the output of the pin of the buzzer to high.

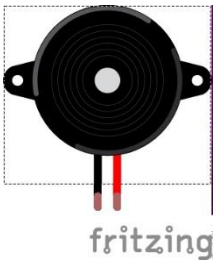

Figure: 4.7: Buzzer

Hardware Pin Layout

The following is the Arduino Pin Layout; it shows which pins are connected to which component.

Component	Component Pin	Arduino Pin
HC-SC04-1	VCC	5V
HC-SC04-1	GND	GND
HC-SC04-1	Echo	2
HC-SC04-1	Trig	3
HC-SC04-2	VCC	5V
HC-SC04-2	GND	GND
HC-SC04-2	Echo	4
HC-SC04-2	Trig	5
HC-05	VCC	5V
HC-05	GND	GND
HC-05	TX	RX
HC-05	RX	TX
MPU-6050	VCC	5V
MPU-6050	GND	GND
MPU-6050	SCL	SCL
MPU-6050	SDA	SDA
Potentiometer	VCC	5V
Potentiometer	GND	GND
Potentiometer	Analog	A0
Buzzer	VCC	7
Buzzer	GND	GND
Push Button	VCC	8
Push Button	GND	GND

Table: 4.1: Hardware Pin Layout

Hardware Circuit Diagram

The following is the Circuit Diagram of the Arduino and the Components it shows how the components are connected.

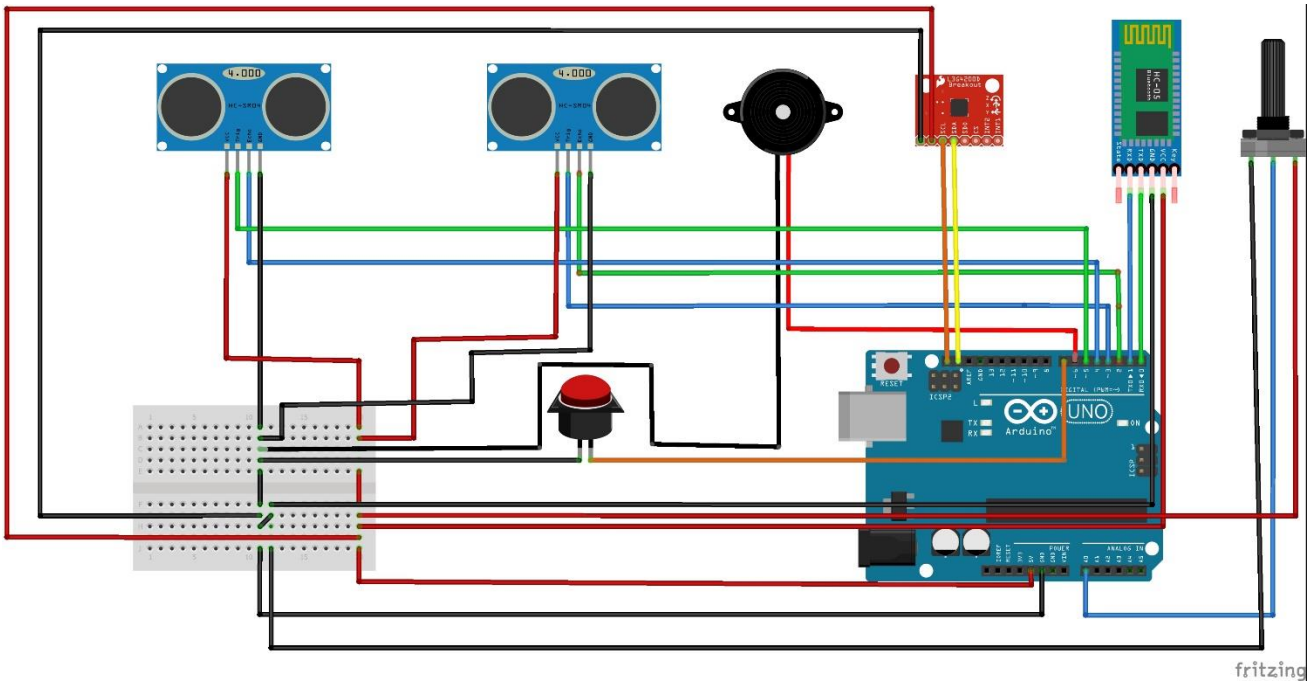

Figure: 4.8: Hardware Circuit Diagram

Software Implementation

The Software implementation of the Android application for Smart Eyes, was done on API 27 which supports up to Android 8.1 Devices, the apps working is, when the app is opened after the splash screen the user is given two options either I'm Blind or Track a Blind Person.

If 'I'm Blind' is pressed it will take the user to the Login and Sign-up page of the blind person there the blind person will be registered or if he/she is already registered, he/she can sign-in. After the sign-in is complete the user is taken to the activity that will connect the Bluetooth of the Arduino. After the connection is complete the app will then start generating alerts according to the data that is being sent by the Arduino.

If 'Track a Blind Person' is pressed it will take the user to the Login and Sign-up screen of the Emergency Contact where the emergency contact can either login or sign-up. After the login is complete the Emergency contact will be brought to the activity where the emergency contact can add his/her blind contact by searching their mobile number. After the blind person is added the track button can be pressed from where the user will select the blind contact they want to track and then after that person is pressed the person will be shown the location of the blind person.

Screenshots

Splash Screen

This is the Splash Screen that is displayed when the app is started.

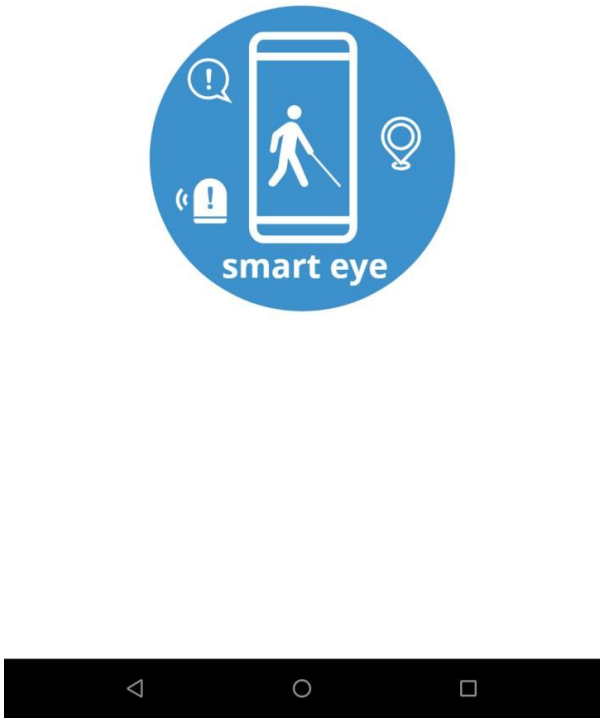

Figure: 4.9: Splash Screen

Main Screen

This is the main screen where the User will be chosen either Blind or Emergency Contact.

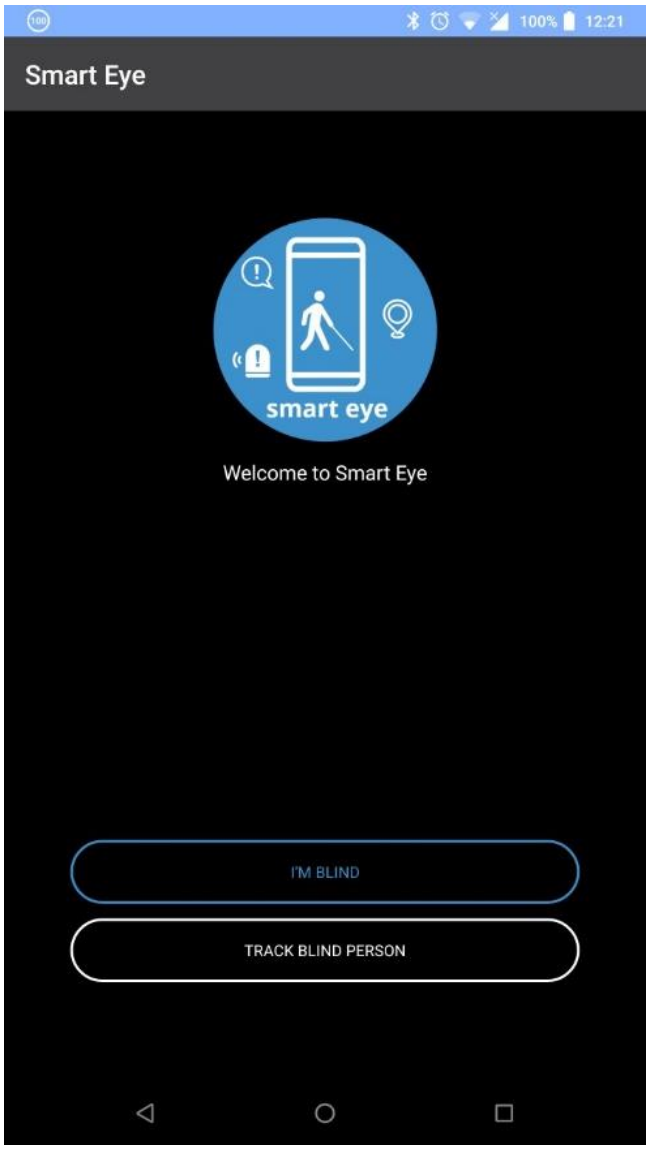

Figure: 4.10: Main Menu

Login/Register Screen

This is the Login/Register screen where the User will Login or Register.

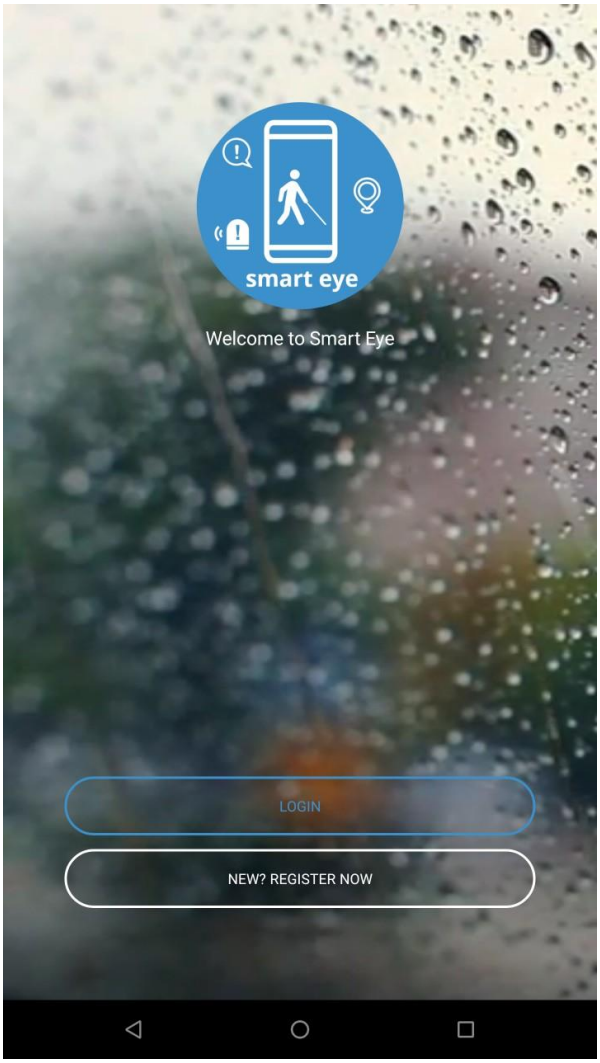

Figure: 4.11: Login/Register

Register Screen

This is the Register screen where the User will be able to Register themselves.

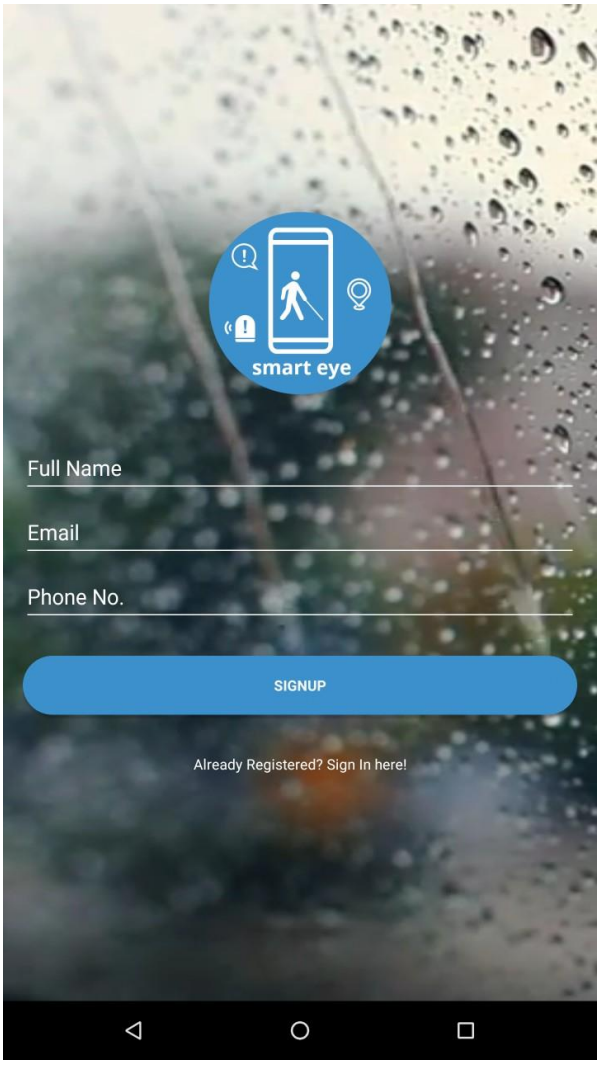

Figure: 4.12: Register

Login Screen

This is the Login screen where the User will be able Login into the app.

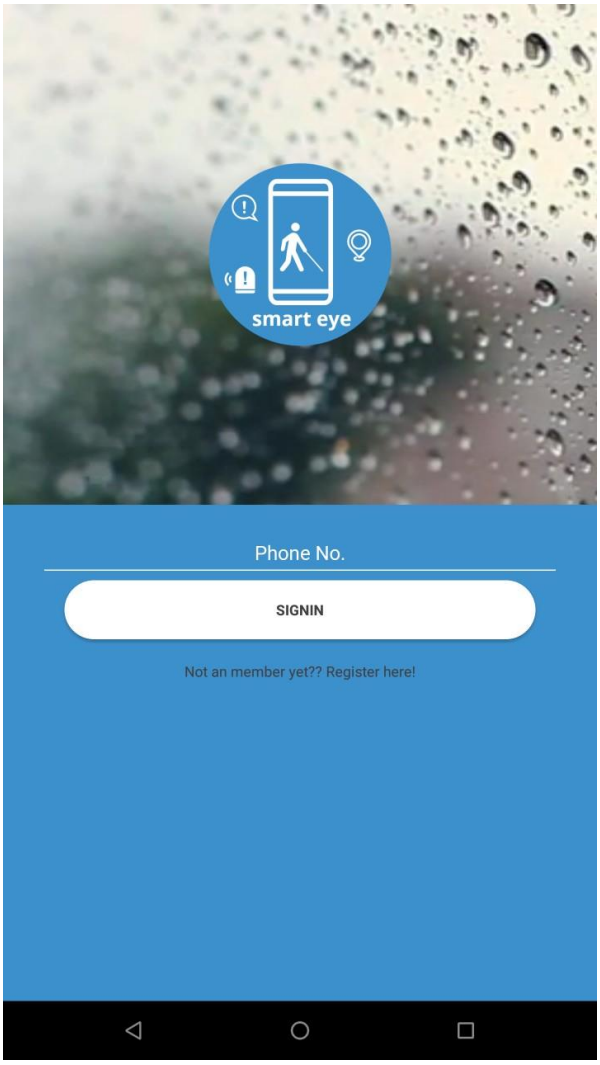

Figure: 4.13: Login

Verification Screen

This is the Verification screen where the User will verify their phone numbers by using the code that will be sent to them through SMS.

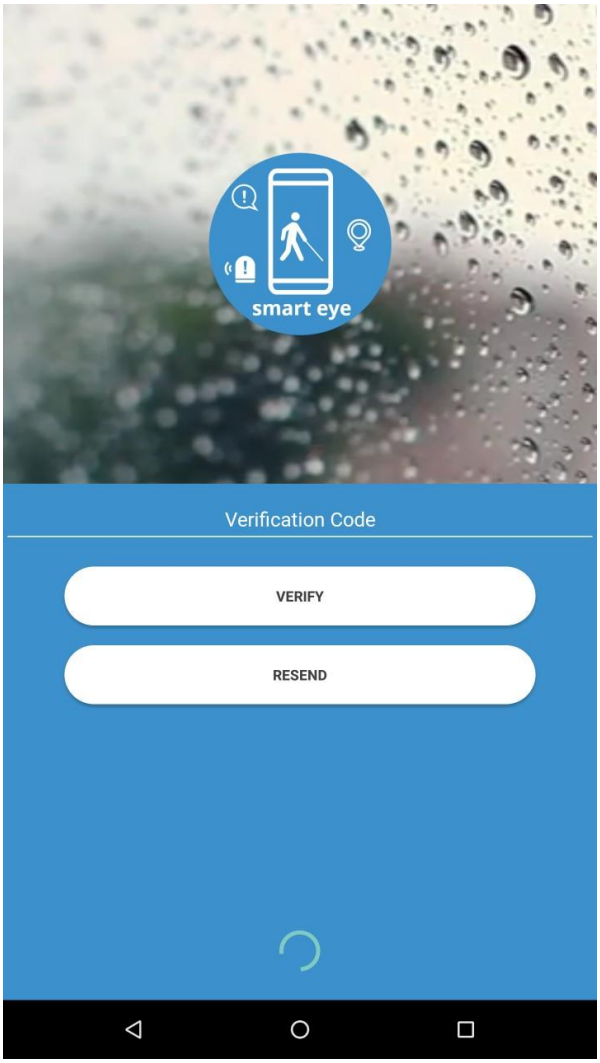

Figure: 4.14: Verification

Blind Person Home Screen

This is the Home screen for the blind person where they will connect to the Arduino Bluetooth.

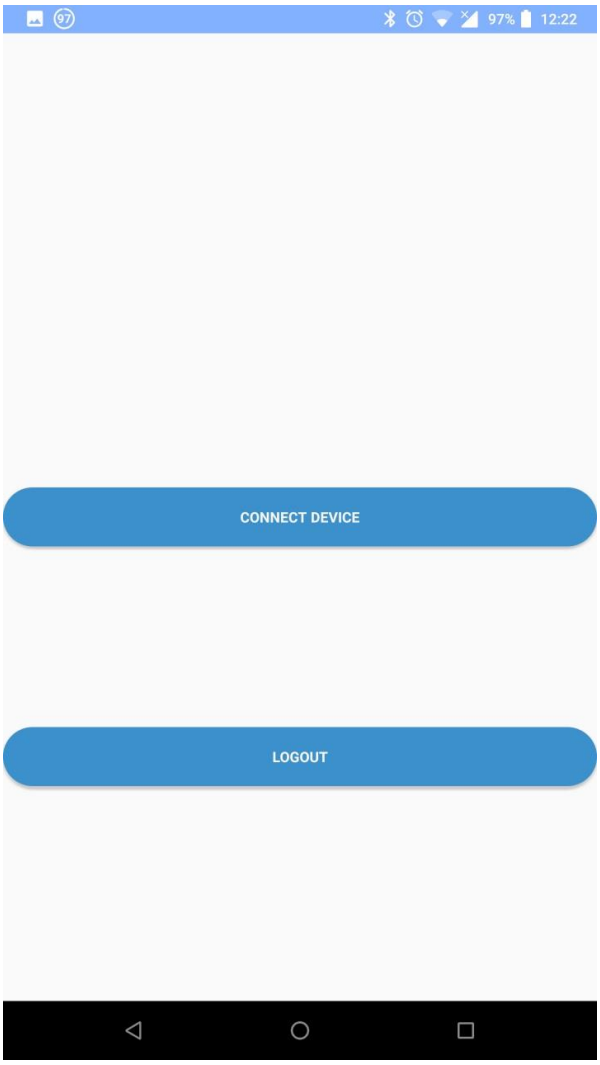

Figure: 4.15: Blind Person Home

Select Bluetooth Screen

This is the Select Bluetooth Device screen where the User will choose the Bluetooth they want to connect to.

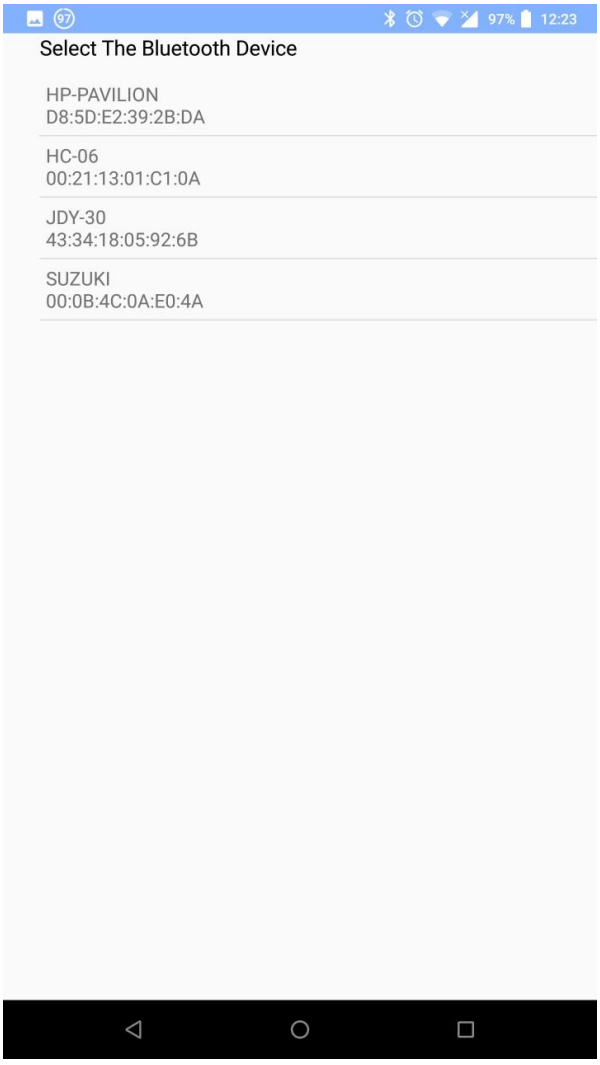

Figure: 4.16: Select Bluetooth

Emergency Contact Home Screen

This is the Emergency Contact Home screen where the User will be able to add the blind contact and then track them.

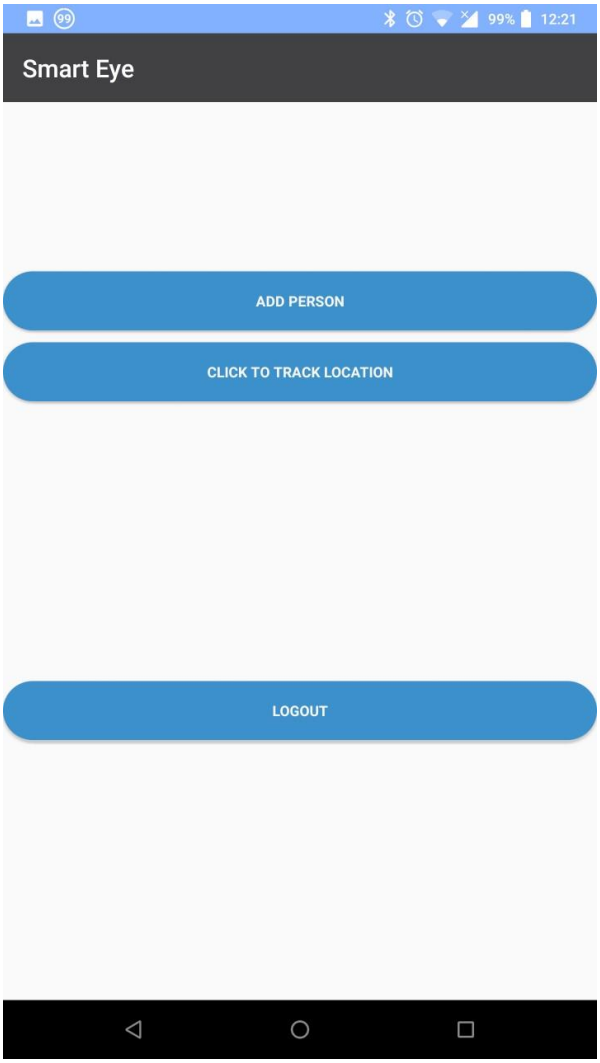

Figure: 4.17: Emergency Contact Home

Search Person Screen

This is the Search Person screen where the User will be search the blind contact using their phone number and then add them.

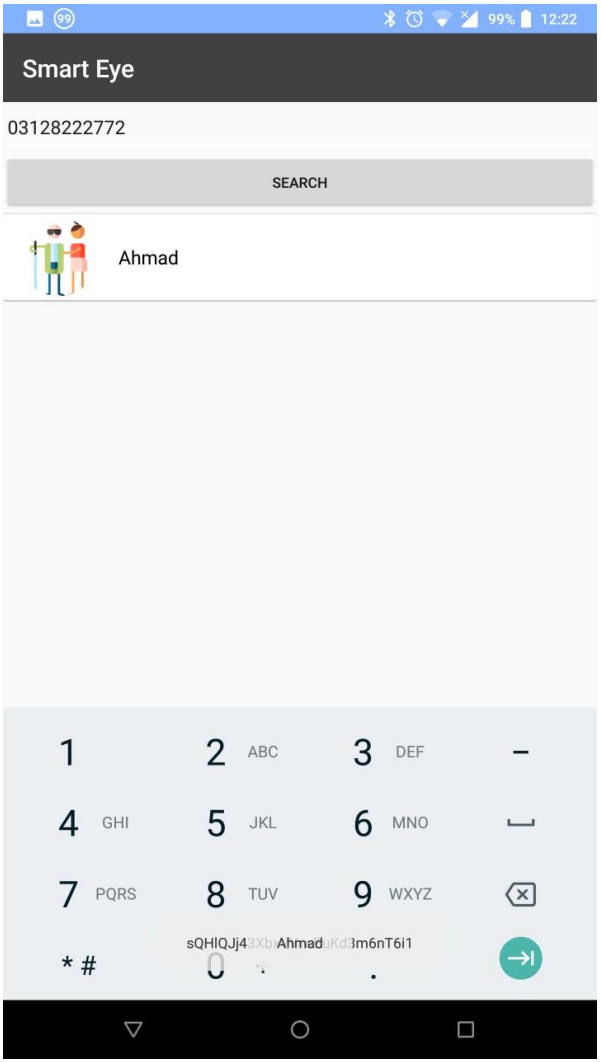

Figure: 4.18: Search Person

Select Person Screen

This is the Select Person screen where the User will select the person they want to track.

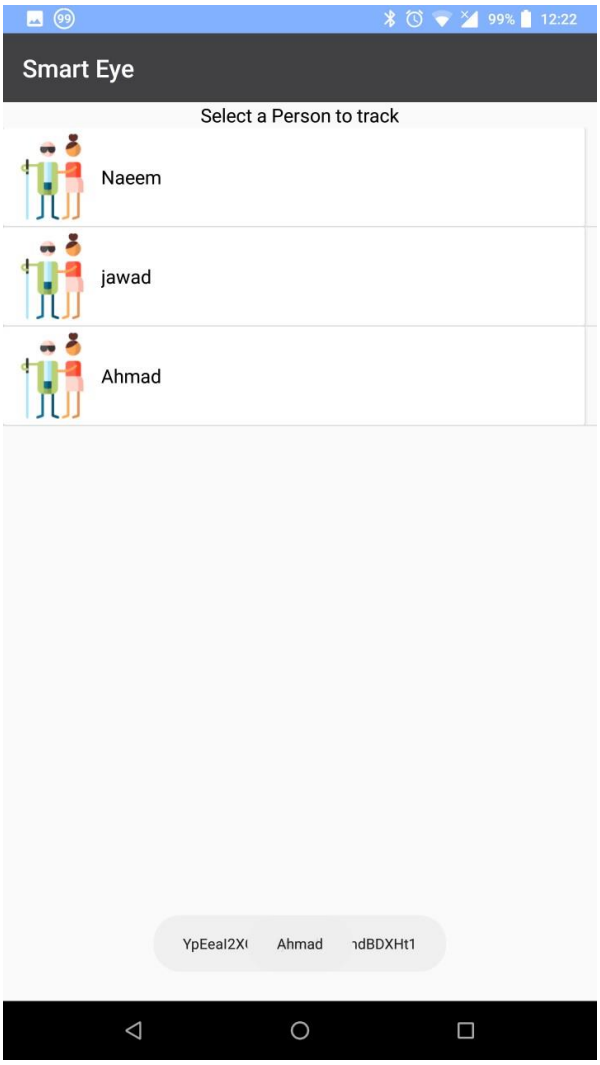

Figure: 4.19: Select Person

Tracking Screen

This is the Tracking screen where the User will be able to see the location of the blind person.

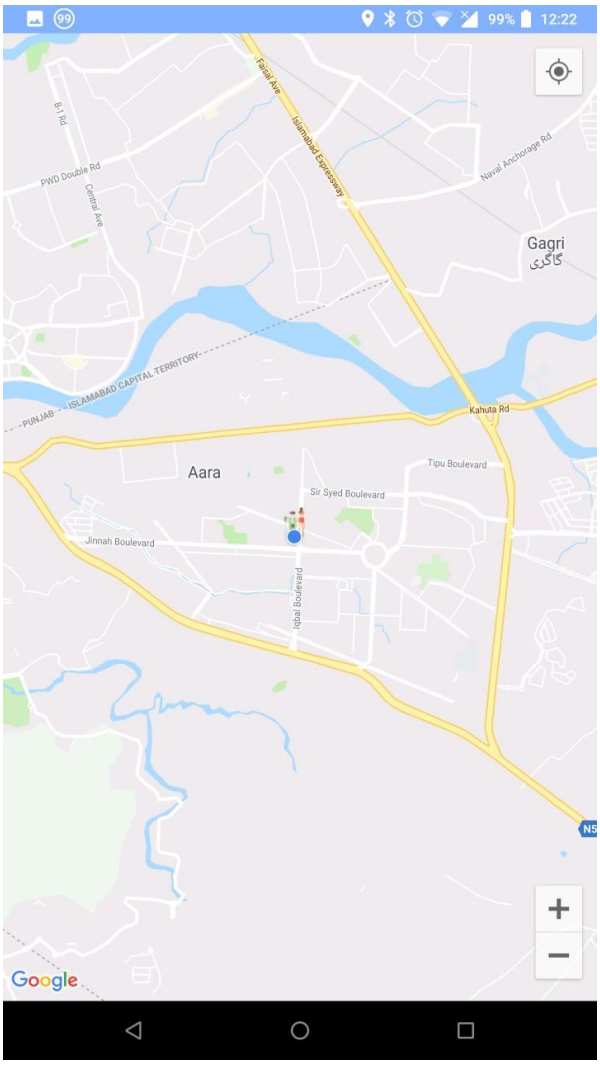

Figure: 4.20: Tracking

5.3. Implementation Tools and Technologies

Software

Following are the Platform and the Software that is being used in the project:

Platform

- Android
- Arduino

Tools

The Tools that are used for this project are:

Android Studio

- Tool: Android Studio
- Language: Java

Arduino IDE

- Tool: Arduino IDE
- Language: C++

Firebase

- Tool: Google Firebase Console

5.4. Summary

The Implementation of this project was done on two platforms Android and Arduino. Android was developed on Android Studio while Arduino was coded on Arduino IDE.

Firstly, all the necessary connections to the Arduino and the components were made then the code was developed to make the components work and to get data from them. After the Arduino development the android development was started in which firstly the interfaces were made then the firebase was added then firstly the login/register functionality was made after this function the GPS tracking function was made then in the end a function was made to connect the Bluetooth of both devices, after the connection was established the necessary changes were made to get the notifications working on the android.

Chapter 5 Testing

5.1. Testing Techniques Employed for This Project

The Following Techniques have been used to test this Project:

- Integration Testing
- Usability Testing
- Installation Testing

5.2. Test Cases

Integration Testing

Test Case ID	Test Case Objective	Test Case Description	Expected Result	Actual Result
1	To check if the Login of the app is Saving data in Firebase	Enter Data in Login of App and See if the data is stored in the Firebase	Data is stored	Data is stored
2	To check after the blind log in functon the Bluetooth function activity is opening	After entering the login credentials for the blind the bluetooth activity should be open	Bluetooth Activity is running	Bluetooth Activity is running
3	To check if the apps bluetooth connection is established with the arduinos bluetooth	After pairing of the bluetooth devices, the arduino begins transmission of the data to the bluetooth of the android	Both the Bluetooth devices are working and data is being transmitted	Both the Bluetooth devices are working and data is being transmitted
4	To check if the after the emergency contact login the tracking and adding blind contact page is working	After entering the login credentials for the emergency contact the tracking and adding blind contact activity should be open	Tracking and Adding Blind Contact Activity is running	Tracking and Adding Blind Contact Activity is running

Table: 5.1: Integration Testing

Usability Testing

Test Case ID	Test Case Objective	Test Case Description	Expected Result	Actual Result
1	Check if the Sign-up Function is Saving Data in the Firebase Database	Enter Data in the Sign-up Fields and check if the data is saved in the Firebase Database	Data is Saved	Data is Saved
2	Check if the Login Function is Working	Enter Data in the Login fields and check if the data which is entered is sent to Firebase and is confirmed that it is accurate	Login Function is working	Login Functoin is Working
3	Check if the Authentication code which is sent by the Firebase	Check if the Firebase Authentication code is accurate and the app confirms automatically from the incoming SMS	Authentication code is accurate and is confirmed	Authentication code is accurate and is confirmed
4	Check if the Arduino and Android app are connected and the app is generating the appropriate warnings	Connect the Arduino with the Android app and put something infront of the sensors so that they are triggered and they generate a warning	Devies are Connected and Generating Responses	Devies are Connected and Generating Responses
5	Check if the Emergency Contact can add their blind contact	After Emergency contact login the Emergency Contact can then search the blind contact using their phone number the phone number is confirmed from the Firebase and then the results are shown so the contact can be added	Blind Contact is being found and can be added	Blind Contact is being found and can be added
6	Check if the Emergency Contact can track their blind contact	After the blind person is added the person can go to track location and select his/her specific friend and then track their location	Tracking is Working	Tracking is Working

Table: 5.2: Usability Testing

Installation Testing

Test Case ID	Test Case Objective	Test Case Description	Expected Result	Actual Result
1	Install on Android OS 6	App was installed and checked on API Level 23	App and Every feature is working	App and Every feature is working
2	Install on Android OS 7	App was installed and checked on API Level 24	App and Every feature is working	App and Every feature is working
3	Install on Android OS 8	App was installed and checked on API Level 26	App and Every feature is working	App and Every feature is working
4	Install on Android OS 8.1	App was installed and checked on API Level 27	App and Every feature is working	App and Every feature is working

Table: 5.3: Installation Testing

5.3. Test Results

All the tests that were performed were successful all the functionalities of the Android app and the Arduino were checked. All the data was being transmitted and all the alerts were being generated.

Chapter 6 Conclusion

6.1. Conclusion

The delivered project is for the blind community of the world who are in need of this new rapidly developing technology to benefit their lives. So by making Smart Eyes we have combined the two platforms of Arduino and Android, so that the sensors can work on the Arduino and send that data via Bluetooth to the Android application form the users can perform their respective functions. In the future more functions can be added to the application to make it completely voice based for the blind person, while the emergency contact can still use the traditional GUI.

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Appendices

Appendix A: Plagiarism Report

Turnitin Originality Report

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