AudioUnlock: An Internship Project

By

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Attestation

This body of work is created solely based on a project with an original idea in collaboration with my company's supervisor. I attest that no part of this report is plagiarised from other sources.

_____   _____
Signature   Date

Labib Rahman
_____
Name

Acknowledgement

Letter of Transmittal

To
Moumita Asad
Lecturer
Independent University, Bangladesh
Plot 16 Aftab Uddin Ahmed Rd,
Dhaka 1229

Dear Madam,
I am very pleased to submit my internship report titled "AudioUnlock: An Internship Project", completed at Massive Electronics. I have successfully completed my internship period at this company and look forward to working with them as a full time employee.

With that said this report contains all the details of the project that I undertook during my internship period at the company. With the help of my supervisor I have successfully created the mobile app along with the web app that fulfills all the requirements exhibited in the internship presentation earlier in the semester. I tried to follow all the instructions that you gave us in class and tried to create this report inline with that guidance. Throughout this process I've evolved as a student, employee and as a developer. Finally I would like to express my gratitude for your constant support throughout this entire process. Thank you for your time and consideration.

Sincerely,
Labib Rahman
1710514
CSE Department, IUB

Evaluation Committee

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Signature

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Name

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Supervisor

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External Examiner

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Name

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Convener

Abstract

Mobile phones are an integral part of our daily life. It has transcended beyond it's initial purpose of contacting people and now has a key role in a lot of the things we do everyday. Young people especially are inseparable from their devices and they use it everyday for a large number of hours. But one aspect of young people using these devices is that they use a lot of social media apps which has a lot of notification sounds and so they tend to mute their phones most of the time. What this leads to is their phone being on silent all the time. Now this creates a problem when they lose track of their phone. Since their phone phone is on mute they can't call it and find it difficult to find their phones. To solve this very issue I propose a mobile app: AudioUnlock, where users can send a text with an unique code to unmute and locate their phone. The app will also feature a location module that will help users of the app find other users on a map on the app. A web app will accompany this product that will allow users to retrieve their code easily and securely. The app will be GSM and cloud based which will solve the commmon inconvenience of losing one's phone.

Keywords— mobile-app, GSM, cloud, unmute, locate

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Chapter 1

Introduction

I, Labib Rahman from the CSE department acquired an internship in a company named Massive Electronics in the month of June, 2021. I got recruited through networking since I had a past work relationship with the company. The company is a micro-controller based tech firm based in the Telecom sector providing services for the industry giants such Grameenphone, Banglalink and Robi. My role in the company is one of an unpaid tech intern as a mobile app developer. I also help debug code of micro-controller interfaces under supervision. I am hoping this will be a stepping stone for my career in mobile app development.

1.1 Overview/Background of the Work

My role as a mobile app developer entails that I will be working on developing apps and AudioUnlock is the first major project of my internship that will ensure my time as an intern is spent productively. Initially I started working on the project with a co-developer but I eventually took the whole project under my umbrella and intend to finish it myself under the supervision and guidance of the supervisor and co-developers. The AudioUnlock app is a mobile application for android devices that can help users locate their phone by sending a text from another phone to their phone if it gets lost. It's a GSM based app that allows users to locate their phone in the case that it gets lost on mute using a text and gps(if connected to the internet). Our app is focusing on an sms based system that can generate a code that will be stored on the target phone. Anyone can send this code to the target phone through a text in case they lose it. This will be read by the target phone automatically and unmute the phone, playing their ringtone in the process. If the target phone is connected to the internet it will also get its location data and send it on the app if the requesting phone has it. It is not mandatory for the requesting phone to have the app for the main task of unmuting a phone since it can be done by sending a simple text with the code to the target phone. The generated code will also be stored in a Firebase database which can be requested by any user anytime on the AudioUnlock website.

1.2 Objectives

AudioUnlock is a small-scale project with straightforward objectives. Hence our fundamental objectives for the project are:

- Solve the inconvenience of losing a phone on mute.

- Help users locate their phone on a map

- Act as a security measure in case its stolen

The objectives mentioned above are the primary goals of our project which will be focused on throughout the project development. From a personal perspective, the objectives I want to fulfill in this internship is as follows:

- Properly learn the React-native Framework

- Improve programming skills to an industry grade standard through Pair Programming

- Learning how to interface real-time micro-controller based electronics with mobile applications

- Improve communication skills for a more cohesive and efficient workflow in team settings

1.3 Scopes

The scope of this project is limited in the sense that this is a small app focusing on the primary objectives. Our scope is also limited to the resources that we have at our disposal at the time of development as well as the time that we have.

- Locate and unmute phone using an sms based system

- Generate unique code for user and store it in database

- Enable users to request the code using the website

- Create an auto-readable module for reading the code in the sms

- Allow users to visually locate their phone on other phones if they have the app using GPS

Since most of the functionality is bound to sms, a connection to the internet is an optional requirement(required to see the phone's location). Any other functionality beyond which is described here is outside the scope of the project.

Chapter 2

Literature Review

2.1 Relationship with Undergraduate Studies

The project is a native app development for mobile devices built on Java and Javascript and this ties in nicely with objective oriented programming(CSE213) where we learnt Java and loosely with Web Application and Internet(CSE309) courses where we learnt about web apps. The project design phase was greatly assisted using the knowledge acquired in System Analysis and Design(CSE307) where we learned about UML diagrams and other system design artifacts. This is going to be useful while creating documentation for the project. Since my internship is in a microcontroller based company I am also acquainted with a lot of microcontrollers which was taught in CSE216 Microcontroller Interfacing and assembly language.

Overall the project that we are undertaking is greatly complemented by my studies in IUB and will hopefully be a product of it.

2.2 Related works

Literature on this topic is very limited since our idea is a unique one and very few papers or products on the market have tackled this issue. There are a lot of audio modules and a few papers discussing the issue of locating a phone using it's GSM network towers but none of them combined the two to make a product like AudioUnlock. A paper by Tobias Engel (1) outlines the idea of locating a phone using a protocol suite called signalling system7 which is used by telecom companies to communicate between each other. Using VoIP anyone can exploit this protocol which has no authentication to locate a phone to its nearest tower. Another paper by Ding-Bing Lin et al (2) takes a different approach to the same problem. The location estimation is based on the differences of downlink signal attenuations, which are used to determine circles composed by possible mobile locations. Then the actual location is given by the intersection of the circles.The technology mentioned in these papers are not perfectly aligned with our work but it gives us a different insight into how we can use GSM technology to locate our phones without the internet but for all intents and purposes application of these ideas will be considered as future work and are beyond the scope of our project.

Chapter 3

Project Management & Financing

3.1 Work Breakdown Structure

The Work Breakdown Structure clearly illustrates the different phases of the development process. The initial starting phases are followed by the planning, research, design, execution, and deployment phases. The tasks undertaken in these phases are underlined here and explained further in the upcoming visualizations and subsections.
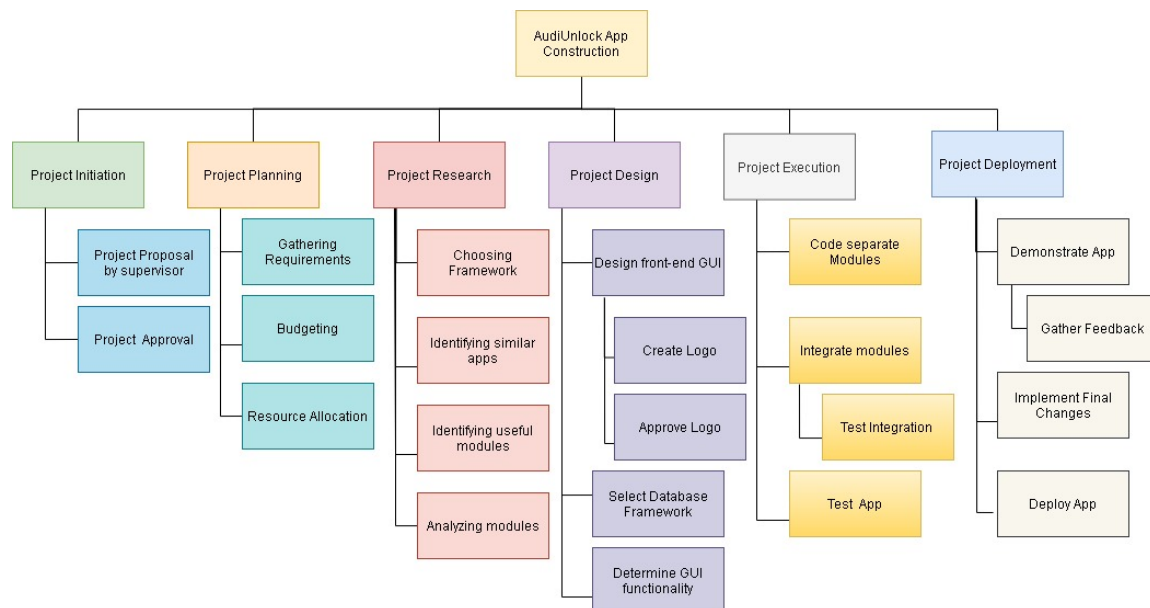

Figure 3.1: Work breakdown structure
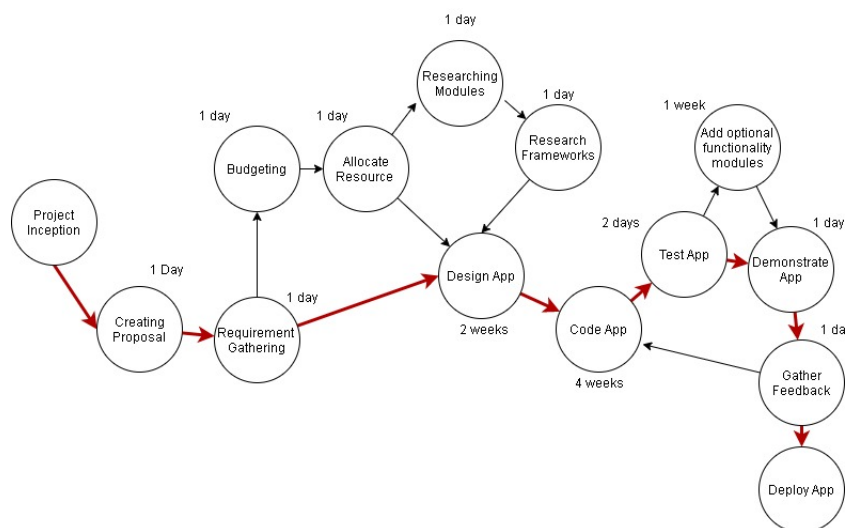
3.2 Process wise Time Distribution

Figure 3.2: Critical Path Method

Critical Path Method.
The above diagram shows the critical path of the development process of the app. The diagram depicts the workflow of the project development. Various different paths are shown to represent the non-essential tasks that could add to the development time. The critical path is colorized red for better intuition.

If we follow the critical path, development should be completed in just under 7 weeks at the earliest. At the latest it could take 12 weeks considering we go through the loop of feedback only once.

3.3 Gantt Chart

' The Gantt chart(fig3.3) below illustrates the allocated time for each task and phase of the project. This will help us visualize the distribution of our main resource: time, in an efficient manner and reach project completion. All tasks will be scrutinized by the supervisor for quality maintenance and some tasks will overlap over the course of development. A gap in the chart between 19th and 24th July is representative of an idle period due to break for religious event(i.e Eid-Ul-Azha).
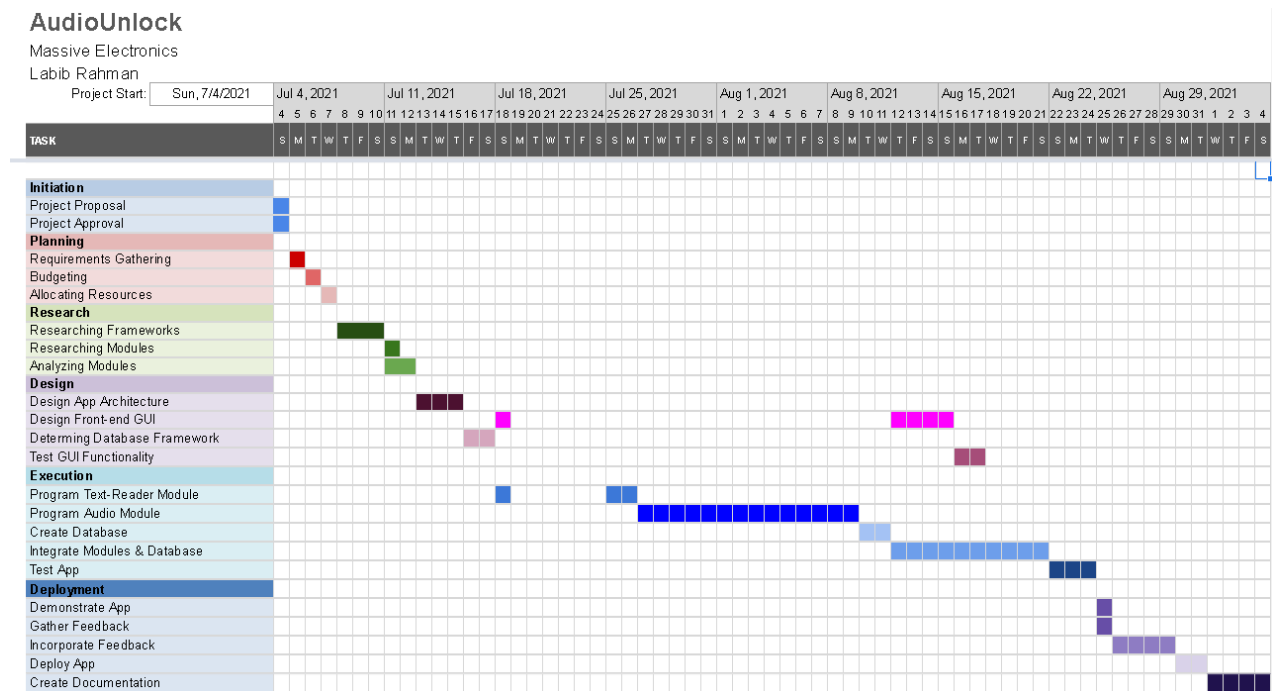
Figure 3.3: Gantt Chart

3.4   Process wise Resource Allocation

The figure below(fig3.4) states the types of resources allocated for each task in each phase. Essential resources will include office expenses such electricity, internet and office space. Infrastructure includes Developer's environment, GSM connection, Framework support etc. A lack of analytical data on these resources is evident in the table due to little to no tracking of said resources. Despite this, it will help us envision how we intend to dedicate our resources in each step of the way.

TASK	Resource Type			
	Essential	**Infrastructure**	**Server**	**Miscallenous**
Initiation	✓			✓
Project Proposal	✓			✓
Project Approval				
Planning				
Requirements Gathering	✓			✓
Budgeting	✓			✓
Allocating Resources	✓			✓
Research				
Researching Frameworks	✓			
Researching Modules	✓			
Analyzing Modules	✓			✓
Design				
Design App Architecture	✓			✓
Design Front-end GUI	✓	✓		
Determing Database Framework	✓	✓	✓	✓
Test GUI Functionality	✓	✓		✓
Execution				
Program Text-Reader Module	✓	✓		✓
Program Audio Module	✓	✓		✓
Create Database	✓	✓	✓	✓
Integrate Modules & Database	✓	✓	✓	✓
Test App	✓			
Deployment				
Demonstrate App	✓	✓	✓	✓
Gather Feedback	✓	✓	✓	✓
Incorporate Feedback	✓	✓	✓	✓
Deploy App	✓	✓	✓	✓
Create Documentation	✓			✓

Figure 3.4: Resource Allocation chart

3.5 Estimated Costing

Estimating the cost on a small project like AudioUnlock without a Budget Analyst is difficult due to all the types of resources used in the entire development process. The first table[fig3.5] is a representation of the total cost of the project considering all types of expected expenses. It is noteworthy that this budget is subject to change on a situational basis. For example one junior developer was pulled out of the project as per my request so that I could take on more responsibilities.

The second table[fig3.6] breakdowns the human resource value put into the project in terms of hours, dedication and input. This is drastically reduced due to the team member cut. The salary values used are as mentioned by my fellow employees and supervisor.

Analyzing the other type of resources proved to be incredibly difficult as Management does not keep track of all resources and the ones they do keep a track off are not available to a intern

developer. The values mentioned in the table are as suggested by my supervisor.

Project: AudioUnlock	Budget Allocation				Massive Electronics R&D
Week of: June 7, 2021					
Team	**Planned Developer Hours**	**Additional Resource**	**Overheads**	**Misc costs**	**Total Valuation**
2 Junior Developers,1 Supervisor	480 Developer Hours	Infrastructure-based subscriptions,Cloudbased server costs	Support costs, Internet cost,Electricity costs	Stationary and miscallenous costs	1,00,000 Taka
	40,000tk	20000tk	30000tk	10000tk	

Figure 3.5: Primary Cost Table

Developer Title	Developer committment	Developer Salaries/monthly	Developer Hours	Project Input	Misc costs	Total Valuation
Supervisor	25%	40,000	480	20%	10,000	30,000
Jr Developer*	20%	15,000	60	20%	2,000	5000
Intern	100%	0	480	60%	5,000	5000
					Total value	40,000

Figure 3.6: Human Resource Cost*

*Junior Developer was released from the project 1 week into development and cost has been adjusted accordingly.

Chapter 4

Methodology

Our company is a small tech company with 20 employees working in the forefront and 30 others in the background and hence the development processes are not exactly streamlined and we follow a hybrid scrum methodology. Scrum is a framework within the agile methodology which focuses on fast workflow and is heuristic; it's based on continuous learning and is focused on making adjustments to fluctuating factors. (3) Scrum has iterative periods of work called sprints where milestones are reached and feedback is incorporated to improve on the product. Documentation in the form of artifacts such product backlogs, sprint backlog and increments are essential to the product development process and are hence minimal. People in this framework have multiple different roles as developers, product managers and scrum master. In our company our meetings are held weekly along with minimal documentation of the development process. Most documentations are done after the product is complete and is scheduled for shipping. We adhere to an system of accountability to our supervisors who makes sure we are completing our "sprints" in time and are maintaining quality in the process.

Chapter 5

Body of the Project

This section explores all the detailed workflow of the project. As stated further along in this chapter the reader will notice all the detailed analysis and visualisations that contributed to the development process. Some of these artifacts are as shown in the figures and in some cases oral instructions were provided to establish the point. Detailed descriptions of each analysis are provided in the subsections that will attempt to expand on each activity, resource and requirement.

5.1 Work Description

The AudioUnlock app is a mobile application that can unmute your phone using a text from another phone if your phone gets lost. This is a very common issue we face in the real world. Users' mobile phones always have a Do Not Disturb mode or an audio mute option and sometimes they tend to lose track of their phone while on mute. In this scenario they can't locate their phone by calling it because it is muted. What we are working on here is an app that can solve this very issue. Our app is focusing on an sms based system that can generate a code that the user can remember and use another phone to send this code to the target phone in case they lose it. This will be read by the target phone automatically and unmute the phone, playing their ringtone in the process. Throughout this entire process we can locate the phone very easily. A scenario of the app at work is as follows: The user will download the app and will make an account using their name and phone number. Our app will then generate a code using a hashing algorithm. They can now close the app as it is now initialized and ready to be used.

A point to note here is that other phones do not need the app on their phone for this system to work because it is text based. In the case the target phone is lost any other phone can send the text with the code that they can request on the website and play the ringtone of the target phone. Thus the phone will be located. The generated code will be stored in a database that can be requested by the user on the website using their credentials if it's lost. Everytime a code is received by the app it will cross check it with the code saved in it to check if it should take action or not. Another module of the app will turn on the GPS of the phone and help pinpoint

its location. In case a user want to find a friend's phone location the app will help you do that given the user has their friend's phone number and code. They can go on the app and request their friend's location directly and it will show on the integrated google map.

5.2 System Analysis

5.2.1 Six Element Analysis

The six element analysis done on this project rendered table 5.1 on the next page. The processes listed are the actions that fall under the scope of this project. A significant point to notice is the fact that none of these processes require any non computational hardware which is why the element was removed from table 5.1. The only two stakeholders of this project the user and the admin are listed and their tasks to complete each process are described briefly below in the table.

5.2.2 Feasibility Analysis

A feasibility analysis considering human resources, time and money was done in the early stages of the project planning. No formal documents were produced in the meeting but there was an understanding that the project was feasible under the current circumstances of the company. One of the requirements that could make this project slightly unfeasible is the location module where a user can find another user using their code and phone number. This feature could prove to be a difficult task to finish within the internship period due to its dependencies and the likelihood of integration issues. This module also partially contradicts our project vision of making an app that can function without the internet. Despite this I intend to move forward with the fulfillment of this functional requirement.

5.2.3 Problem Solution Analysis

The problem presented in this project is a very simple common inconvenience in our daily lives. The fact that we tend to use our phones on mute is an increasing trend especially among young people. We tend to put our phone on mute because of all the unnecessary tones and sounds that our social media apps produce and because we don't really use it to call as much as older generations. So this leads to an issue when we lose our phone. In this case when it's lost we can't even call it because it's usually on mute. So as a countermeasure I decided to provide a solution to this problem in the form of this app. The app will not only unmute a user's phone and play the ringtone, it will also allow them to find their friend's phone location. This app is meant to make sure no-one goes through that inconvenience of losing their phone on mute ever again.

Table 5.1: Six Elements Analysis

Process	System Roles				
	Human	Computer Hardware	Software	Database	Network and communication
Unmuting Phone	User sends text to his phone	Mobile Phone	Mobile App	Firebase	GSM connection (sim card)
Locating a Friend	User moves to locating a friend screen and put in the unique code	Mobile Phone	Mobile App	Firebase, Google Cloud Platform	Internet
Requesting Code	User opens browser and enter their credentials to request their unique code	Phone/ Laptop/ PC	Web App	Firebase	Internet
Creating a User	User opens app and click the register button and fill up the form to create an account	Mobile Phone	Mobile App	Firebase	Internet
Deleting/ Resetting a User	Admin opens Firebase console then chooses the authentication page and remove the user	Laptop/ PC	Firebase Console	Firebase	Internet

5.2.4   Effect and Constraints Analysis

The effect of this project is going to be realized in terms of a better user experience for a mobile phone user. And since that is a huge percentage of the population this app could actually bring meaningful functionality to a lot of people. Although this app is not visioned as an anti-theft mechanism it could still be used in that manner under certain circumstances and I think that is a useful impact this app could bring to the table. Constraints of this project are the time and resources involved. The time required to build this app with all it's functionality is estimated at 3 months but that could change during the development process depending on the development issues that arise. A Google firebase subscription is another back-end constraint that my company has yet to deliver support for. For the time being this app is being built on the free based bundle. With a proper subscription a lot more could be done on the app. Support in this area is expected to be covered once the app is done.

5.3   System Design

5.3.1   Rich Picture
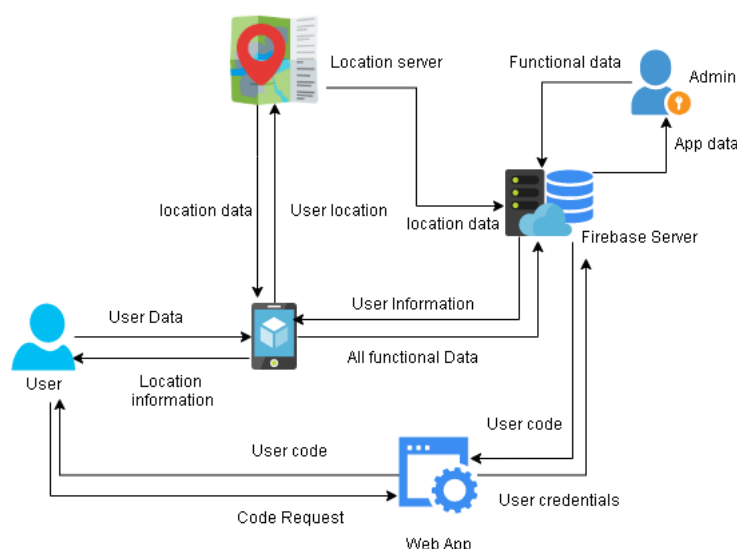
Figure 5.1: Rich picture

The rich picture gives us a high-level overview of all the components and actors in this app ecosystem. It shows us the data-flow of each entity.

5.3.2 UML Diagrams

The following diagrams will exhibit the UML diagrams produced during the development process. Each diagram is an attempt to quantify the tasks in each activity for fulfilling each requirement.
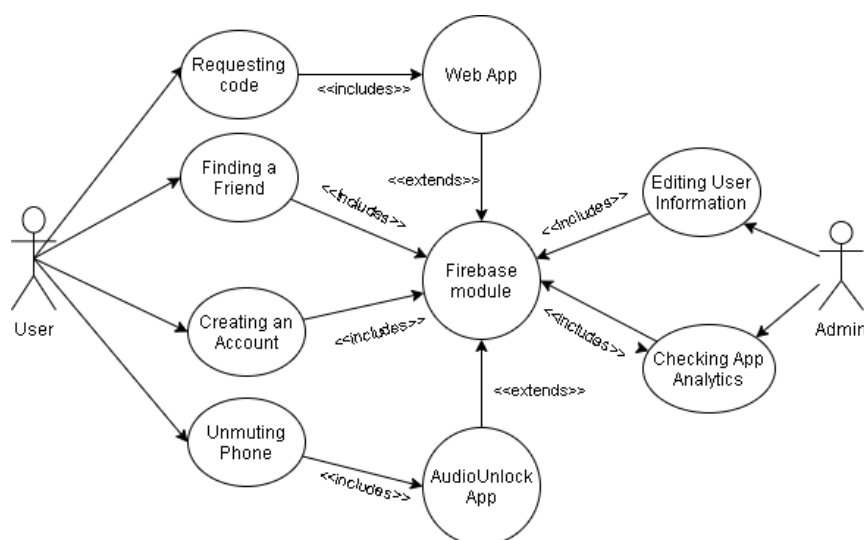
Use case

Figure 5.2: Use case

The use case is another representation of how all the actors and components will interact in all scenarios. It depicts the users of the project and how each activity is connected to each part of the system. The app and the web app is an extension of the firebase module which acts as the main server.

Activity Diagrams

The activity diagrams show a systemic way of how each action is taken. It shows us each step of the way for fulfilling each action. This will help clear readers understand how each action will be handled. Each swimlane is a representation of the different partitions in the logical level i.e User interface has limited logic and most logical operations are performed in the app layer just as all back-end logic is handled by the firebase server.
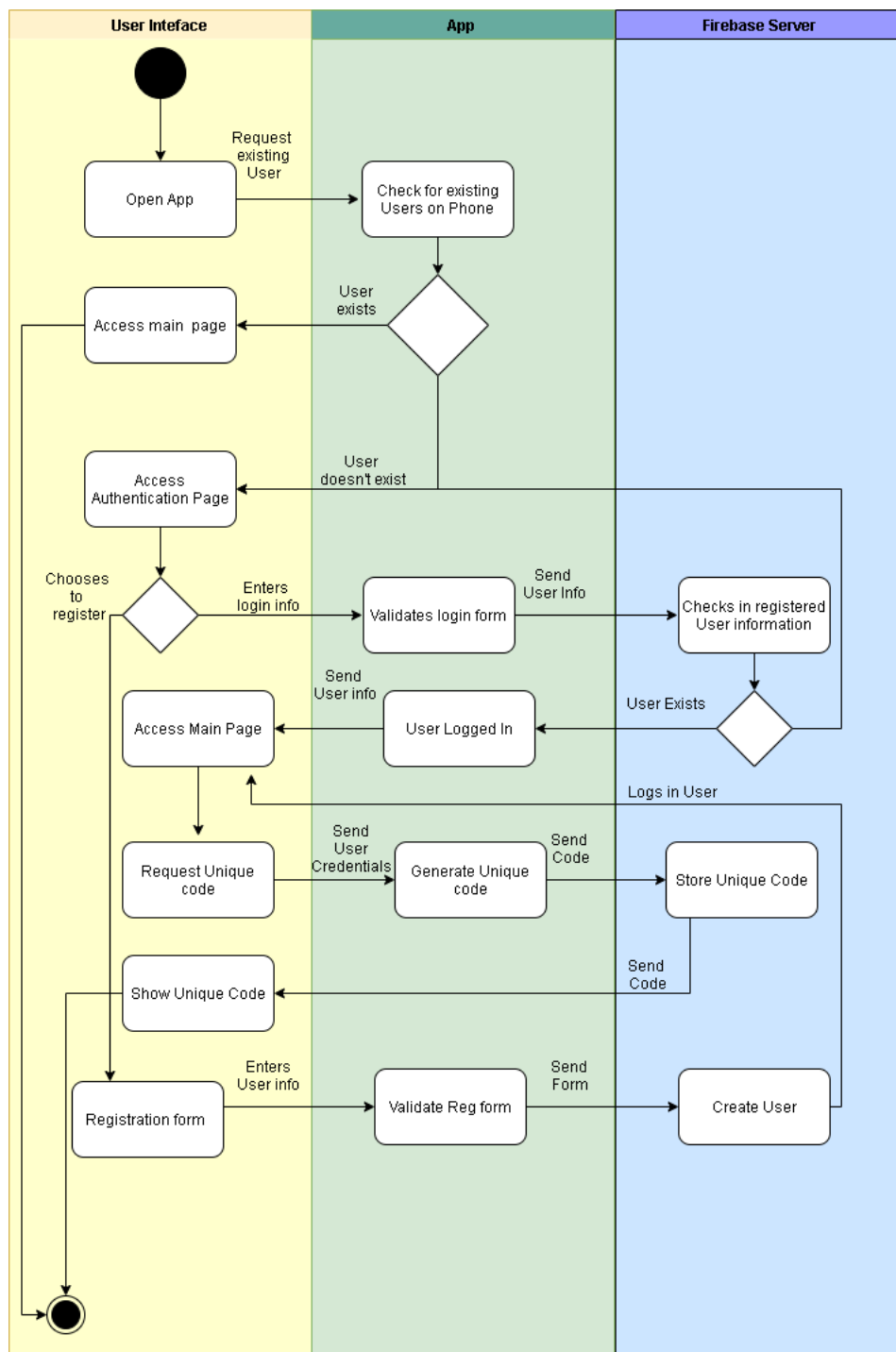
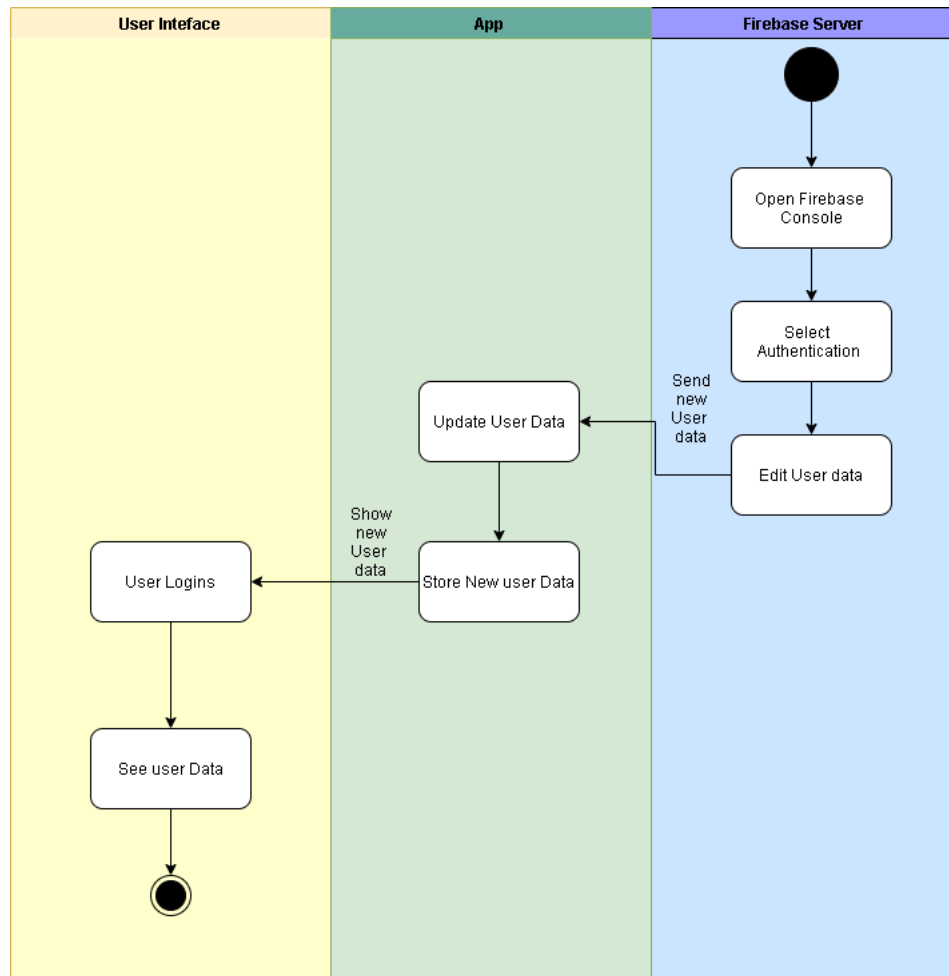Figure 5.3:   Activity Diagram for User login and sign up.

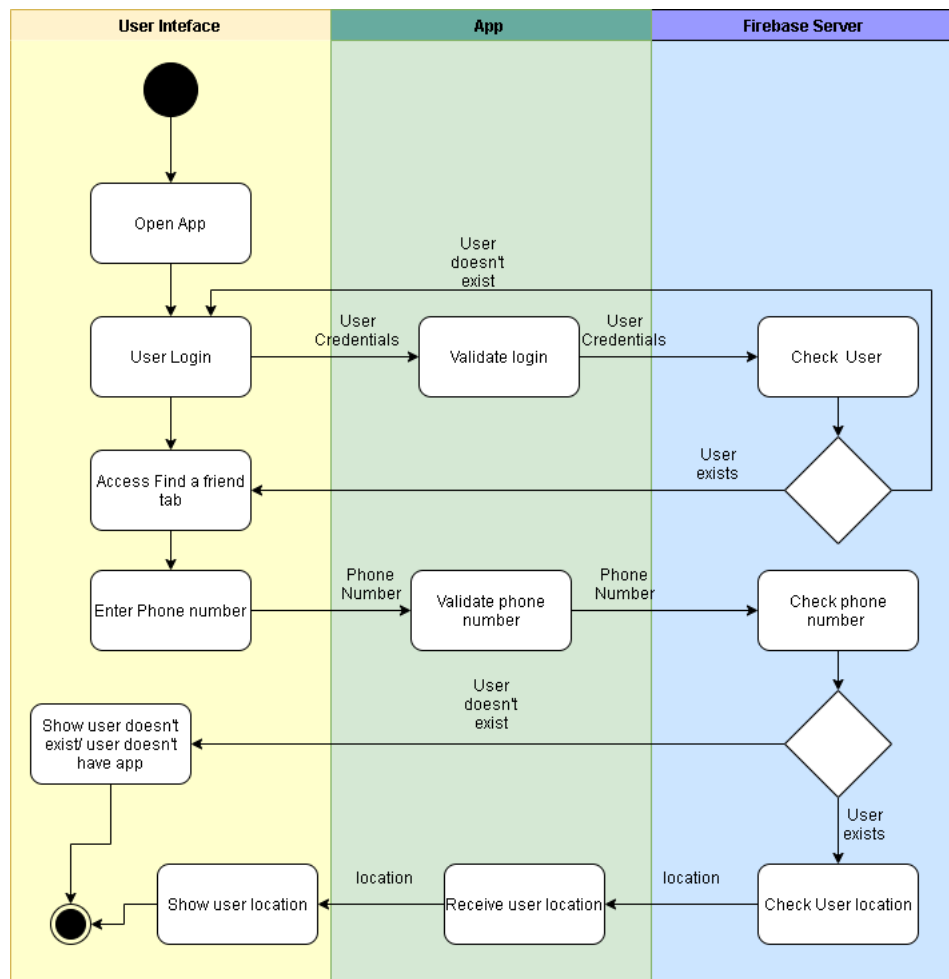Figure 5.4: Activity Diagram for Admin Processes.

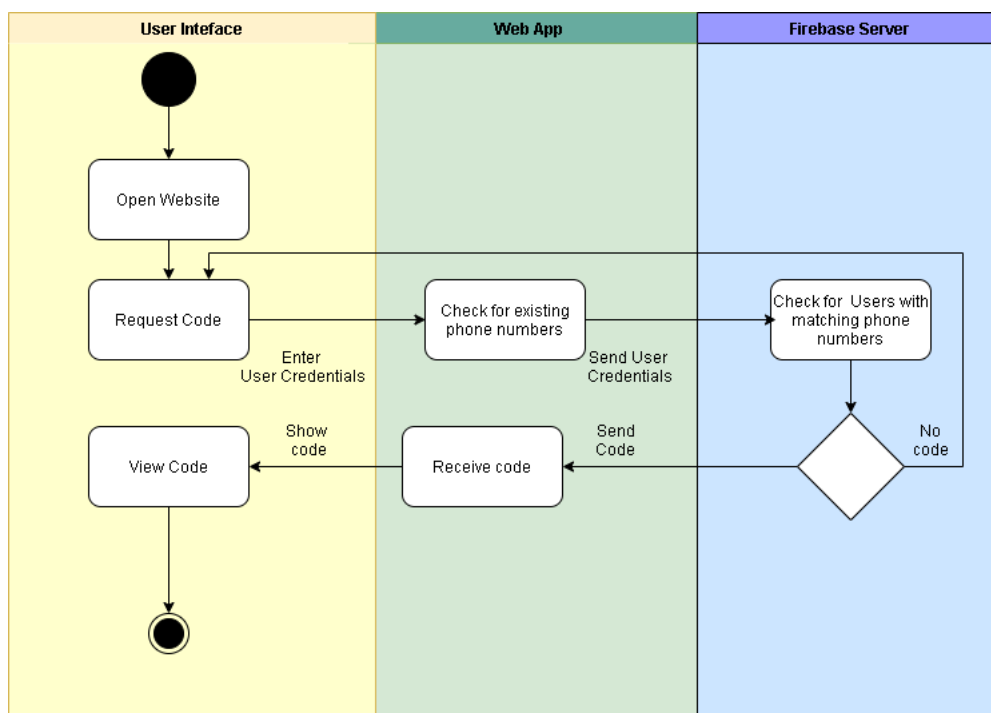Figure 5.5: Activity Diagram for User Location Request

Figure 5.6: Activity Diagram for User Code Request

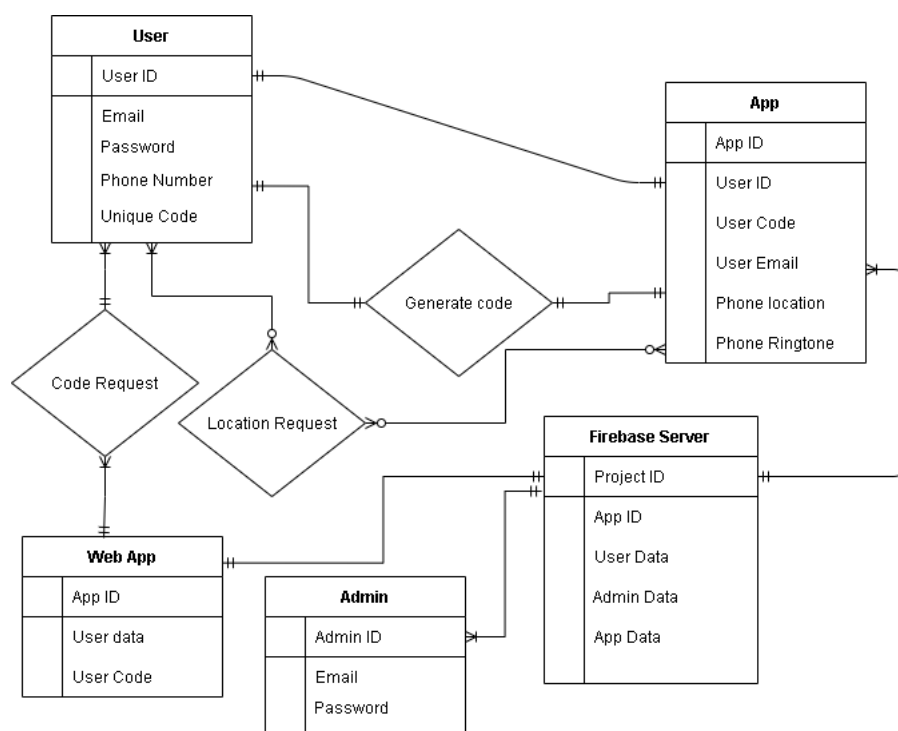**Entity Relationship Diagram**

Figure 5.7: ERD

The ERD is a representation of all the entities in the system and how they correspond in relative to each other. Each table represents an entity that will communicate between each other. The connections represent the cardinality between the two entity.

5.3.3 Functional & Non-functional Requirements

Functional Requirements:
The functional requirements are the main requirements of the project which needs to be fulfilled in order to consider this project successful.

- The mobile app must be able to unmute the device

- It must be able to play the ringtone of the device

- The user should be able to create an account

- The app must be able to use to a user's credentials to generate a unique code

- It should be able to locate another phone's location given it has the app installed

- The admins should be able to edit the user data

- The users should be able to retrieve the code from the web using a web app

- The admin should be able to look at the analytics of the app

Non Functional Requirements:

The non-functional requirements are the additional requirements that the project might have. These requirements can improve the user experience and functionality but the core of the project can function without the fulfillment of these requirements.

- User data update:
  The user should be able to view and edit their data in the app

- Google Sign-in Functionality:
  The app should have a google-sign in option which will greatly enhance the user experience

- Startup Functionality:
  The app should run at start-up so that it becomes an integral part of the android app environment

5.4 Product Features

5.4.1 Input

From table 5.2 we can see that the inputs of the app are the user credentials and sometimes their unique code when they need to locate their phone. The admin only needs their credentials to access the app back-end and manipulate it.

Table 5.2: Input

Inputs		
		Modules
Admin	Email	
	Password	
User	Name	Login, Registration
	Email	
	Password	
	Phone Number	Audio,Text
	Friend's unique code	Location
	code	Audio,Text

5.4.2 Output

The output of the app is primarily the location of our phone in terms of hearing it ring but in terms of empirical data the user gets their unique code, friend's location and their user account once they sign up. The pages where they will view this data is given in table 5.3. The admin on the other hand has access to all user data, and can view all sorts of reports and analytics which can represent the state of the app and help run the app. All types of reports and data visualisations are produced by the firebase console.

Table 5.3: Output

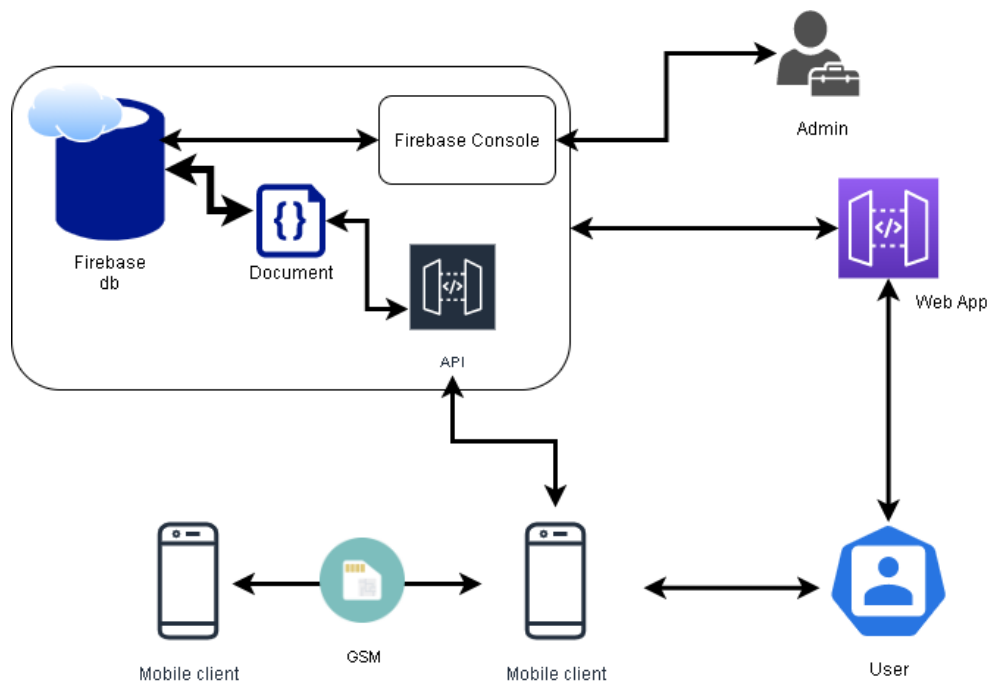| Outputs		
		Page
Admin	User data	Firebase Console on PC
	App Analytics	Firebase Console on PC
User	code	Main page on app
	location info	Find a Friend page on app
	User Account	Main page on app

5.4.3 Architecture

GSM-cloud based Architecture

Figure 5.8: Architecture of the system

The architecture of the system is exhibited in fig 5.8 which components are connected to each other and how the different apps connect with each other. It also shows how the database creates a document for each user where all the user data is kept and how phones communicate to unmute each other.

Chapter 6

Results & Analysis

This chapter is dedicated to exhibiting the product and presenting the testing for quality assurance. All testing was done on Windows 10 (64-bit).

6.0.1 Testing

The AudioUnlock mobile app was unit tested on a few android devices. The results presented in table 6.1 were taken from a specific android device(SM-M315F) with a Android 10 OS and ARM architecture. As we can see from table 6.1 unit testing was carried out successfully and the app is ready to be deployed.

Table 6.1: Unit Testing

Test ID	Test Case	Input Data	Steps to be executed	Expected Result	Actual Result	Pass/ Fail
T1	User sign up	User's name, email, phone number, password	Open app ->Touch sign up button ->enter user information ->click on register button	User signed in and Main page is to be showed	User signed in successfully and Main page is shown	Pass
T2	User log in	User's email and password	Open app ->Enter credentials ->Press login button	User logged in successfully and Main page is to be showed	User logged in successfully and Main page is shown	Pass
T3	Generate a code	-	Login/signup ->Touch "Generate code" button	A code should be generated and shown to the user	A code is generated and is shown underneath the welcome user message	Pass
T4	Unmute phone	Target phone's unique code	User's friend: -> Enter code in text message ->Send text	The code should be automatically read and the phone's ringtone should play regardless of the phone's state	Immediately after the text is received the phone starts ringing.	Pass
T5	Locate a phone	Friend's unique code	Open Main page -> Touch "Find a Friend" button ->Enter Friend's unique code ->Touch "Find a friend" button	A marker should be shown on the map for the location of the target phone	A red marker is shown on the marker indicating the target phone's last known coordinates	Pass
T6	Request code	User credentials	Open website -> Enter Credentials ->Click on "Get code" button	If the credentials are correct the unique code should be shown	The unique code was shown	Pass

6.0.2   App & Website UI

The app was designed with simplicity in mind and that is reflected in the UI. A clean UI can uplift the user experience and so I designed the UI with soft colours with a minimalistic outlook. The website was also designed with a similar thought process.
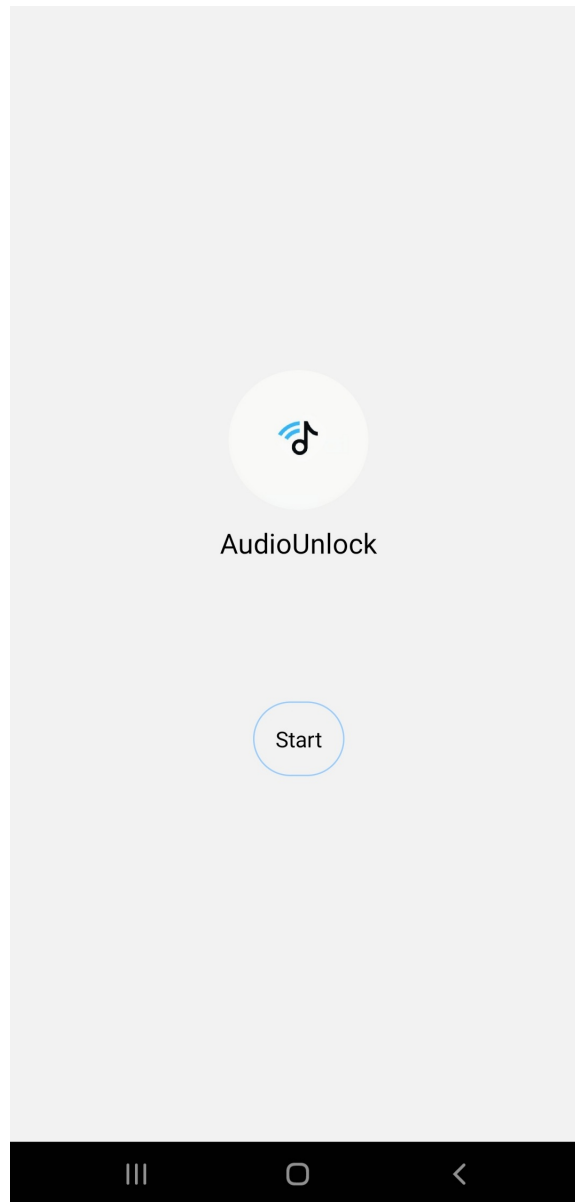

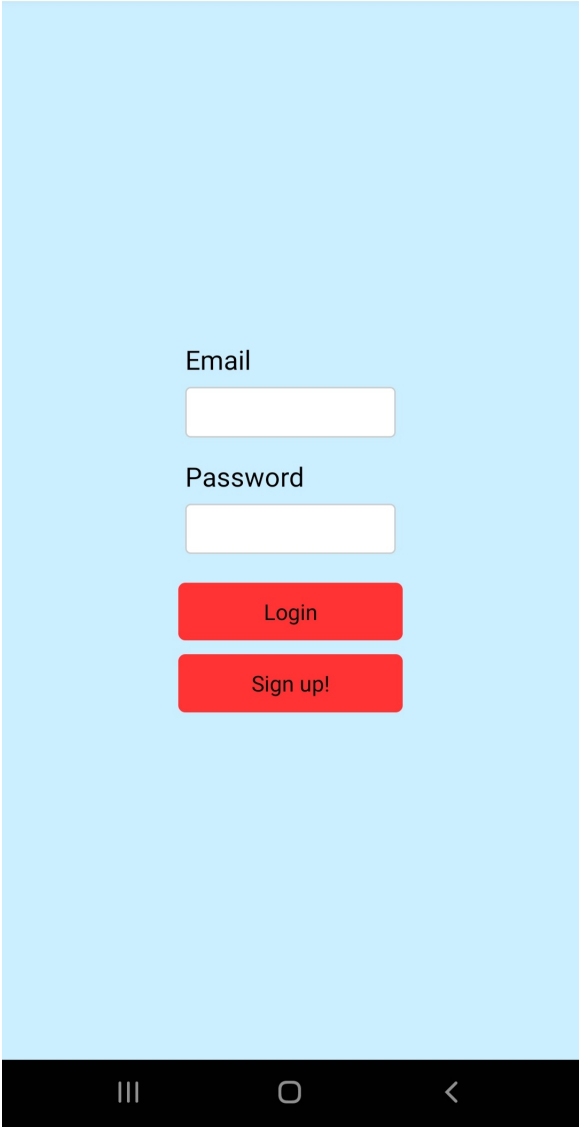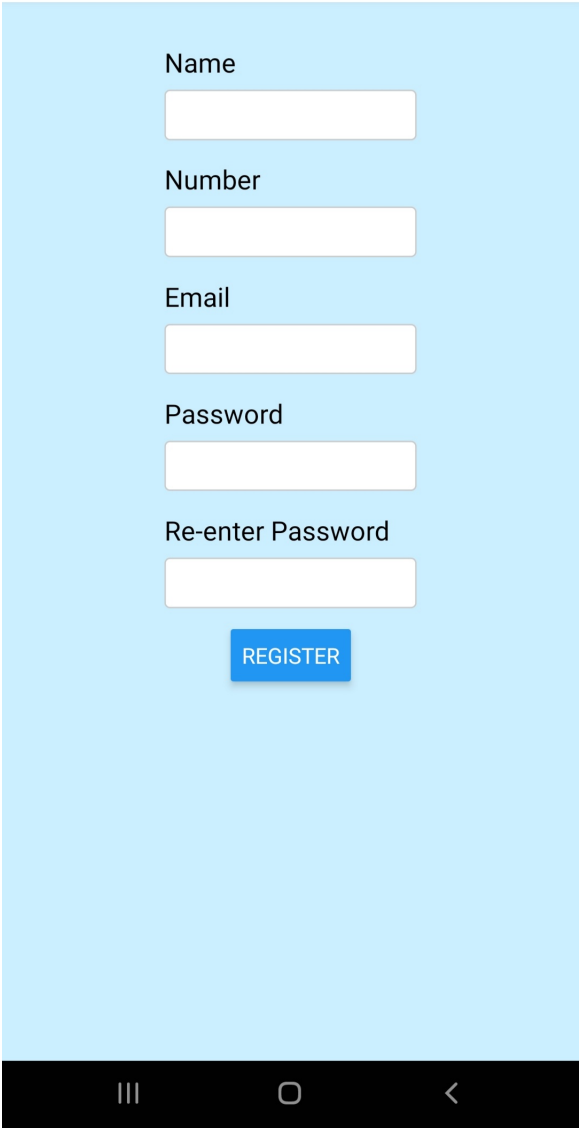Figure 6.1: The Start screen

Get into AudioUnlock

Figure 6.2: The Authentication page
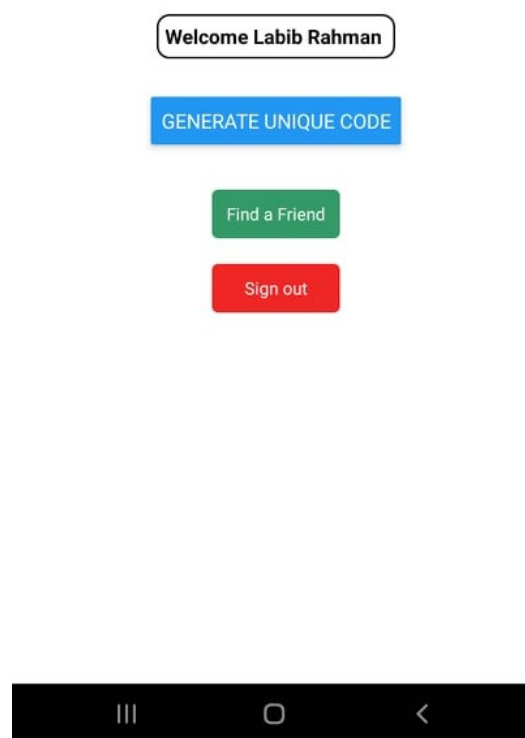
Figure 6.3: The Registration page

Figure 6.4: The Main page
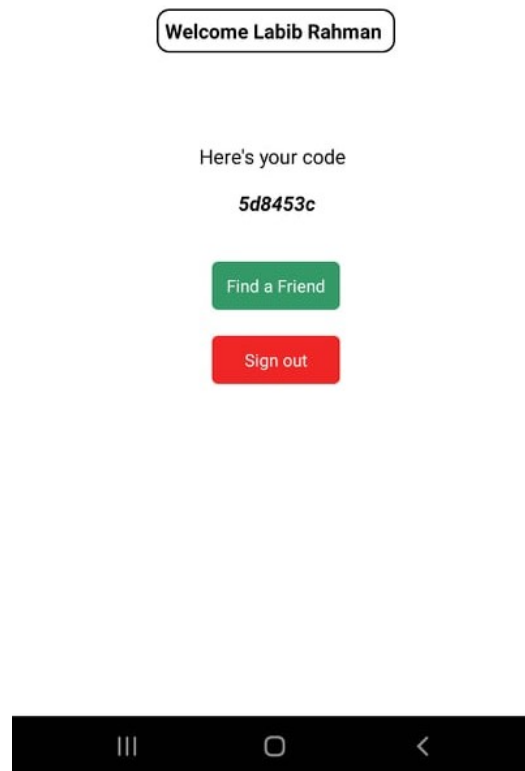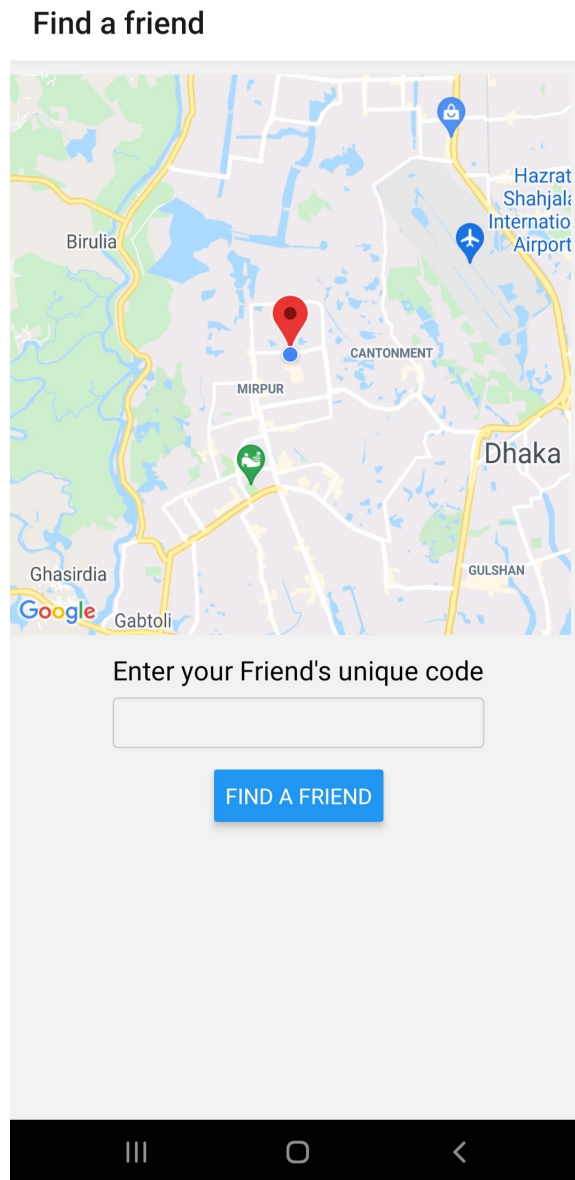
Figure 6.5: The Main page after generating the code.

Find a friend

Figure 6.6: The Location page

Figure 6.7: The Website page

Figure 6.8: The Web page after requesting code

Chapter 7

Project as Engineering Problem Analysis

As engineers we tend to analyze a problem and build a solution from the ground up. This chapter is dedicated to explain how our solution is sustainable and how it will affect society as a whole as well expanding on the ethical issues that came up during the development process.

7.1   Sustainability of the Project/Work

The problem that we tried to provide a solution for is a common one and it's not going anywhere. As more and more younger people start using mobile phones this issue of losing your phone on mute will increase. Our mobile app provides a unique solution to this unsolved problem, one that does not require internet to function. Due to it's unique characteristic I believe this project will stand the test of time.
Maintenance of this project is not something that was included in my budget and so a discussion with my supervisor made me come to the conclusion that making this app open-source was the best way to sustain this project. Since this idea is unique and the premise has been set I believe making this app open-source will allow other developers to input their ideas and improve this already unique app.
If possible in the long run I would like this app to be an integral part of the android system so that users can have this fail-safe app running in the background to help them locate it anytime. Overall the potential sustainability of the work that is done here is high and only time will prove our intuitions.

7.2   Social and Environmental Effects and Analysis

As discussed in multiple other sections in this report the social implications of this project is the fact that it's going to be easier to locate your phone once it's lost. As mobile phones become an integral part of our life, knowing where it is, is essential for it to be useful. In our country especially where Internet is not available everywhere(especially when travelling) locating your

phone just by sending a text is a convenient solution to this widespread problem. In addition to that if the phone gets stolen, someone can easily locate it using our location feature. So this app is bringing a solid solution to a common issue that will greatly benefit our society at large. The environmental effects of this project is minimal since it's mostly GSM and cloud based. Our project is not going to affect the environment any significantly more than what the existing technology already has. Our carbon footprint is only in terms of the electricity we consumed during the development process and the electricity consumption by the servers on Google Firebase once this project goes public.

7.3   Addressing Ethics and Ethical Issues

Addressing the ethical issues of this project leads me to the fact that our app does contain a module that checks for text messages and reads the contents of these messages in order to check for any code sent to the mobile. Although this is not recorded in any manner this still partially intrudes into the user's personal data. But then again the contents of any text message is not recorded, stored or used in any manner other than it's main purpose. Another ethical issue that came up during a discussion with my supervisor is that our app does record user's location in order to provide them with the location service. This data will be periodically updated in our database in order to keep it consistent. As a disclaimer we declare that we intend to keep this data confidential and will never re-purpose, reuse or sell this data to any third party company for profit.

Chapter 8

Lesson Learned

This chapter will focus on the adversaries that I faced during my internship period and how I overcame them in order to prove myself as a proper corporate employee.

8.1 Problems Faced During this Period

The start of my internship period was pleasant as most employees including my supervisor were very receptive of my presence in the office. With that said the lesson learnt during the first few weeks of my internship is creating the development environment for android which was a bigger hassle than anticipated. Android studio is very taxing on my workstation and makes it very slow. The following week I faced the incredibly complex task of debugging a module in Android development. The error logs really didn't specify what was wrong.
Developing the app the next few weeks I faced difficulty in integrating my project with MongoDB. In addition, integrating all parts of the project together was intense work and I've learnt a lot about finalising a product for deployment during the last few days of development.

8.2 Solution of those Problems

Over time I simplified the approach to opening an android development environment by simply using VS code and debugging my phone instead of Android Studio emulator. Along with that creating my first project in the first few weeks gave me a nice insight into programming in React-Native framework. I looked up every single issue online in order to resolve them. In addition to that I also learned about the project management charts such as critical map method, gantt chart, feasibility analysis, six system analysis table and effect and constraint analysis etc. I've also learnt a lot about the back-end functionality that Google Firebase provides and how android apps can be programmed to communicate with a real-time database. I've learnt what Unit testing is after completing the app. I also learnt functional testing and all the other types of testing from my supervisor. In the end I found most solutions to my problems by myself on the internet but sometimes my supervisor helped me get out of a rough patch with timely suggestions on how I should move forward with my app.

Chapter 9

Future Work & Conclusion

9.1 Future Works

The future work for this project will be integrating this app into the android system so that the app doesn't need to run in the background for it to work. Another feature I'd like to add to this app is the Google sign-in feature so that users have a smoother sign-in experience. Finally I'd like to enable users the feature to update and delete their data from the website so that can have control over their data.

9.2 Conclusion

AudioUnlock is a mobile app that is based on a unique idea and tries to solve a common problem in our daily lives. With the functionality it provides it could be prove to be an integral part of the mobile app ecosystem and bring value to users worldwide. With that said AudioUnlock has been a landmark project for me since it marks my step into a career that I look forward to and ends my Bachelor's studies in this great institution. I have tried to apply all that I've learned here, gather as much experience as possible and be an ideal representative in the corporate world. I look forward to using this knowledge and applying myself in new paradigms.

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