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TUS
Technological University of the Shannon:
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An Android Mobile Application to Assist People with various disabilities and to connect them to an online buddy system

Fyaz Qadir Ahmed Ikram

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A Final Year Project submitted in partial fulfilment of
the requirements of Technological University of
Shannon: Midlands Midwest for the degree of
Bachelor of Science (Honours) in
Internet Systems Development.

Supervised by:

Pamela O'Brien

Month/Year

Ethical Declaration:

I declare that this project and document is wholly my own work except where I have made explicit reference to the work of others. I have read the Department of Information Technology Final Year Project guidelines and relevant institutional regulations, and hereby declare that this document is in line with these requirements.

I have discussed, agreed, and completed with whatever confidentiality or anonymity terms of reference were deemed appropriate by those participating in the research and dealt appropriately with any other ethical matters arising, in line with the TUS Research Ethics Guidelines for Undergraduate and Taught Postgraduate Programmes policy document.

_____ _____

Fyaz Qadir Ahmed Ikram [Date]

Acknowledgements

I would like to thank my supervisor, Pamela O'Brien, for giving me the opportunity to undertake this project. Her constant support and guidance were an invaluable resource throughout the project.

I would also like to thank my friends and classmates for all the help and support they have given me during this project and over the past four years.

Finally, I would like to thank my parents and my sister, Ikram, Nilofar, and Safaa who have been great to me throughout my whole life, and without whom none of this would have been possible.

Abstract

For the Final Year Project, the author has looked at the problem of social isolation and loneliness with people with intellectual and physical disabilities and decided to create a mobile application to have a buddy system wherein two parties (Buddies and people with disabilities) could interact and socialize with one another (Tough et al., 2017) ("Sage Journals", 2021) (Anderson, 2021) (Hodapp, 2020) (Raising Children Network, 2021).However, currently there are many e-buddy services online, but they all communicate via email, which in this day and age, is a lengthy process and could be very inefficient. All these services also do not provide any type of mobile application for buddying these types of parties. That is why the author has decided to create a Realtime Mobile Application which will help and assist people with various disabilities to overcome their solitude and loneliness and help them interact with peers or buddies on the mobile application. Any person (with or without disability) will be able to register themselves as a user and either get assistance or register as a buddy. Whenever a user register, they will be able to create a diary for availability to pair up with a buddy, which will get stored in a Realtime database. The app will also automatically gather the user's location from the geo location service API, which will allow both parties to arrange an appointment to meet up with the respective parties. The app would also incorporate a chat area for both parties to communicate between each other via text, or call.

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List of Abbreviations

API	Application Programming Interface
GLS	Geo-Location Services
SP	Shared Preferences
UI	User Interface
UE	User Experience
RDBMS	Relational Database Management System
P2P	Peer to Peer
iOS	iPhone Operating System
OS	Operating System
DBMS	Database Management System
AWS	Amazon Web Services
DB	Database
GPS	Global Positioning System
IDE	Integrated Development Environments

1 Introduction

The reason for this Project's development was to assist people with various disabilities (physical and mental) and help them socially interact with people without any disabilities using a real time buddy mobile application. The aim is to create an android mobile based application that would help people with disabilities to overcome their solitude and to interact with peers or buddies without much difficulty using a social online platform. This project will consist of an Android Application, a Firebase Database, a Chat Service, and a Geo-Location Service, while including accessibility features to cater for various (visual, hearing, etc.) impairments. As a huge issue among people with disabilities is social loneliness and solitude. The app will be able to buddy a person(s) with disabilities and a person(s) without disability together which will allow them to communicate via the mobile application.

The main objectives of this project were to develop a system capable of chat communication and that has the ability of pairing parties of people with and without disability together using Geo-Location Services, while helping people with disability overcome the loneliness and solitude. While working on this Project, it gave the author the opportunity to experience new technologies that he had not worked with before such as Android Studio.

The main functional objectives of this project are as follows:

- People with disability would be able to register and request for a buddy
- People without disability would be able to register and offer to be a buddy
- Both parties would be able to create their diary for availability
- Both parties would be able to go to the help page which would answer Frequently Asked Questions
- The app would contain accessibility features to cater for people with all types of disability (Hearing, Visual, Speech) Impairments
- The app would be able to identify the location of users using geo location services which allows users to find the buddies closest to them on a map
- The app would contain a chat area to communicate to different users via text or call
- The app would feature an online booking system via chat to meet up and socialize between users

- The app would be able to also provide an emergency bay that directly links to the local country's emergency service

The Authors reasoning for picking a project such as this one, is since his parents were former health professionals working in the area of helping people with disabilities. They would always consider the idea of creating a buddy program that could easily be accessible and efficient for its users. The Author is developing this application to help decrease the problem of social loneliness and exclusion among people with disabilities.

This project involved researching the topics of Social Isolation among people with disabilities to fully understand the area of research. The Author used this knowledge to pitch the idea of an Android Application to benefit people with disabilities. This project involved software elements to complete this application. Over the course of the year the Author experimented with different techniques and designs for the project to ensure the Author came out with the best solution for the user.

The main methodologies for research that will be used for this project are as follows:

- Internet - Will be used to research various aspects of the subject and identify further ideas for the mobile application.
- Library Resources (Books, Articles and Journals) - Will be used to research various aspects of subject and identify further ideas for the mobile application.
- Interviews - Will be used to better understand, and explore research subject opinions, behavior, experiences, and phenomenon and will be used to gather further requirements of the mobile application and understand different approaches of the subject.

Some research questions that the Author had in mind when researching about the area of research were as follows:

- What platform does the Author intend on developing this application?
- How can Geo Location be used to capture the nearest locations for their buddies?
- What is the framework of connecting google maps to the specific buddy nearest to another buddy?

- What database would be used to store the information on the application?
- What would the database be used to store (Kind of Data) on the mobile application?
- Would the data store on the mobile application hold any sensitive data (What would that data be)?
- What would the online chatbot incorporate and try to answer on the mobile application for its users?
- What security measures would be taken into consideration to verify people with and without disability?

This Document entails the steps the Author went through to bring the project to completion. The chapters include:

- Literature Review
- Analysis and Design
- Implementation
- Testing and Results
- Discussion and Conclusion

2 Literature Review

2.1 Introduction

What current applications exist and what services do they offer in regard to online buddying systems for people with disabilities?

Currently there are websites that provide various e-buddy services in Ireland such as St. Hilda's and Best Buddies. These websites include friendships with peers, securing jobs, and living independently. The aspect of the buddy program on their websites are an element of their services and offer buddying services for people with intellectual developmental disabilities wherein people with and without disabilities can socialize and interact via emails. In this day and age buddying via email's is very inefficient and slow. Although there are many social media platforms such as Snapchat, Facebook and Twitter which allow users to communicate and chat with different people there currently are no such online platforms which cater and accommodate people with various disabilities and provide a peer/buddy system to accommodate for people with various impairments. After conducting an interview with the Author's mother, The Author has found that many people with both physical and mental disabilities do not prefer using platforms such as Facebook, Twitter, and Snapchat due to the fact that people with disabilities cannot communicate effectively and clearly to people without any disability. This demands the need to create an application that can open the window of opportunities for people with intellectual disabilities and people with physical disabilities, to communicate and socialize effectively online.

What would make the Authors application unique?

The Author has also looked and researched into if there are any mobile applications similar to these websites that provide these types of services, but currently no such applications exist. The Author has decided to create and provide these services as mentioned but would be implemented using a mobile application which would enable a wider audience as well as allowing people with all kinds of disability to interact and socialize with buddies in an efficient and enjoyable way. The mobile application would highlight various new technologies and features not implemented currently with any other online buddy systems, including geo-location services to connect both parties (People with/without disability) by nearest locations, chat area to communicate between both parties, one-on-one appointment arrangement system to meet up with the respective parties, and an emergency bay to connect the people with disability to the local emergency service in case of any predicaments.

2.2 Project Context

2.2.1 Disability

The main factor for this Android Application is developed around catering and helping people with disabilities buddy up with people without any disabilities. The social involvement of disabled people is inadequate and low; one of the reasons often overlooked but of great importance may lie in the disparate patterns of social interaction between the disabled and abled people (Liu et al., 2021, para.1). According to best buddy's annual survey, fifty-four per cent (54%) of the members with intellectual disability disorder showed that they feel more confident engaging in an online platform ("e-Buddies", 2021, para.6). The best buddy survey was conducted among college participants in the United States. The findings suggest that both the college students and the people with intellectual disabilities benefitted from the program. Both the groups reported that they enjoyed their experiences and engaging in friendship activities were mutually beneficial (Hardman & Clark, 2006, p.56-63).

There are two main categories of people with disabilities, which include people with physical and mental disabilities. Social Isolation and Exclusion is a huge concern for people not just with cognitive disabilities but also people with physical disabilities. According to Disabil Health J, People with a disability experienced loneliness, inadequate perceived social support, and social isolation at remarkably higher rates than people without any disability. People with physical disabilities are affected by loneliness and exclusion mainly due to the restriction caused by their limited movement, which affects them to interact or socialize with anyone. However, when it comes to people with mental disabilities, the main reason for their social isolation is their inability to communicate clearly and effectively.

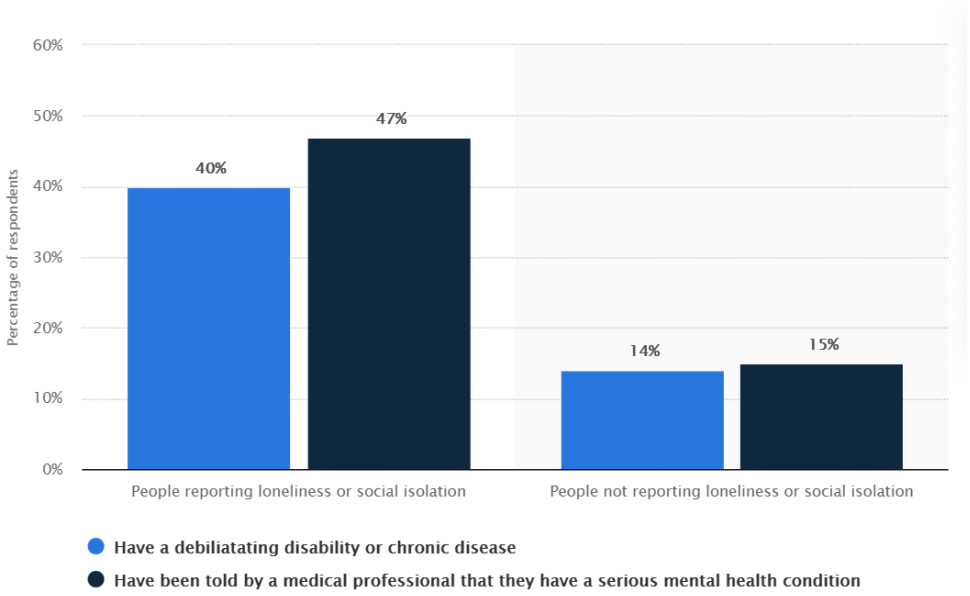

Figure 1 Proportion of people experiencing loneliness and social isolation in the U.S. in 2018, by physical or mental health condition

In a survey conducted by Statista in 2018, over 40% (2/5) of the US population who either have a debilitating disability or have been told by a medical professional that they have severe mental health conditions have reported that they suffer from social loneliness and isolation. In comparison, the people saying that they do not suffer from social isolation and loneliness in the US is significantly lower at a percentage of around 15% (3/20).

	Most Integrated		Moderately Integrated		Moderately Isolated		Most Isolated		Number in sample
	%	95% CI	%	95% CI	%	95% CI	%	95% CI	
Self-rated health									
Excellent/V. Good	25.9	(24.3,27.5)	40.2	(38.5,42.0)	27.8	(26.1,29.5)	6.1	(5.2,7.2)	4459
Good	20.2	(18.4,22.2)	40.7	(38.5,42.9)	30.3	(28.0,32.6)	8.9	(7.4,10.6)	2441
Fair/Poor	11.8	(10.0,13.8)	37.3	(34.0,40.7)	34.7	(31.5,38.1)	16.2	(13.7,19.1)	1260
ADLs									
None	22.6	(21.4,24.0)	40.2	(38.8,41.5)	29.1	(27.8,30.5)	8.0	(7.2,9.0)	7475
At least one	14.7	(12.0,17.8)	36.8	(32.4,41.3)	34.5	(30.2,39.0)	14.1	(10.8,18.2)	699
IADLs									
None	23.0	(21.7,24.3)	40.4	(39.1,41.8)	28.6	(27.3,30.0)	8.0	(7.1,8.9)	7575
At least one	9.7	(7.4,12.6)	33.3	(28.9,38.1)	41.1	(36.3,46.0)	15.9	(12.4,20.3)	599
Chronic conditions									
None	22.3	(20.1,24.7)	37.5	(35.0,40.1)	31.9	(29.2,34.6)	8.3	(6.6,10.3)	1838
One	23.9	(21.8,26.0)	40.9	(38.6,43.3)	27.7	(25.5,30.1)	7.5	(6.2,9.1)	2288
Two	21.2	(19.2,23.4)	41.4	(38.9,43.9)	29.0	(26.5,31.6)	8.4	(6.8,10.3)	1894
Three or more	20.2	(18.2,22.4)	39.5	(37.1,42.0)	30.2	(27.9,32.6)	10.1	(8.6,11.8)	2154
CAPS-19 Quality of life									
Mean score	45.8	(45.5,46.2)	44.5	(44.2,44.9)	42.5	(42.0,43.0)	40.0	(38.9,41.1)	7146
CES-D depression score									
Mean score	4.4	(4.1,4.8)	5.4	(5.1,5.7)	7.0	(6.6,7.5)	9.5	(8.5,10.5)	8070
CES-D depression status									
None/mild	24.6	(23.2,26.1)	41.3	(39.8,42.9)	27.7	(26.2,29.3)	6.3	(5.5,7.2)	5851
Moderate	16.9	(14.8,19.2)	41.1	(38.2,44.0)	30.6	(27.9,33.5)	11.4	(9.3,14.0)	1416
Severe	13.2	(10.8,16.1)	28.4	(24.7,32.5)	41.2	(36.8,45.7)	17.2	(13.8,21.2)	776
Total	21.9	(20.7,23.2)	39.9	(38.6,41.1)	29.6	(28.3,31.0)	8.6	(7.8,9.5)	8174

Table 1 Distribution of social isolation by key health and psychological wellbeing indicators

Furthermore, according to the findings from the Irish Longitudinal Study on Ageing (TILDA) as shown in Table 1, it displays the distribution of social isolation in relation to major health and psychological variables. A higher level of social isolation was linked to lower self-rated health. 16.2 percent (95 percent CI: 13.7-19.1) of participants with mediocre or poor self-rated health were socially isolated, compared to 6.1 percent (95 percent CI: 5.2-7.2) of those with outstanding or very high self-rated health (Loneliness, social isolation, and their discordance among older adults, 2021).

Considering all these factors, The Author has concluded the best way to socialize, interact, alleviate, and help people with disabilities overcome their solitude and loneliness is to create this buddy system using a mobile application.

2.2.2 Accessibility

The Author has defined that he would incorporate accessibility features into the mobile application. Accessibility is a critical feature in any application, but it is vitally important to integrate it into this project since it caters to and helps people with disabilities. Accessibility is the design of a mobile application for individuals with disabilities. The disabilities could include anything from hearing to mobility-related problems. The app will consist of accessibility features to cater to various hearing, visual, and speech impairments. According to Appoly, it is stated that around 15% of people globally suffer from some form of disability or impairment. Mobile applications need to implement accessibility features mainly because 1 in 7 people might not be able to use it because it would not regale any accessibility features (“The Importance of Accessibility in a Mobile App”, 2021).

The Accessibility options that the Author has featured and make good use of within this mobile application are good mobility, clear vision, colour perception, and hearing, speech, cognition, and literacy assistance. These elements will be addressed and implemented by assigning assistance for keyboard interactions, configurable hand gestures and screen readers; the application would also support user customization within the mobile application allowing the user to be able to change settings depending on what impairments they may have. For people that may have low vision and hearing impairments customizable font sizes, magnification lenses, colour change customization, and high contrast settings would be used. The Author has included descriptive labels, screen readers, and audio descriptions of text for those people who are visually impaired (Accessibility and your app design, 2021).

The Author has included a good UI design with a modern and clear colour scheme that would enable the user to use and access the mobile application with ease and comfort. In terms of navigation within the mobile application, the Author has also created a straightforward workflow within the pages to get to the required page destination with the least number of clicks.

2.2.3 Geo Location

Another key feature that this application would incorporate into this mobile application is Geo-Location Services. A Geolocation API is a communication interface between an application (Client-Side) and an application (Server Side), recognizing and retrieving information about the client's geographic location. Geolocation APIs are called when there is a need to call and configure a web/mobile-based application programmatically based on the user's location. Common use cases include geo-tracking and implementing user security checks (What is a Geolocation API and how is it used?, 2021).

The Geolocation Service API does not hold any information within the API; however, it can accumulate existing information from the machine being queried (What is a Geolocation API and how is it used?, 2021)

The Author has integrated Geolocation services within this mobile application to find, search and connect to the buddy nearest to another buddy based on the closest geographical location. The Geo-Location Services would be implemented using the Geo Location API on Google that provides Libraries to call and use these functions to integrate it with a mobile application. This would be a massive feature on the mobile application as it would allow users to pair up with buddies closest to them, which would make it more accessible and convenient for the user.

2.2.4 Chat Services

Another main characteristic that would embody this mobile application is a chat service that will allow its users to communicate with different parties (people with and without disabilities) together. Chat service is an online service or technology that enables text messages to be translated in real-time between users (What is Chat Service - Helpshift, 2021).

The Author emphasizes putting this feature as the focal point on the mobile application solely since this feature will aim to help people with disabilities socialize and buddy up with people without any disability.

The application would first prompt the user to sign up and register using his/her email on the mobile application, which will create an account for the user and request the person(s) to log in. Using the details that were stored for registering with the account, the chat service would then register them onto the chat service platform enabling the user to find their friends using the find friends area via search or map, which in turn allows the user to connect and chat to their buddies and peers effectively.

The chat service that this application would comprise within this mobile application would include two main implementations for online communication: calling and texting. These options for exchange give the user different choices based on their preferred mode of social interaction. The Author would also implement video calling as an extra mode of communication for the users using the mobile application.

3 Technologies Research

3.1 Mobile Application Development

In today's world, technology has become a critical factor in everyday life. One of the most widespread components of technology these days is the use of smartphones/hand-held devices. Smartphone users have significantly surpassed the amount of desktop/laptop users. In a survey of smartphone users around the globe by Statista, in 2021, over 3.9 million people use smartphones in Ireland; it is expected that by 2026, that number is expected to go up to 4.41 million, which is a considerable proportion of the Irish population (Ireland mobile internet users 2016-2026 | Statista, 2021). As time progresses, the popularity of smartphones grows worldwide as well. A 2021 survey showed that 7.1 billion users around the world use a smartphone today. According to DataReportal, that is roughly 73% of the world population (Forecast number of mobile users worldwide 2020-2025 | Statista, 2021). Even though smartphones are popular today, the two most established platforms are Google's Android Operating System and Apple's iPhone Operating System. Due to the following reasons, the Author has decided to develop a mobile-based application.

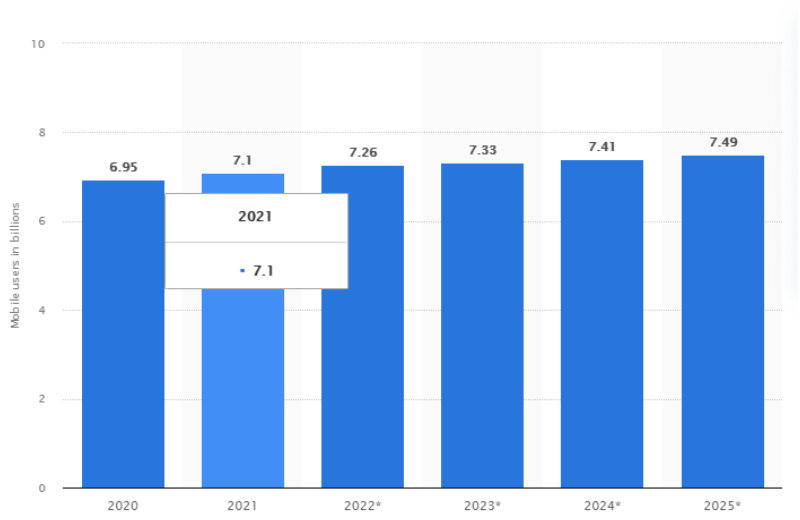

Figure 2 Number of mobile users worldwide from 2020 to 2025

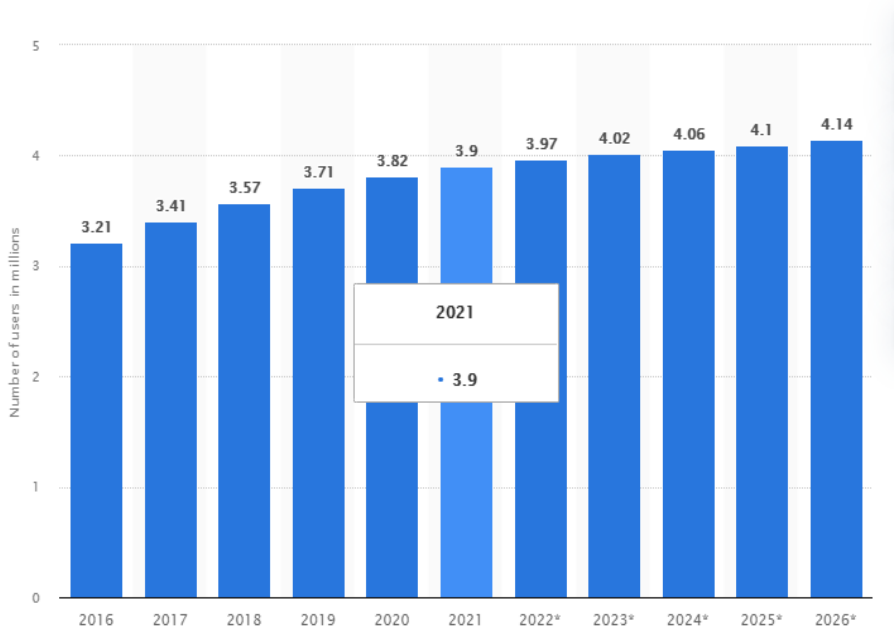

Figure 3 Number of mobile internet users in Ireland from 2016 to 2026

3.1.1 Android

Android is an operating system formed on the Linux Operating system and is a free, open-source platform for various mobile devices such as tablets, smartphones, and smart devices. Android ranks as the most used mobile application platform. According to Statcounter, in September 2021, Android held a 72.44% portion of the mobile phone market (Android Operating System Market Share Worldwide | Statcounter Global Stats, 2021). Android was founded by Open Handset Alliance, which Google and other Multinational Companies led. Android allows its developers to only develop in Android, which could be implemented and used across multiple devices powered by Android, making it efficient and easily accessible. The first pre-release of the Android Software Development Kit was released in 2007 by Google. Then in 2008, the stable version was released, which was for commercial use. Google then announced the next Android Version, 4.1 Jellybean, in 2012. Jellybean was an updated version for Android, which provided better UI in terms of Performance and Functionality (Android - Overview, 2021).

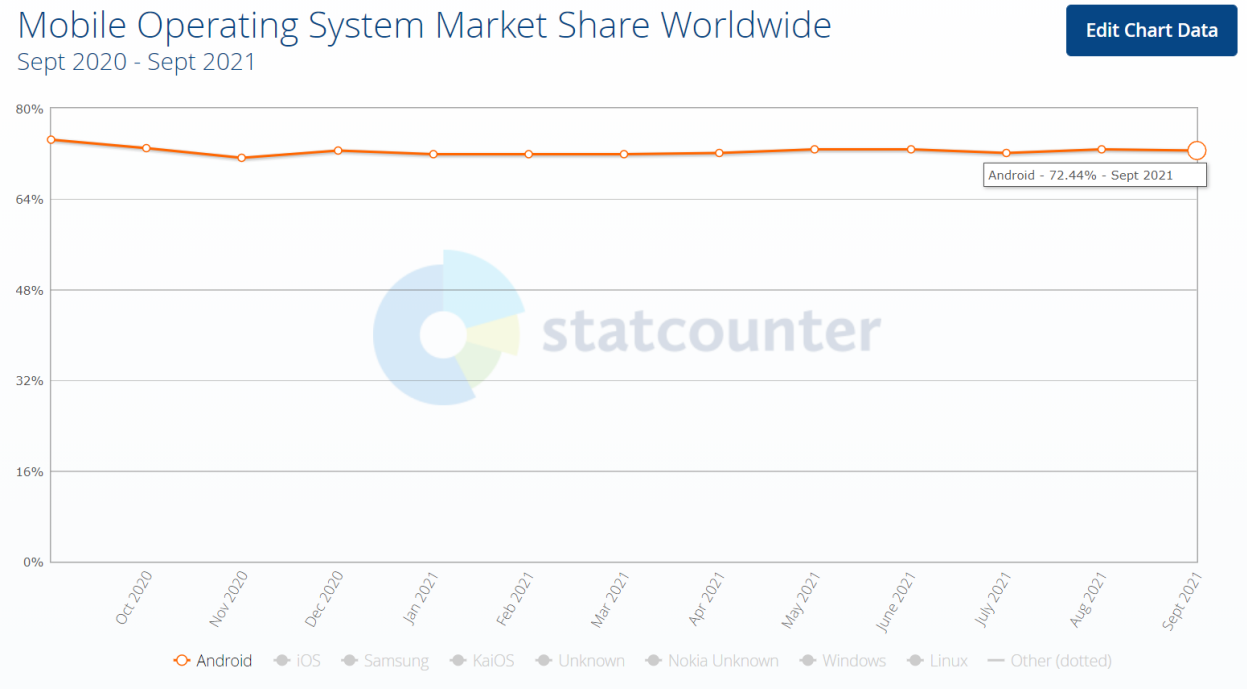

Figure 4 Android Operating System Market Share Worldwide

There are several reasons why Android Operating Systems have become consequently popular. Android Operating System provides an Open-Source Environment for its users. They have a prominent developer and Community Reach, have Increased Marketing, provide Inter-App Integrations, allow for Reduced Cost of Development, have a High Success Ratio, and supply a Rich Development Environment (Android - Overview, 2021).

Android is a powerful Operating System that provides and supports a vast number of features. Some main features and advantages of the Android Operating System include the following:

- UI Design – Provides a modern and intuitive user interface.
- Connectivity – Provides connections to various technologies, mainly Bluetooth, Wi-Fi, and NFC.
- Storage - SQLite is a software package that provides a Relational Database Management System.
- Media Support – Supports various media extensions, mainly MPEG-4 SP, MP3, WAV, JPEG, PNG, GIF, and BMP.
- Messaging – This Allows for MMS and SMS type messaging.

- Multi-Touch - Android has native support for multi-touch which recognizes more than one point of contact with the device surface for easy access.
- Multi-Tasking - Users can jump from one application to another and can also concurrently run various applications at the same time.
- Widgets - are resizable, so users can enlarge them to identify more content or shorten them to save lots of space.
- Multi-Language - Supports using different languages by internationalization.
- GCM - Google Cloud Messaging (GCM) is a service that lets developers send short messages to users on Android devices without having an exclusive sync solution.
- Wi-Fi Direct - A technology that lets apps discover and pair directly over a high-bandwidth P2P transmission.
- Android Beam - A NFC-based technology that allows users to share immediately by touching two NFC-enabled phones together.

(Android - Overview, 2021)

However, looking at the benefits and an immense number of features that Android provides, there are also many downfalls in using the Android Operating System. Some applications on the Android Market can contain viruses and bugs, a considerable amount of background processes can lead to the battery quickly draining, advertisements would always be on display with these applications, they contain a high device fragmentation, and they have low-security policies on their Operating Systems (The Pros and Cons of Android, 2021) (Advantages and Disadvantages of Android & iOS, 2021).

3.1.2 iOS

Apple iOS is an Operating System for iPhones, iPad and other smart apple devices based on the Mac Operating system. iOS ranks as the second most used mobile application platform, right behind the Android Operating System. According to Statcounter, in September 2021, Apple iOS held a 26.75% portion of the mobile phone market (iOS Operating System Market Share Worldwide | Statcounter Global Stats, 2021). Apple Operating System was first released in June 2007 by Apple. Apple released their iPhone Software Development Kit in 2008, which allowed

developers to create applications for the Apple platform. Apple published their iOS version 12 in 2018, which paved advancements in design and functionality (Apple iOS, 2021).

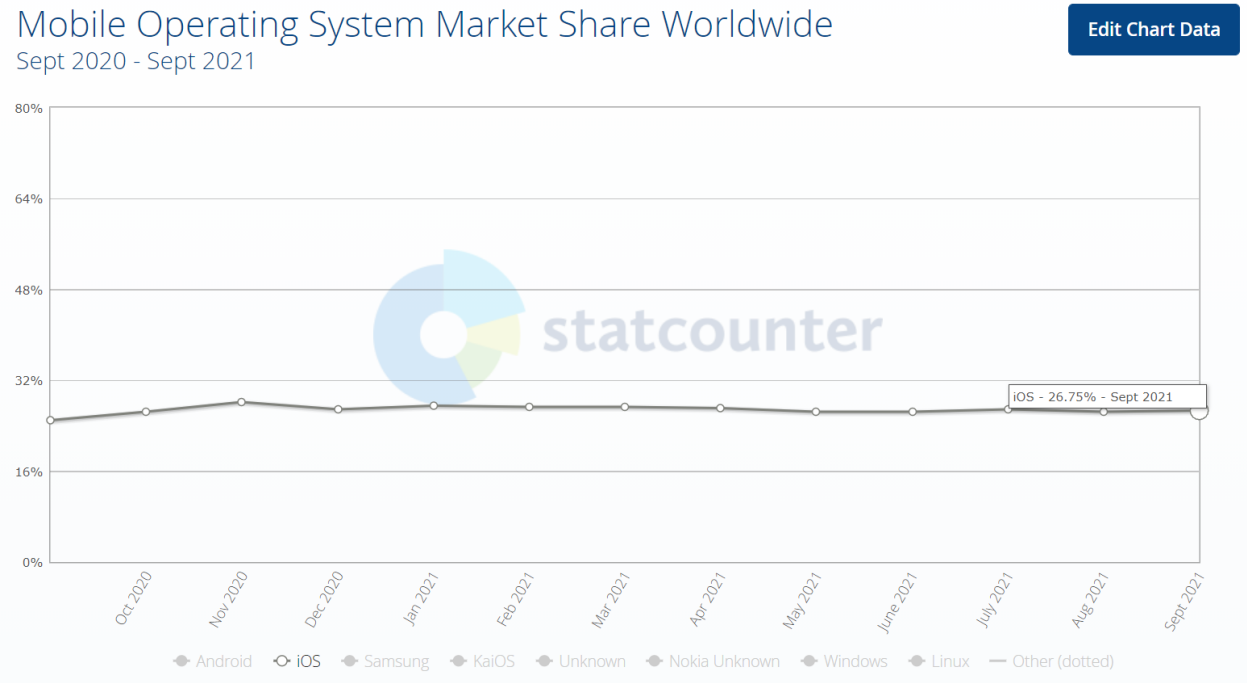

Figure 5 iOS Operating System Market Share Worldwide

There are multiple reasons why the Apple Operating System has become so popular and globally recognized. According to Investopedia, Apple sold nearly 218 million iPhones within the year 2018. Estimates show that iOS products have made around $1 Trillion of Revenue for Apple. iOS Operating System provides higher revenue, Higher return in investments, takes less time to develop, offers a fluid user experience to consumers, and has better security (Apple iOS, 2021) (Top Reasons to Choose the iOS Platform for Mobile App Development, 2021).

There are many features that the iOS Operating System provides and supports. Some of the features and advantages of using an iOS Operating system are as follows:

- UI Design – Provides a modern and fluid user interface.
- Connectivity – Provides connections to a variety of technologies, with the main ones being Bluetooth and Wi-Fi.
- Storage – A Solid-State flash memory, which stores all the data.

- Media Support – Supports various media extensions, with the main ones being H.264, MPEG-4.
- iMessaging – Allows for MMS and SMS type messaging
- Multi-Touch - Android has native support for multi-touch which recognizes more than one point of contact with the device surface for easy access.
- Multi-Tasking - Users can jump from one application to another and can also concurrently run various applications at the same time.
- Apple Pair – Allows the user to pair and send data to other apple users.

Nonetheless, with all the benefits and features that the iOS Operating System provides, there are also disadvantages to the iOS Operating System, which are it is not compatible with any other types of platforms or devices, it has no widget support for iOS apps, does not provide NFC and is not radio built in. The app size is usually too big, consuming too much storage and space (Advantages and Disadvantages of Android & iOS, 2021) (Advantages and Disadvantages of iOS | IOS App Development Service, 2021).

3.1.3 Preference of Platform

The Author, after looking and researching the Android and iOS Operating Systems. The Author has decided to approach this project and develop this application using the Android OS. The main reason for choosing the Android OS is because it has a wider market share compared to iOS OS, which in turn allows the Author to reach a wider audience. Android OS also provides an open-source environment in comparison to iOS OS, which is a closed source. There is also more customization allowed when developing on Android OS compared to customizing on iOS OS, which does not offer much customization on their platform. The Author would also be using the Android OS over the iOS OS due to the higher market share which would increase the target audiences using the mobile application with Android compared to iOS applications (Android vs iOS - Which mobile platform is better in 2020? 2021).

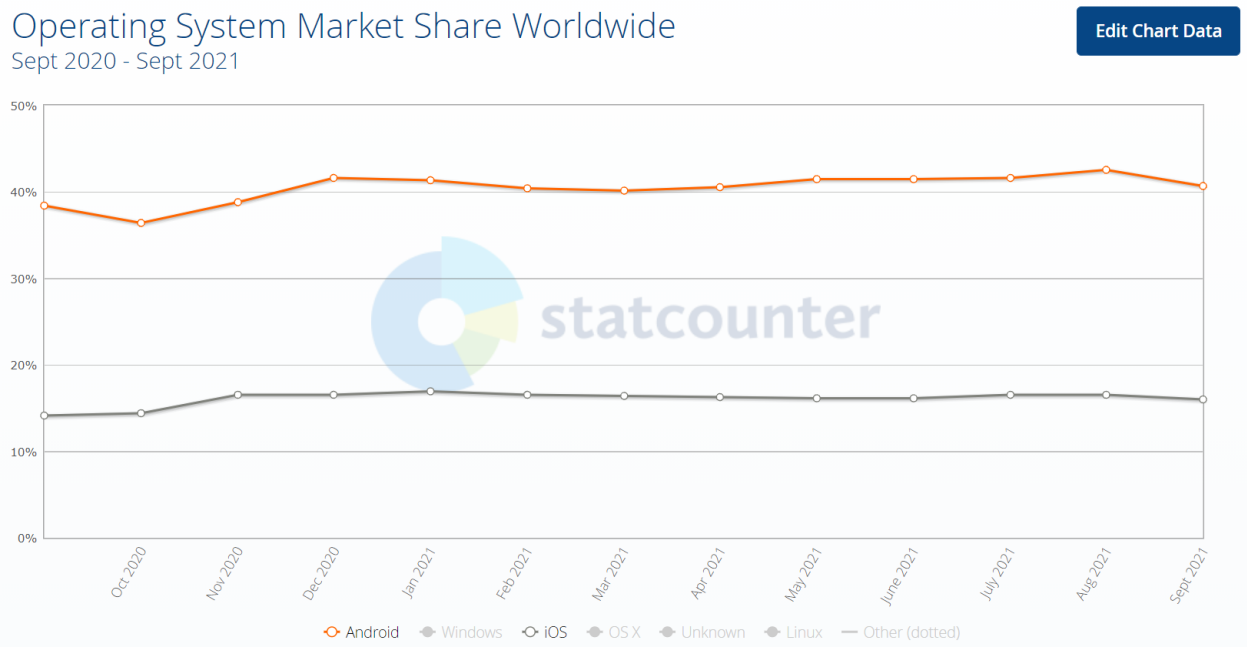

Figure 6 Android Operating System Market Share Worldwide vs iOS Operating System Market Share Worldwide

3.1.4 Java versus Kotlin

There are two main programming languages used in developing an Android Application on Android Studio: Java and Kotlin.

Java is a Programming Language developed in 1995 and emerged in 1995 by James Gosling at Sun Microsystems, which Oracle then acquired in 2009. Java is an object-oriented, open-source and general-purpose language. Java also works on most platforms and devices (Kotlin vs Java: the 12 differences you should know, 2021).

Kotlin is also a Programming Language but is very new compared to Java, as it was first introduced in 2016. Kotlin also supports various Libraries and Frameworks made from Java that are compatible with Kotlin Projects. Kotlin is also known as the Updated Java Programming Language for Android Development which allows for cleaner, more accessible, and faster compilations. It contains a mixture of functional and Object-oriented Programming (Kotlin vs Java: the 12 differences you should know, 2021).

Java and Kotlin are now the two most prominent Programming Languages for Android Development. The Author will conduct and present the main key differences between the two Languages and then select which language would be used to develop the mobile application. The main differences between Java and Kotlin Programming are as follows:

- Code – Regarding code, Kotlin requires less code and is very concise, whereas, in Java, it requires more lines of code than Kotlin.
- Functional Programming – In aspects of Functional Programming, Kotlin contains a combination of both functional and object-oriented programming, but in comparison, Java is only limited to object-oriented programming.
- Primitive Data Types – In Kotlin, once a primitive data type is initiated, it would be treated as an object. In contrast, in Java, variables of primitive types are not considered objects but are defined as Java data types.
- Wildcard Types – In Kotlin, it does not provide any form of wildcards, but on the other hand, Java offers and provides wildcards.
- Public Fields – Kotlin does not offer public fields, whereas public fields are available in Java.
- Data Classes – Kotlin imparts a more effortless path to create classes to store data by using the “data” keyword in the class definition. Still, in Java, Developers must initialize the fields to store the data, such as using the getter and setter functions and other functions.
- Casts – Smart cast features cater cast Checks by Kotlin, which automatically manage redundant cast while on the contrary, Developers much check the variable types per the operation.
- Checked Exceptions – Checked exceptions are not supported on Kotlin, whereas it allows for checked exceptions in Java.
- Null Safety – In Kotlin, it is impossible to attribute null values to variables or objects by default. Still, Java allows NullPointerException, enabling developers to assign a null value to any variable.
- Extension Functions – Kotlin permits the developers to extend the functionality of classes without trying to inherit from a class. In contrast, Java requires creating new classes and inherit the functions from the parent class to extend the functionality of an existing class.

- Coroutines Support – Kotlin provides coroutines assistance. Coroutines are stackless, which permit developers to write code, suspend the execution and resume it later. Java, on the other hand, enables the formation of several background threads when handling lengthy operations.
- Implicit Conversions – Kotlin does not support implicit widening conversions, while Java allows for implicit conversions, which means that's developers do not need to perform explicit conversions.

(Kotlin vs Java: the 12 differences you should know, 2021).

3.1.5 Preference of Programming Language

Making comparisons on both the Java and Kotlin Programming Languages for Android Development. The Author has culminated to develop this mobile application using the Java Programming Language. The Author has decided to go with Java over Kotlin for many reasons, for the first reason being that Java has faster and cleaner builds compared to Kotlin. (Lastovetska, 2021), also, there is a broader community for Java than Kotlin; hence it offers more resources such as articles, websites, journals, and books. Another reason why the Author has concluded to develop this mobile application in Java is due to his proficiency in this programming language.

3.2 Databases

Databases are a huge part of any mobile application. A database is a structured gathering of different information, usually stored on a computer. A Database Management System (DBMS) generally runs a database. A DBMS is an interface that connects the database with the users or applications to retrieve, update, create or delete data allowing them to organize and manage the information. The database, the DBMS, and the applications that use them all work together and form a whole database system (What is a database? 2021).

There are many types of databases that are used, but the most popular of which are as follows:

- Relational Databases – In the 1980s, relational databases became the standard. A relational database's items are structured into tables with columns and rows. The most effective and versatile approach to access structured data is through using a relational database.

- NoSQL Databases – Unstructured and semi-structured data can be stored and manipulated in a NoSQL or non-relational database. As online applications became more frequent and complicated, NoSQL databases became increasingly popular.
- Cloud Databases – A cloud database is a structured or unstructured collection of data stored on a non-public or public cloud computing platform. Traditional and database as a service are the two sorts of cloud database models (DBaaS). A service provider with DBaaS handles administrative and maintenance tasks.

(What is a database? 2021).

Android Mobile Applications can use various databases to implement and use when developing their applications. The Author has chosen to research the three most popular databases: Firebase, MySQL Lite, and AWS DynamoDB. After looking in-depth at the three databases, the Author would then decide on which database would be used when developing the mobile application.

3.2.1 Firebase Cloud Database

Firebase is a real time database feature that is very efficient and easy to use. It is a NoSQL cloud-based database which stores and sync's data. The data always remains available and synced to the developer even when the application is offline. Firebase is also stored in a JSON format (Firebase Realtime Database | Firebase Documentation, 2021) (Khawas and Shah, 2018)

Advantages and Disadvantages of Firebase (Firebase Pros and Cons: When You Should and Shouldn't Use Firebase | OSDB, 2021).

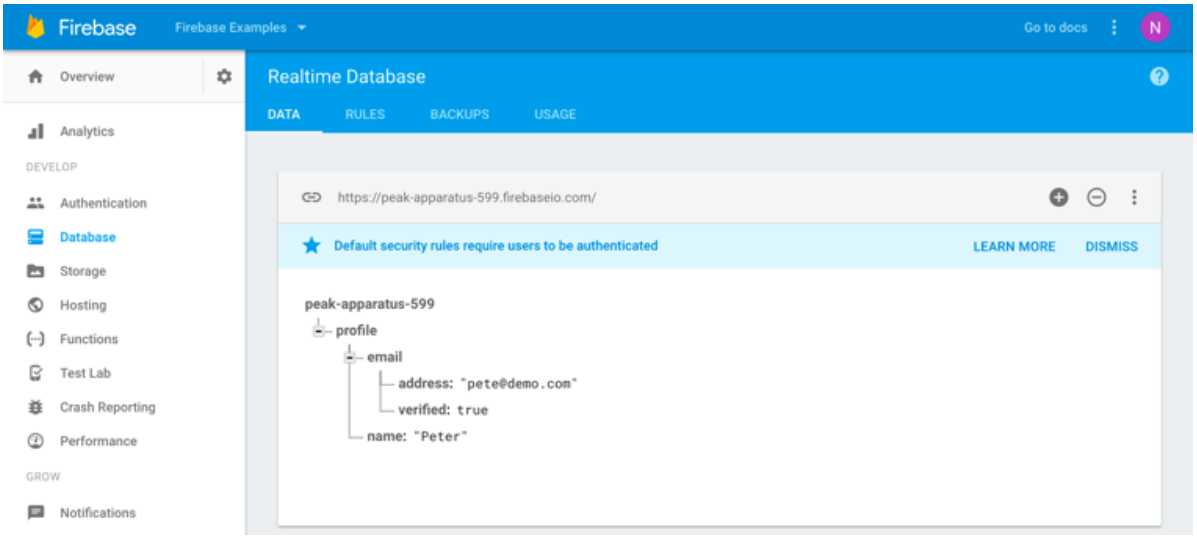

Figure 7 Firebase Database Structure of app

The Firebase Real-Time database provides many key capabilities and advantages such as its running in real-time which permits for data synchronization for any changes in the data which could be received within milliseconds up the update. Also, Firebase applications remain active even when the application is offline due to the SDK requesting the data to disk. Firebase in addition is accessible from various client devices by directly allowing it to connect to client devices by security and data validation rules. Firebase further authorizes to scale across multiple devices databases by subscribing to a free blaze plan on Firebase. Firebase is also very easy to configure for android mobile applications and is not complex. Looking at figure 7 we can also see that Firebase has a very structured and ordered layout when it comes to displaying the data (Firebase Realtime Database | Firebase Documentation, 2021) (Khawas and Shah, 2018)
Advantages and Disadvantages of Firebase (Firebase Pros and Cons: When You Should and Shouldn't Use Firebase | OSDB, 2021).

However, with all the capabilities and advantages that Firebase has. Some disadvantages of Firebase include it not having the ability to manage immense and complex queries, limited data migration transfer, and it being very android centered (Firebase Pros and Cons: When You Should and Shouldn't Use Firebase | OSDB, 2021).

3.2.2 MySQL Lite Database

MySQL Lite is a C-Language Library that performs a small, fast, high reliability and whole featured Structured Query Language (SQL) database engine. The most popular type of database used in Android development is the MySQL Lite. For Android Development, MySQL Lite is usually the default database (SQLite Home Page, 2021)

One advantage of MySQL Lite is that the database is very light and compact. Also, it offers better performance for writing and reading operations which is 35% faster than the default file system. There is also no need for installation needed which makes it very easy to use. It also offers excellent reliability by continuously updating data so little or no data is lost in the event of a crash or power failure. MySQL Lite is accessible through a wide variety of third-party tools and is also portable across multiple 32-bit and 64-bit operating systems (SQLite Advantages and Disadvantages - javatpoint, 2021).

Nevertheless, MySQL Lite has some downfalls as well. MySQL Lite is usually used to handle low to medium-sized traffic HTTP requests. The database size is restricted to only 2GB in most cases which could be a nuisance if the application being developed requires more data to be stored. MySQL Lite also requires developers to have in-depth knowledge of using SQL and understanding its syntax. (SQLite Advantages and Disadvantages - javatpoint, 2021).

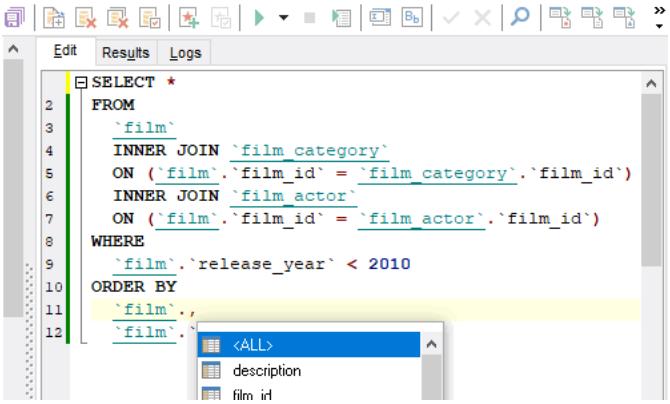

Figure 8 MySQL Lite Query

3.2.3 AWS DynamoDB Database

Amazon DynamoDB is a wholly managed, serverless NoSQL database built to run high-performance applications of any size. Amazon DynamoDB comes with built-in encryption, automated backups, memory caching, and data expertise tools (Fast NoSQL Key-Value Database – Amazon DynamoDB – Amazon Web Services, 2021).

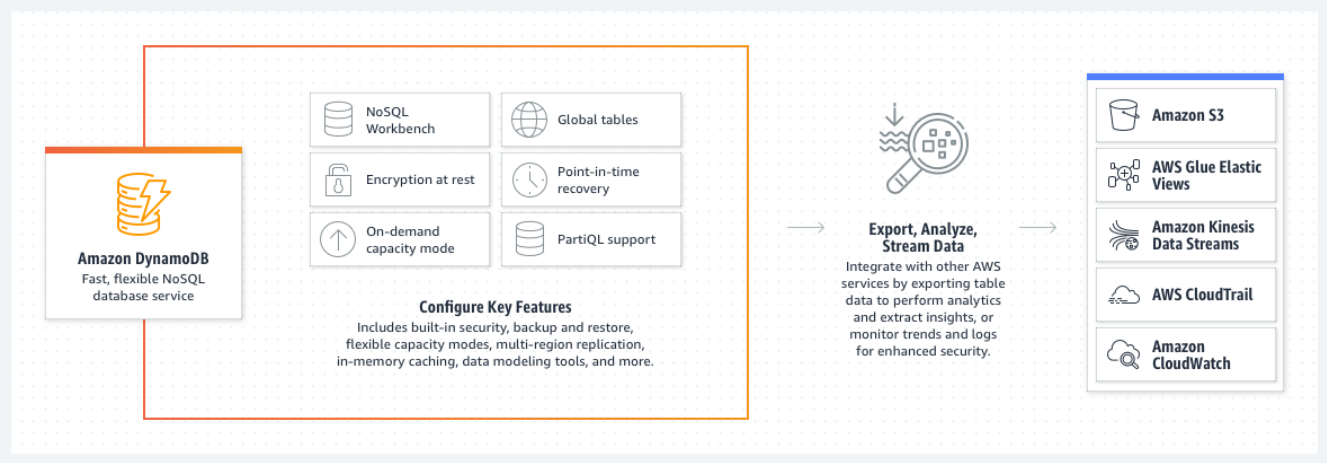

Figure 9 Features of Amazon DynamoDB

Some key advantages of using the Amazon DynamoDB database is that it offers and provides scalability, which means that users can store infinity quantities of data according to their needs. Amazon DynamoDB also allows for Data Replication, managed across multiple availability zones in a region or across multiple areas. It is a schemeless database, which is exemplary for IoT, mobile and gaming. It is also very secure and monitors and alerts Database Threat Detections, Customizable traffic filtering and more (DynamoDB, 2021).

Yet, Amazon DynamoDB being some powerful and efficient as a database, there can be disadvantages that come with them. Some workloads are not suitable for Amazon DynamoDB, for instance, when menu-items transactions are required, when complex queries are essential and when real-time data on necessary data is needed (DynamoDB, 2021).

3.2.4 Preference of Database

Evaluating and inspecting the three different databases that the Author has proposed, The Author will use the Firebase Real-Time Database for many reasons. The first reason is that Firebase allows for more easy sharing of data, and secondly because it can support various real-time features like notifications, chats, and real-time feeds. Another reason why the Author has purposed on using Firebase as the database used to develop this application is it allows for integration with other tools, such as Google Ads, Data Studio and Google Analytics, which in turn guarantees better user experience and smarter marketing feedbacks such as collecting information on the target audiences using the mobile application and also marketing information to see how many people have viewed and used the mobile application within different timeframes (Firebase Realtime Database | Firebase Documentation, 2021) (Khawas and Shah, 2018).

3.3 Technology for Geo-Location Services

As mentioned previously, a critical factor that this application would incorporate would be using the Geo-Location API to allow users to connect to buddies by nearest locations. There are many ways this feature can be achievable, but the Author would use device-based collections. A device-based collection is banked on using cellular networks and GPS, which allows it to be more accurate in areas with higher population density since there is a narrower triangulation distance. The accuracy, on the other hand, decreases when the population density falls. There are generally delays or pauses in data in these situations. This, in turn, escalates the margin for error. People can use (and be used by) these services to find people's general location via GPS-tower-device triangulation as long as location-based services are enabled and have a GPS chip and a mobile network signal. However, users must allow location detection on each device and each application for this feature to work (What is Geolocation? How it Works & Why it Matters | Gravitate, 2021).

There are various Geolocation API's Properties that can be used to get the user's location on the map, such as the getCurrentPosition(), watchPosition(), and clearWatch(). The Author will use the getCurrentPosition() property from the Geo-Location API mainly because the mobile application will only need one position to get the user's base location and not continuously change location as the user is travelling to different places. The getCurrentPosition() property fetches the device locations data and stores it in latitude, longitude and accuracy into a position object which can then

be used in a callback function. It is also possible to add arguments to specify the accuracy, timeout value and the maximum age to cache position data (What is a Geolocation API and how is it used? 2021).

3.4 Technology for Accessibility Features

Another prominent feature the Author has built into this mobile application is using accessibility features to cater to people with disabilities. The Author has increased text visibility and used extensive and straightforward controls for people with visual impairments to see clearly, which would be achieved by going into the UI design on Android Studio and making adjustments. Secondly, the Author has implemented a screen reader for people having difficulties looking and interacting with online content; an Audio reader is also incorporated into this mobile application to help people with visual impairments. On-screen text and fingerprint gestures will be implemented to help people with any speech and cognitive impairments. These features are all implemented using the Accessibility service that Android Studio provides. The Author creates a button on the mobile application that would directly link the user to the device settings on the mobile device and allow the user to get accessibility features on the mobile application. The accessibility service, which connects to the android-based accessibility menu, will also enable users with disabilities to take screenshots, lock screens, open google assistant, open quick settings and notifications, control volume, and control brightness by allowing the user to use hand gestures and easily accessible buttons. Another prominent feature implemented into the mobile application is the Dark/White mode toggle button, enabling users to toggle between these two different themes and access their preferred version of themes based on their preference. Last but not least, the Author has designed a workflow before the development phase to plan the least number of clicks to get to each page to provide the most enjoyable experience for the user (The Mobile Accessibility Landscape - Level Access, 2021) (Use the Accessibility Menu - Android Accessibility Help, 2021).

3.5 Technology for Chat Services

The chat service for messaging via the mobile application between buddies is also an important feature that would be consolidated within application. The Author would do this using Android Studio with first creating the Messaging User Interface, then creating the view which connects the messages with the UI design. After that the Author would create an activity to allow for

communication. Once all these steps are completed the Messaging system will work and allow users/buddies to interact and communicate via each other via messaging. After that the Author would then implement the calling features that would enable users/buddies to call other buddies and speak with them, this would be done by granting permissions to allow the application to gather the user's contact details, followed by implementing the connection service, to handle all the common calling scenarios such as starting, holding, and ending calls. After the Author would incorporate mandatory chat features included in all mobile applications chat services such as offline support, link previews, commands, reactions, attachments, edit messages and threads. (Android chat tutorial: How to build a messaging UI - Sendbird, 2021) (Build a calling app | Android Developers, 2021) (Android Chat Getstream, 2021).

3.6 Conclusion

This research review's purpose is to help the reader understand different aspects posed by the research on social loneliness and isolation for people with both physical and mental disabilities and also to find the best approaches on how to build a mobile application to successfully cater for an application to allow people with various disabilities to communicate effectively to people without any disabilities. This is significant because people suffering from loneliness and social isolation do not have such services or applications to help them overcome their solitude. Most of the research was conducted from various websites and articles that gave an in-depth insight into the research context and technological research. After conducting this research, the Author has made critical decisions on how the application would be developed. The Author would develop this application on Android platform using Java and XML and incorporating Firebase Real-Tine Database and other technologies such as accessibility, geolocation, and chat services into the mobile application. More research and testing are required to better understand why there are still no applications developed to cater to these kinds of services. It is essential to conduct more studies on the results and why people with disabilities have high social loneliness and solitude rates.

4 Analysis and Design

4.1 System Overview

This project is comprised of various designs that incorporate multiple software aspects which in turn require separate phases of development. An overview of the project can be seen in the figure below.

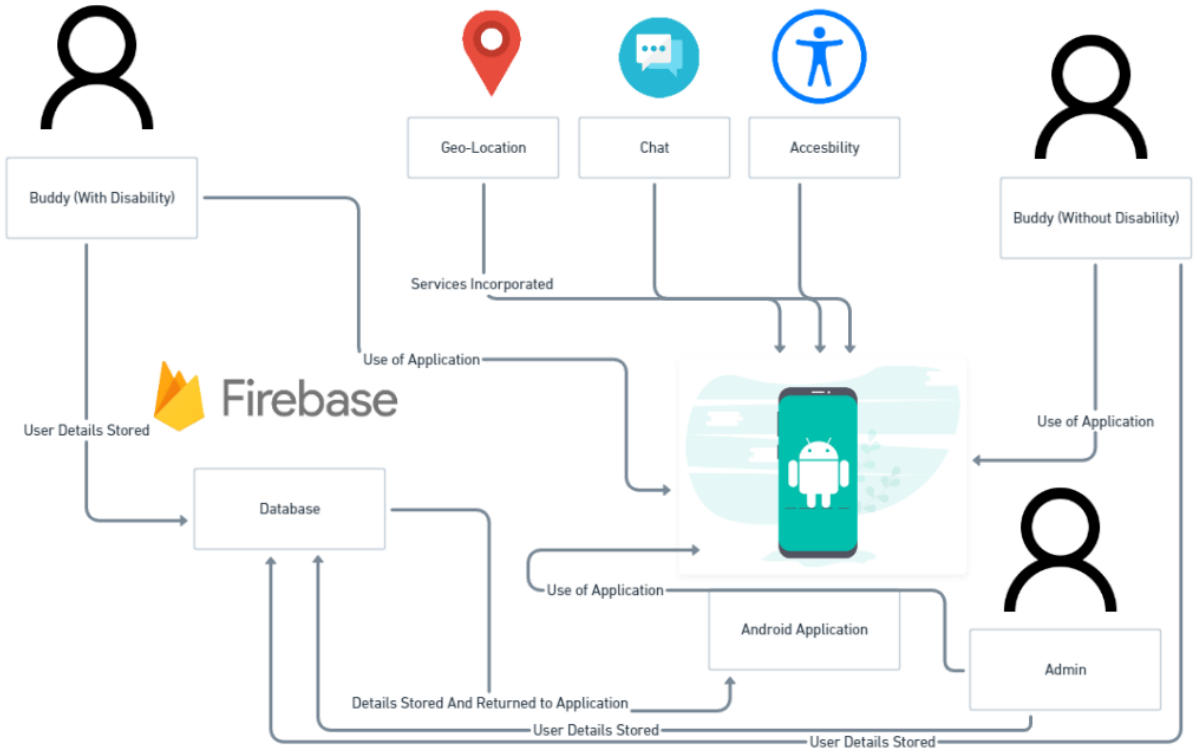

Figure 10 System Overview

This system would be developed using software components within this android mobile application. Each aspect of the project is essential to make the project function and operate successfully. The system contains a Firebase database and an Android application that would incorporate Geo-location, Chat and Accessibility features. The buddy with or without a disability can register on the application and then request the buddy to enable their location service, which gets stored in the Firebase real-time database. Then after registering, the buddy would be able to log in using the details provided to sign up by the system retrieving the information stored from Firebase. The buddy would then be able to add information to their profile for other buddies to read. The application would also let buddies view a map of people using the mobile application

and locate the buddies closest to them and send an invite to pair up with the buddies. After the buddy accepts the invite, the other buddy would then be able to chat via the mobile application and make calls to communicate with each other. For the buddy having disabilities, the mobile application would allow the buddy to access various accessibility features to their liking and aid to use the application more effectively and clearly, for people with different hearing, visual and speech impairments.

4.2 Non-Functional Requirements

The Author has also taken into consideration the following non-functional requirements to develop this mobile application which are:

- Availability – The Author has decided for this application to be operational 24/7 and have minimum idle time by reducing the number of bugs within the application
- Performance – The Author has also considered allowing multiple users access this application simultaneously and having efficient and fast response times when using the mobile application
- Security – The Author has also implemented security and safety requirements to secure the users confidential data in the cloud using firebase cloud database and authentication
- Usability – The Author has also incorporated a friendly and ease of use interface that allows the users to seamlessly interact with the mobile application

4.3 Functional Requirements

The Author has implemented and taken into consideration the following functional requirements to develop this mobile application which are:

- Sign up as a buddy (Person with or without disability – 2 different roles)
- Login
- Logout
- View Personal Profile
- View Other Buddies Profile
- Edit Profile
- Add Diary to Profile
- Find a Buddy via search on contact list

- Search for a Buddy via Geo-Location Services
- Chat with a buddy via message
- Chat with a buddy via call
- Enable Accessibility Features
- Accept Buddy Requests
- Decline Buddy Requests
- Find Suggested Buddies near you
- View Frequently Asked Questions
- Add Attachments and Book Appointments via chat
- File Complaints and Report Abuse
- View Admin Dashboard
- View Reports and Abuse Complaints
- View and Remove Users

4.4 Android Application Wireframe Prototypes

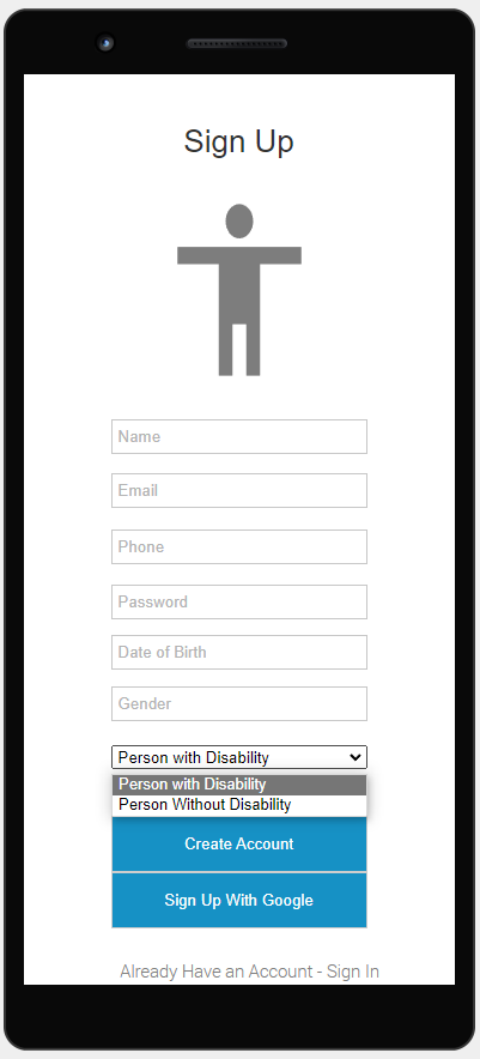

Figure 11 Sign Up Prototype Design

Figure 11:

This is the mobile application's sign-up screen. It will allow the user to sign up with their details to create an account, the user can also sign up with a google account if they have one. If the user already has an account the user can click on the "Already Have an Account – Sign in" Link which would redirect the user to login.

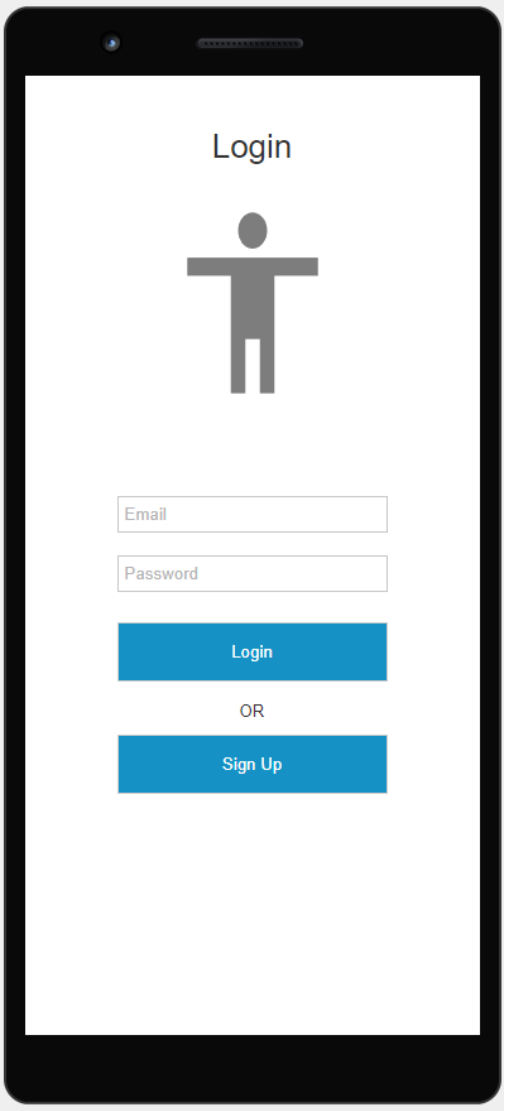

Figure 12 Sign in Prototype Design

Figure 12:

This is the mobile application's login screen. It will allow users to login with their credentials from either creating an account previously within the application or signing in with their google accounts.

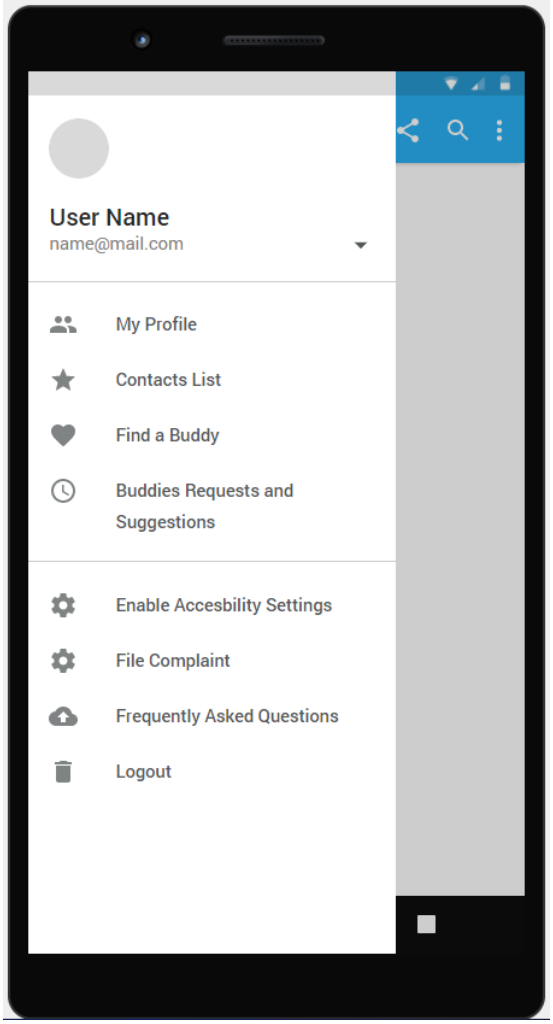

Figure 13 Navigation Menu Prototype Design

Figure 13:

This is the mobile application's navigation pane screen. This screen allows users to view the different pages within the mobile application and navigate to the required pages when clicking on the specific links which redirects them to the specific page.

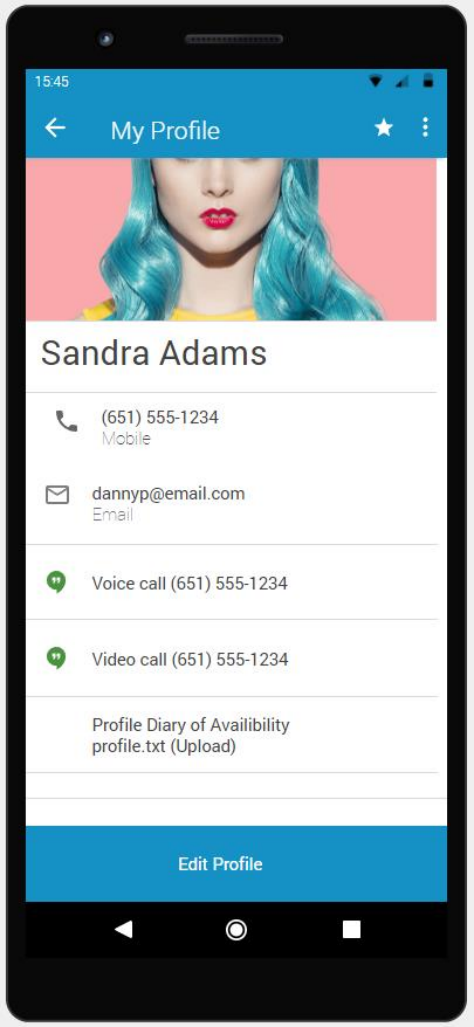

Figure 14 Personal Profile Page Prototype Design

Figure 14:

This is the mobile application's personal profile screen. Here users can view their profiles and edit their contact information and also upload a brief txt diary file of their personal diary and information.

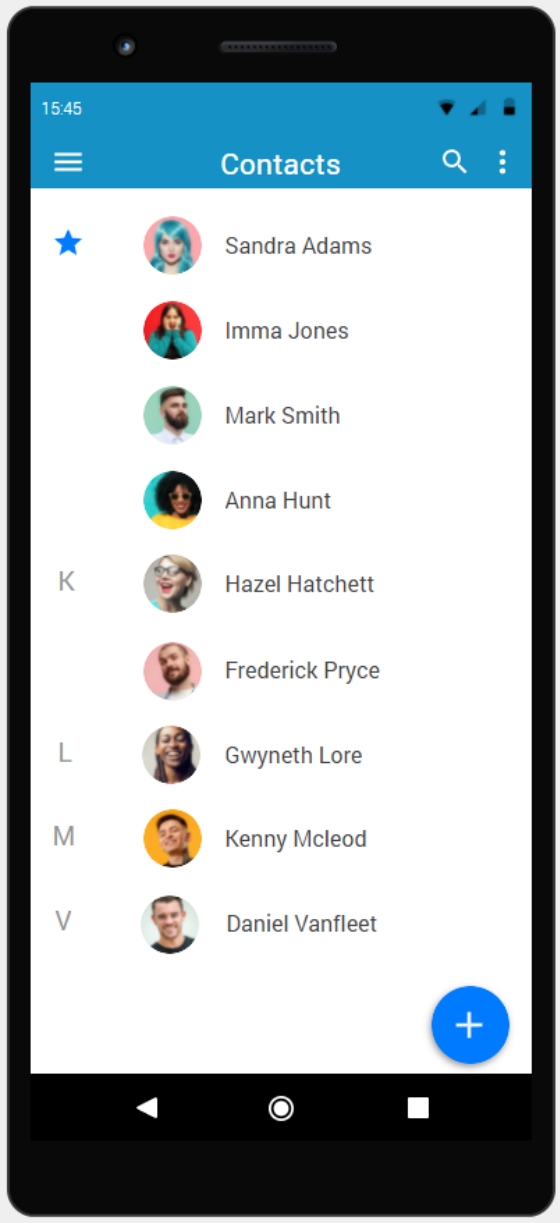

Figure 15 Buddies Contacts List Prototype Design

Figure 15:

This is the mobile application's contact list screen. Here users can see a list of their buddies they have connected with on the mobile application. If the user clicks on a buddy from the list it would link them to the chat for that particular buddy.

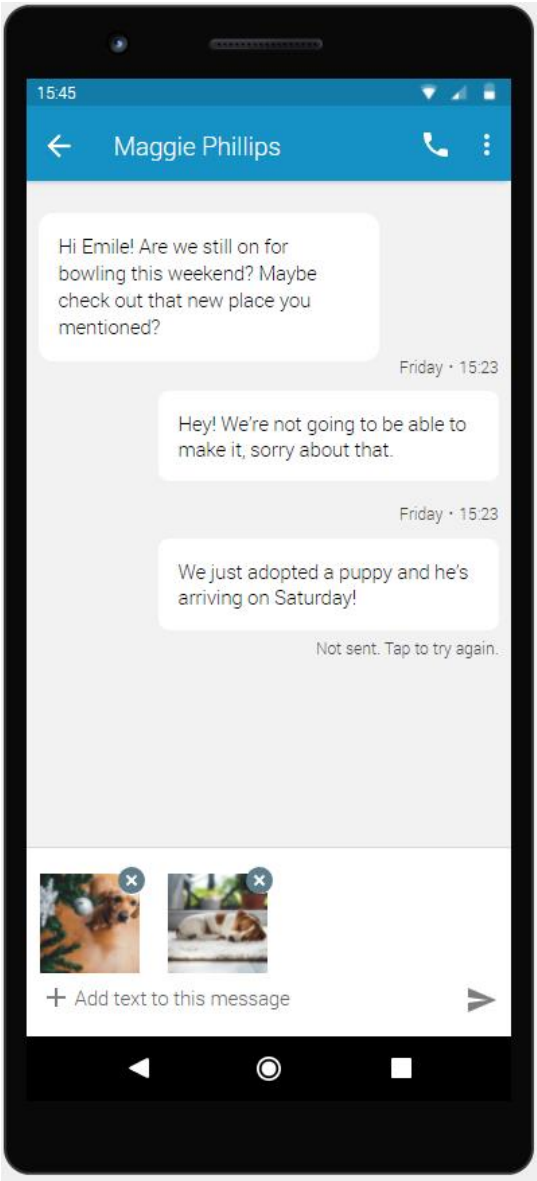

Figure 16 Chat Page Prototype Design

Figure 16:

This is the mobile application's chat screen. This allows the user to communicate with a particular buddy and attach photos, files and arrange appointments etc. The user can also call the buddy if he/she wishes to. If the user clicks the name of the buddy it would link them to their profiles.

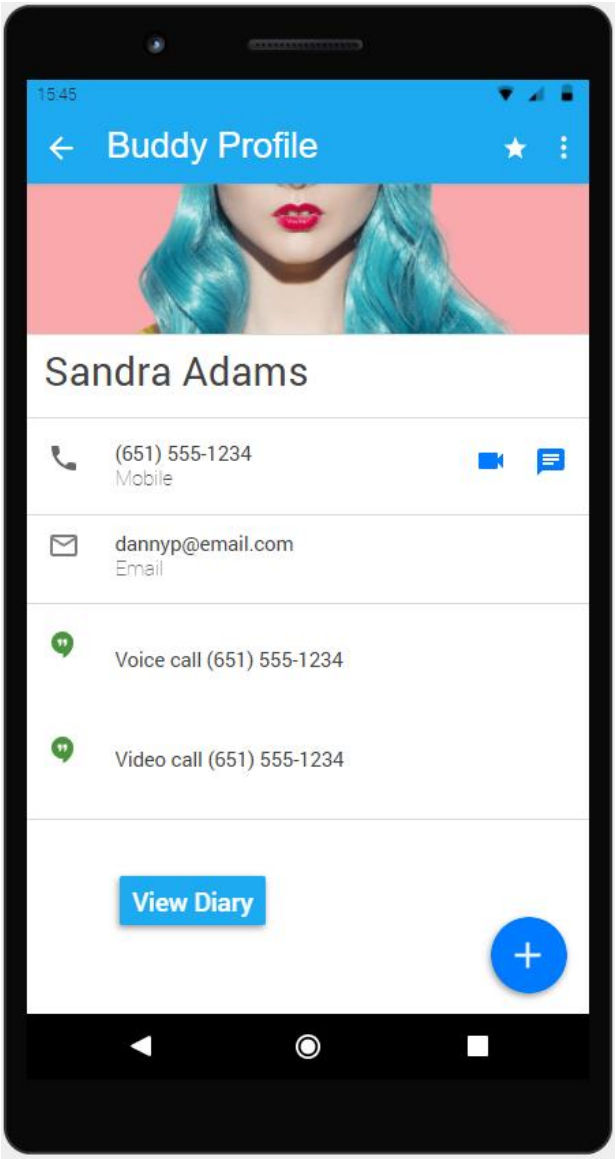

Figure 17 Buddy Profile Page Prototype Design

Figure 17:

This is the mobile application's buddy profile screen. Here users can view other buddy profiles and view a diary file of other buddy's personal diary and information.

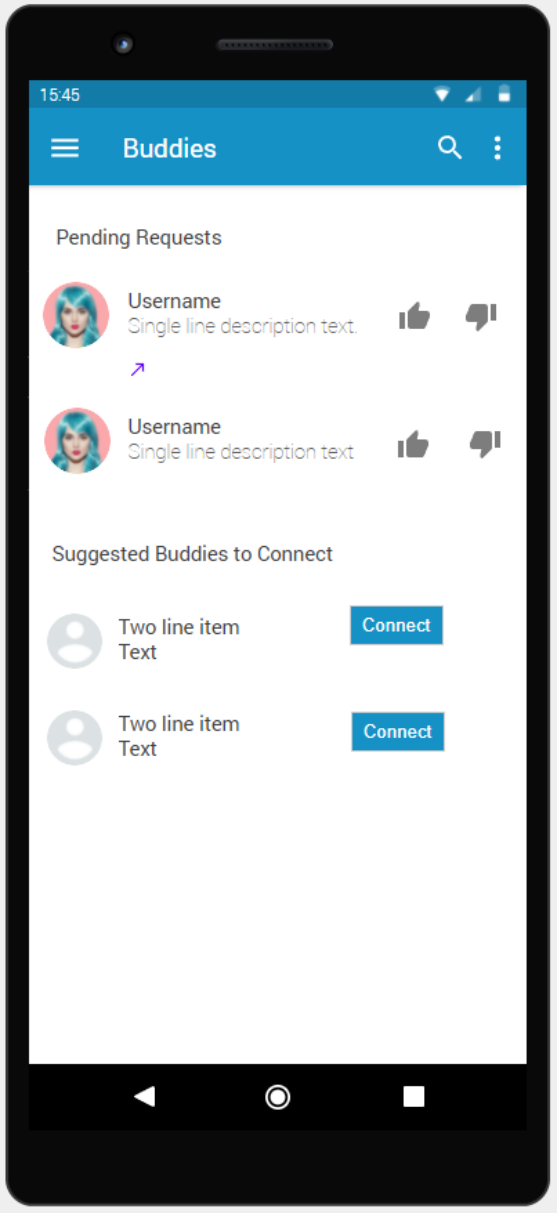

Figure 18 Buddies Suggestions List and Requests Page Prototype Design

Figure 18:

This is the mobile application's pending requests and suggested buddy's screen. Here the users can view a list of pending requests and accept or decline the request to connect with them. It also suggests buddies to connect to by closest distance to you.

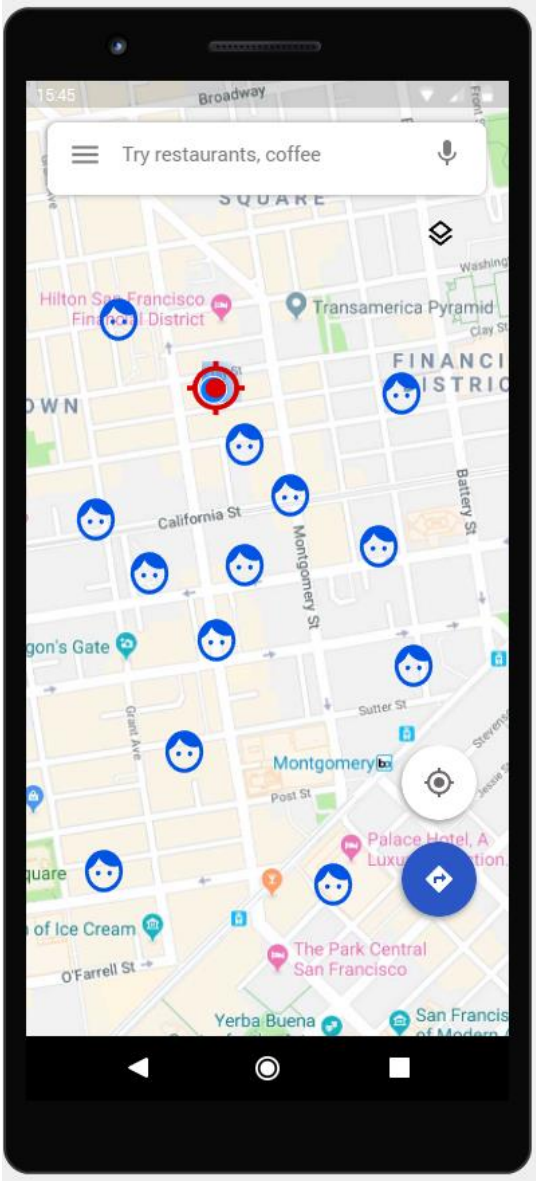

Figure 19 Google Maps Nearest Buddies Page Prototype Design

Figure 19:

This is the mobile application's google maps nearest buddy's screen. Here users can view a map and see other buddies around the world using the application and connect with the buddies closest to their location.

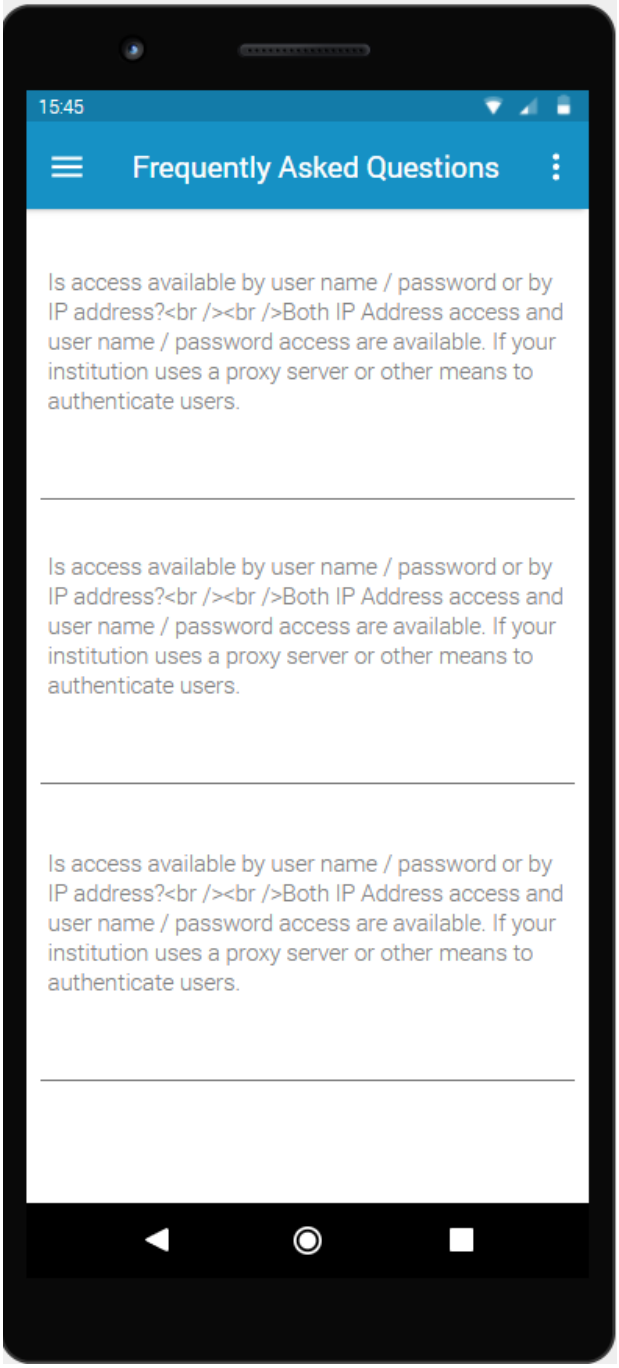

Figure 20 Frequently Asked Questions Page Prototype Design

Figure 20:

This is the mobile application's frequently asked questions screen. Here the users can view a list of frequently asked questions from multiple users which could be found here.

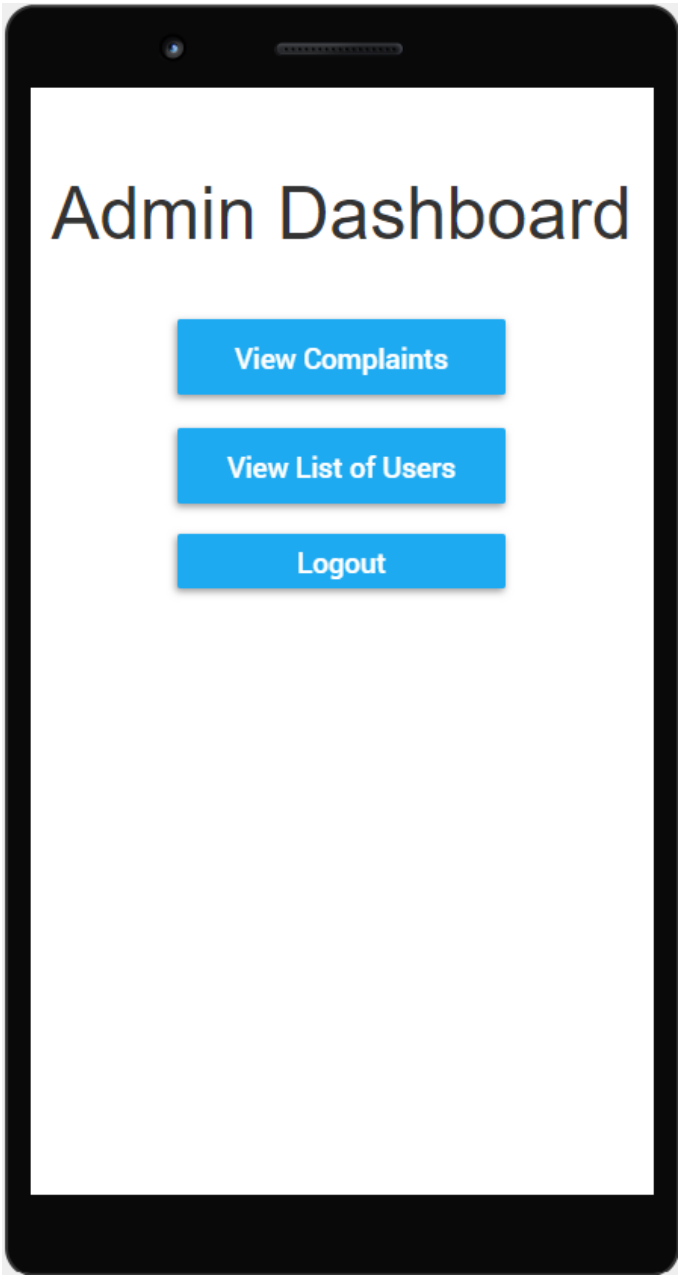

Figure 21 Admin Dashboard Page Prototype Design

Figure 21:

This is the mobile application's admin dashboard screen. Here the admin can either view buddies' complaints or view a list of users by clicking on the buttons.

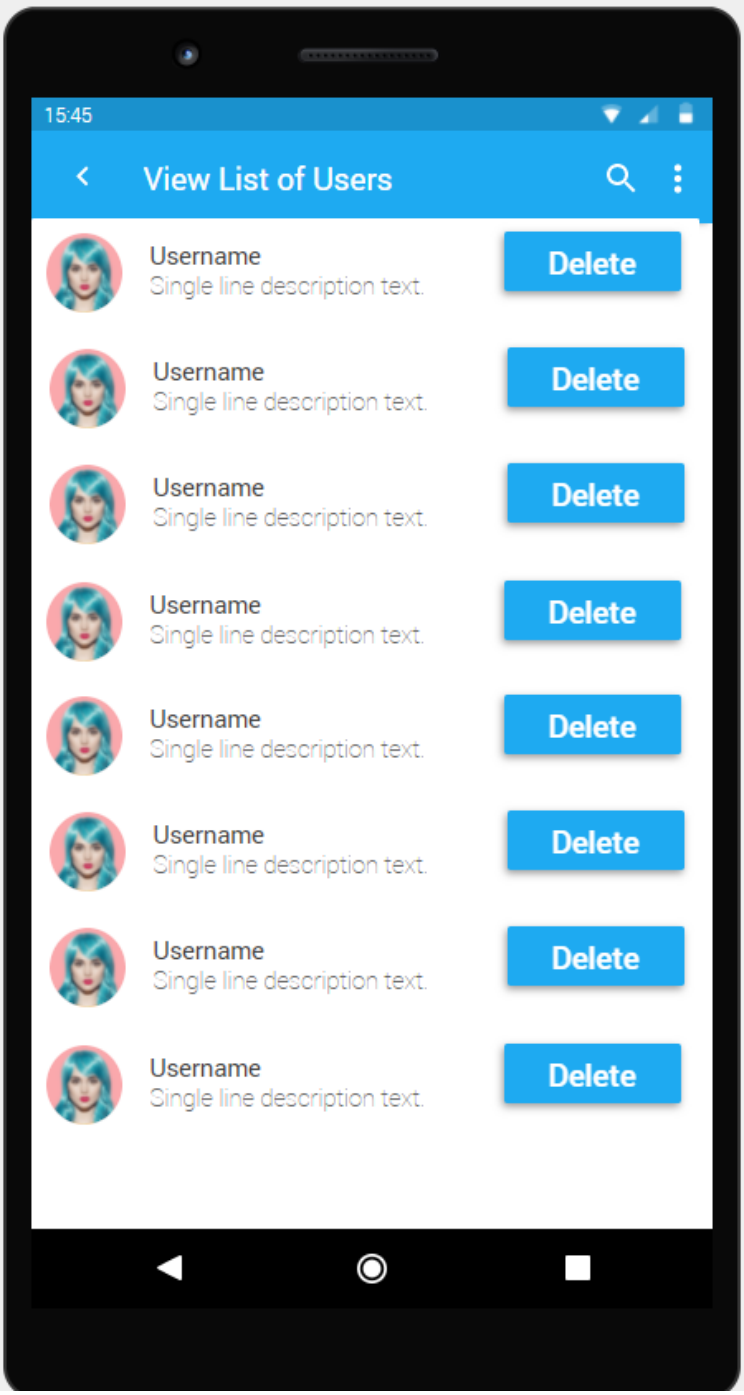

Figure 22 List of Users Page Prototype Design

Figure 22:

This is the mobile application's list of user's screens. Here the admin views a list of users and can delete a user.

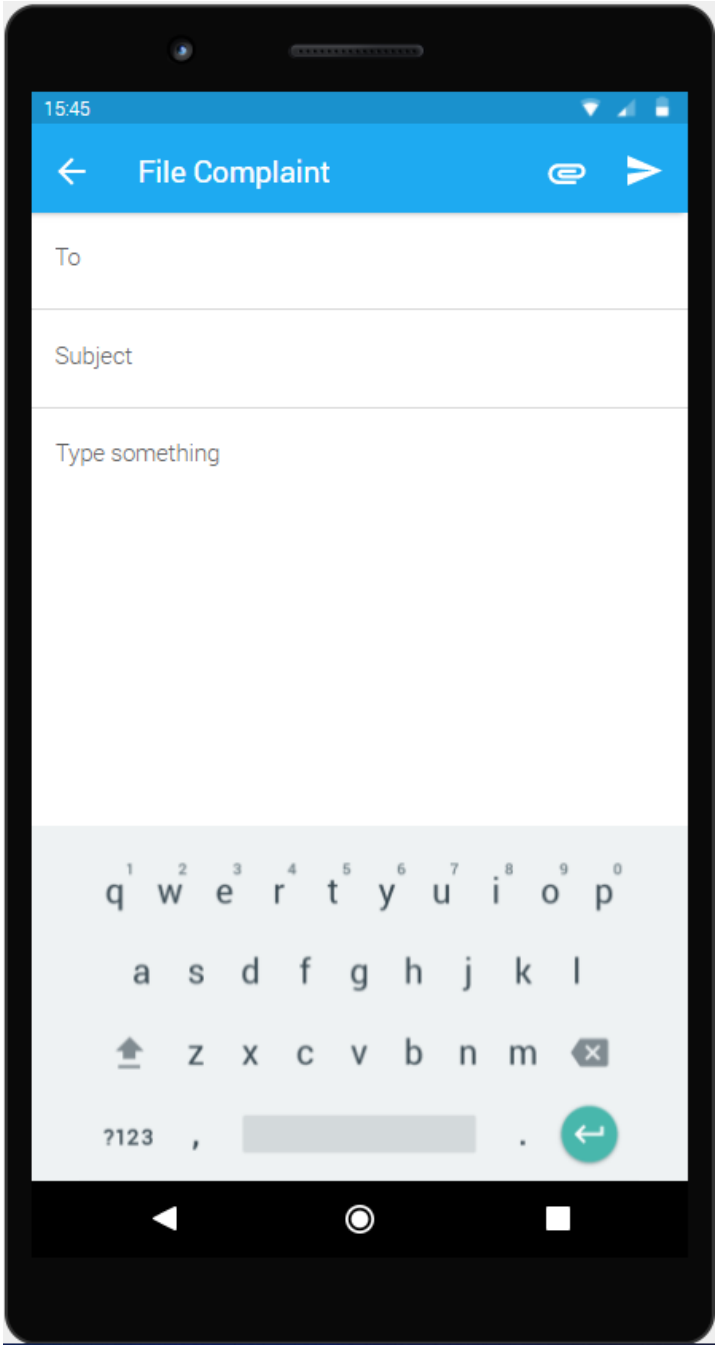

Figure 23 File Complaint Page Prototype Design

Figure 23:

This is the mobile application's file complaint screens. Here the user can file a complaint and report abuse on the application.

4.5 Use Case Diagram

Figure 24 Use Case Diagram

Here the Author has designed a Use Case Diagram to show an overview of the use cases and system that would be defined within the next chapter. In the use case diagram, we have the system and use case operations within the mobile application system. The participating actors within this system are the Buddy with/without disability and the Administrator, which link to various functions/use cases within the system, as shown in the figure above.

4.6 Use Cases

Use Case Name:	Sign Up
Participating Actor:	Buddy with & without disability
Entry Conditions:	1.The Buddy has accessed the system to create an Account. 2.The Welcome Screen function of the system has been invoked.
Flow of Events:	1. The system responds by displaying the welcome screen which displays a welcome message and 1.1 FOR each new buddy the system requests the buddy to sign up and enter a name, email, phone, password, date of birth, gender, and their role. 1.2. The buddy then enters their details into the system to sign up. 2. The system responds by checking if the email and other credentials are valid. If the credentials are valid the system adds the details to the database and the account will be created.
Alternative Flow of Events:	2.1 The system responds by displaying an error message on the sign-up page and prompts the buddy to enter valid details.
Exit Conditions:	The Buddy has successfully created an account.

Table 2 Sign-Up Use Case

Use Case Name:	Log-In
Participating Actor:	Buddy with & without disability, Admin
Entry Conditions:	1.The Buddy/Admin has accessed the system to login to their Account.
Flow of Events:	1. The system responds by displaying the login screen which displays two fields prompting the buddy/admin to login with their credentials. 1.1 FOR each returning buddy/admin the system requests the buddy/admin to enter their email and password to login to the system. 2. Buddy/Admin enters their email and password. 3. The system responds by checking if the information provided in the fields are valid and if the information is correct the system logs in the buddy/admin and brings them to their contacts buddy list page for buddies or dashboard page for the admin.
Alternative Flow of Events:	3.1 The system responds by displaying an error message saying that the credentials are invalid and prompts the buddy/admin to login again.
Exit Conditions:	The Buddy/Admin has successfully logged in to their account.

Table 3 Log-In Use Case

Use Case Name:	View Navigation Menu
Participating Actor:	Buddy with & without disability
Entry Conditions:	1.The Buddy has successfully logged into their account. 2. The View List of Connected Buddies function has been invoked.
Flow of Events:	1. The system responds by displaying the View List of Connected Buddies Screen and allows the buddy to click on the nav icon to display the navigation menu pane. 2. Buddy clicks on the nav menu icon. 3. The system responds by displaying the navigation menu with several links to different pages on the system.
Alternative Flow of Events:	2.1 The buddy backs out of the navigation bar by closing it by pressing the x icon in the menu.
Exit Conditions:	The buddy has successfully viewed the Navigation menu of the system.

Table 4 View Navigation Menu Use Case

Use Case Name:	View Personal Profile Details
Participating Actor:	Buddy with & without disability
Entry Conditions:	1. The buddy is already a member and logged into the system. 2. The View Navigation Menu function of the system has been invoked.
Flow of Events:	1. The system displays the navigation menu pane. 2. The buddy selects the My Profile link in the navigation menu to view the buddy's personal profile. 3. The system then displays a screen which shows all the details of the buddy's personal profile. 4. The buddies can then view their details of their profiles.
Alternative Flow of Events:	2.1 The buddy backs out of the navigation menu pane to close the navigation bar.
Exit Conditions:	The buddy has successfully viewed their personal profile details.

Table 5 View Personal Profile Details Use Case

Use Case Name:	Edit Personal Profile Details
Participating Actor:	Buddy with & without disability
Entry Conditions:	1. The buddy is already a member and logged into the system. 2. The View Personal Profile Details function of the system has been invoked.
Flow of Events:	1. The system then displays a screen showing the buddy personal profile details. 2. The buddy clicks on a specific detail on their profile. 3. The system prompts the buddy to update that specific detail information. 4. The buddies updates the information and clicks save. 5. The system then updates the information and displays the information in the profile screen.
Alternative Flow of Events:	
Exit Conditions:	The buddy has successfully edited their profile details.

Table 6 Edit Personal Profile Details Use Case

Use Case Name:	View List of Connected Buddies
Participating Actor:	Buddy with & without disability
Entry Conditions:	1. The buddy is already a member and logged into the system. 2. The View Navigation Menu function of the system has been invoked.
Flow of Events:	1. The system displays the navigation menu pane. 2. The buddy selects the View List of Connected Buddies link in the navigation menu to view a list of the Buddies Connections. 3. The system then displays a screen which shows a list of connected buddies that the buddy has connected to.
Alternative Flow of Events:	2.1 The buddy backs out of the navigation menu pane to close the navigation bar.
Exit Conditions:	The buddy has successfully view the list of their connected buddies.

Table 7 View List of Connected Buddies Use Case

Use Case Name:	View and Chat with a Buddy
Participating Actor:	Buddy with & without disability
Entry Conditions:	1. The buddy is already a member and logged into the system. 2. The View List of Connected Buddies function of the system has been invoked.
Flow of Events:	1. The system displays a list of connected buddies. 2. The buddy selects a specific buddy to view and chat with them. 3. The system then displays a screen showing the specific buddy and the chat which allows buddies to send messages and make calls to that specific buddy. 4. The buddy then views and send messages to that specific buddy.
Alternative Flow of Events:	
Exit Conditions:	The buddy has successfully viewed and send messages to their buddies.

Table 8 View and Chat with a Buddy Use Case

Use Case Name:	View Other Buddies Profile Details
Participating Actor:	Buddy with & without disability
Entry Conditions:	1. The buddy is already a member and logged into the system. 2. The View and Chat with a Buddy function of the system has been invoked.
Flow of Events:	1. The system then displays a screen showing the specific buddy and the chat which allows buddies to send messages and make calls to that specific buddy. 2. The buddy then clicks the specific buddy's name at the top of the page. 3. The system then displays the profile details of that specific buddy along with their diary.
Alternative Flow of Events:	
Exit Conditions:	The buddy has successfully viewed other buddies profile details.

Table 9 View Other Buddies Profile Details Use Case

Use Case Name:	View List of Suggested Buddies to Connect and View List of Pending Buddies Requests to Accept or Decline
Participating Actor:	Buddy with & without disability
Entry Conditions:	1. The buddy is already a member and logged into the system. 2. The View Navigation Menu function of the system has been invoked.
Flow of Events:	1. The system displays the navigation menu pane. 2. The buddy selects the Buddies Requests and Suggestions link in the navigation menu to view a list of recommended buddies and pending requests for the buddy. 3. The system then displays a screen which shows a list of recommended buddies and pending requests for the buddy. 4. The buddies can then view and connected to the suggested buddies on the list and also accept or decline pending requests from other buddies to connect. 5. After accepting or declining a request the systems will then notify the other buddy on whether the buddy had accepted or declined the request.
Alternative Flow of Events:	2.1 The buddy backs out of the navigation menu pane to close the navigation bar.
Exit Conditions:	The buddy has successfully viewed a list of suggested buddies to connect and viewed a list of pending requests from other buddies to accept or decline their requests to connect.

Table 10 View List of Suggested Buddies to Connect and View List of Pending Buddies Requests to Accept or Decline Use Case

Use Case Name:	Find Buddy by Nearest Locations on Google Maps
Participating Actor:	Buddy with & without disability
Entry Conditions:	1. The buddy is already a member and logged into the system. 2. The View Navigation Menu function of the system has been invoked.
Flow of Events:	1. The system displays the navigation menu pane. 2. The buddy selects the Find a Buddy link in the navigation menu to view FAQ's regarding the system. 3. The system then displays a screen which shows a map of buddy using the system and see the closest buddies based on nearest location. 4. The buddies can then select the buddies closest to them and connect with them from the map view.
Alternative Flow of Events:	2.1 The buddy backs out of the navigation menu pane to close the navigation bar.
Exit Conditions:	The buddy has successfully found and connected to another buddy from the map view by closest location.

Table 11 Find Buddy by Nearest Locations on Google Maps Use Case

Use Case Name:	Enable Accessibility Settings
Participating Actor:	Buddy with & without disability
Entry Conditions:	1. The buddy is already a member and logged into the system. 2. The View Navigation Menu function of the system has been invoked.
Flow of Events:	1. The system displays the navigation menu pane. 2. The buddy selects the Enable Accessibility Settings link in the navigation menu to enable accessibility features for people with various impairments . 3. The system navigates the buddy to the phones device settings and allows them to enable accessibility features to help them navigate on the system better. 4. The buddy selects the accessibility features that they wish to enable for the system and click on the back button once selecting the features to enabled. 4. The system the returns the buddy back to the screen that they previously were using.
Alternative Flow of Events:	2.1 The buddy backs out of the navigation menu pane to close the navigation bar.
Exit Conditions:	The buddy has successfully enabled Accessibility Features.

Table 12 Enable Accessibility Settings Use Case

Use Case Name:	View Frequently Asked Questions
Participating Actor:	Buddy with & without disability
Entry Conditions:	1. The buddy is already a member and logged into the system. 2. The View Navigation Menu function of the system has been invoked.
Flow of Events:	1. The system displays the navigation menu pane. 2. The buddy selects the View Frequently Asked Questions link in the navigation menu. to view FAQ's regarding the system. 3. The system then displays a screen which shows the most Frequently Asked Questions regarding the Application.
Alternative Flow of Events:	2.1 The buddy backs out of the navigation menu pane to close the navigation bar.
Exit Conditions:	The buddy has successfully viewed the Frequently Asked Questions Screen of the system.

Table 13 View Frequently Asked Questions Use Case

Use Case Name:	Log-out
Participating Actor:	Buddy with & without disability, Admin
Entry Conditions:	1. The buddy/admin is already a member and logged into the system. 2. The View Navigation Menu/Admin Dashboard function of the system has been invoked.
Flow of Events:	1. The system displays the navigation menu pane/admin dashboard. 2. The buddy/admin selects the logout link in the navigation menu/admin dashboard to sign out of the system. 3. The system logs the buddy/admin out of the systems and displays the welcome screen.
Alternative Flow of Events:	2.1 The buddy/admin backs out of the navigation menu pane/admin dashboard button to close the navigation bar/logout button.
Exit Conditions:	The buddy/admin has successfully logged out of the system.

Table 14 Log-out Use Case

Use Case Name:	View Reports and Abuse Complaints
Participating Actor:	Admin
Entry Conditions:	1. The admin is already a member and logged into the system. 2. The View Admin Dashboard view of the system has been invoked.
Flow of Events:	1. The system displays the admin dashboard page and prompts the user to either view a list of users or view complaints. 2. The admin selects the view complaints button. 3. The system displays a list of complaints on the mobile application. 4. The admin views the list of complaints.
Alternative Flow of Events:	N/A
Exit Conditions:	The admin has successfully viewed a list of complaints written by users.

Table 15 View Reports and Abuse Complaints Use Case

Use Case Name:	View and Remove User
Participating Actor:	Admin
Entry Conditions:	1. The admin is already a member and logged into the system. 2. The View Admin Dashboard view of the system has been invoked.
Flow of Events:	1. The system displays the admin dashboard page and prompts the user to either view a list of users or view complaints. 2. The admin selects the view a list of user's button. 3. The system displays a list of users on the mobile application. 4. The admin views the list of users and clicks the delete button for one of the users. 5. The system then deletes the user from the mobile application.
Alternative Flow of Events:	N/A
Exit Conditions:	The admin has successfully viewed and deleted users from the mobile application.

Table 16 Remove User Use Case

Use Case Name:	File Complaints and Report Abuse
Participating Actor:	Buddy with & without disability
Entry Conditions:	1. The buddy is already a member and logged into the system. 2. The View Navigation Menu function of the system has been invoked.
Flow of Events:	1. The system displays the navigation menu pane. 2. The buddy selects the file complaints link in the navigation menu to file a complaint on the mobile application. 3. The system displays a for asking the user to fill details about the complaint. 4. The user fills out the details and clicks the send button. 5. The system responds by displaying a message saying that the issue would be dealt with as soon as possible.
Alternative Flow of Events:	2.1 The buddy backs out of the navigation menu pane to close the navigation bar.
Exit Conditions:	The buddy has successfully filed a complaint on the system.

Table 17 File Complaints and Report Abuse Use Case

4.7 Database Design

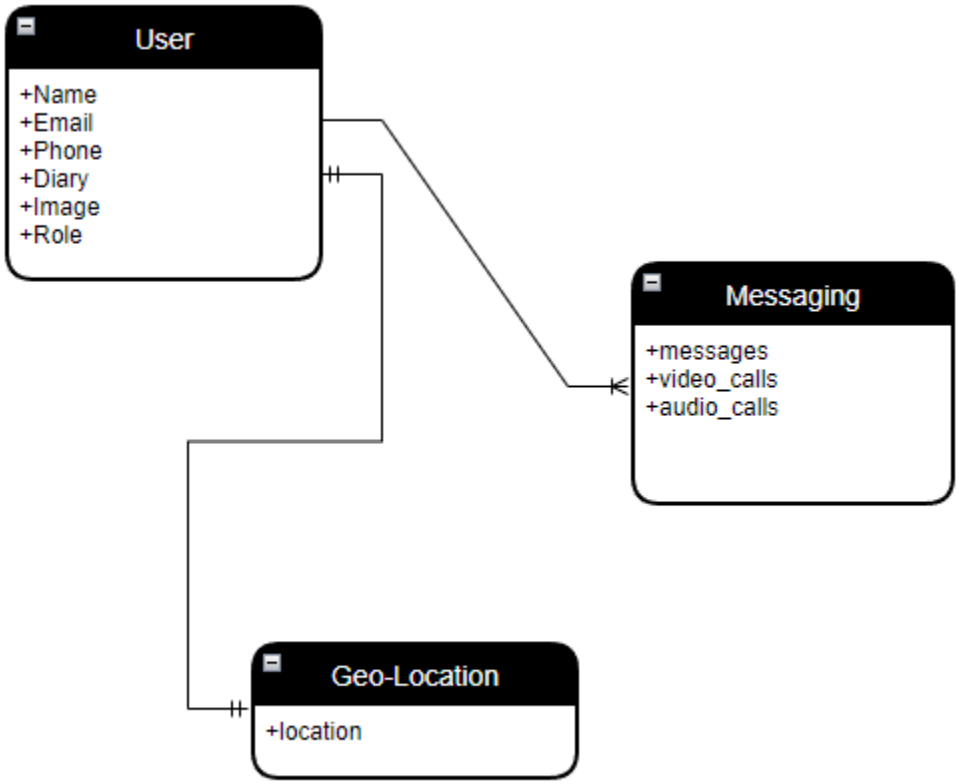

Figure 25 Database Diagram

The database is hosted using Firebase. The Firebase database allows the user to easily control log-in and sign-up using Firebase Authentication, and holding the user, messaging and geo-location data using Firebase's real-time database. The user data table holds all the data in relation to the user using the application. It stores the all the information of the buddy such as the name, email, phone, diary, image, and their role within the application. The Geo-Location table then stores the exact pinpoint location of each user on a geo Google map. The information of the user is then relayed and displayed to others within the application and enables buddies to find and communicate with other buddies within the mobile application which is then stored into the messaging table. The Author also intends on using the Analytics provided from Google Firebase to identify patterns within the data to improve and build the application further.

4.8 Logo

Figure 26 Application Logo

As shown in Figure 11, the Author has created and designed this logo icon for this mobile application. The two-person image in the icon shows a relationship between two different people (people with and without disabilities) as one, showing a close bond and friendship. The Author has also decided to use a gradient of light and dark blue to represent freedom, intuition, imagination, and inspiration. The reason why the Author had chosen to use the colour blue was mainly due to the fact that blue is a colour that is appealing to all audiences and is visually engaging to both people with and without disabilities.

5 System Implementation

5.1 Tools and Technologies

To complete this project, various software technologies were used, such as Programming Languages and IDE's. this section gives an overview of the tools that were used to develop this mobile android application.

5.1.1 Programming Languages

In the development of this Project, the programming language that was used to develop this android mobile application was the following:

5.1.1.1 Java

Java was the programming language used to develop this mobile application mainly due to the fact there were many resources and materials to build mobile applications in Java that the Author could reference. Implementing this project using the Java programming language was easier as it has been the default language for android development for years. The Author being proficient in coding in Java also made the development of this mobile application easier to develop.

5.1.2 Integrated Development Environments (IDE's)

5.1.2.1 Android Studio

Android Studio is an IDE based on the IntelliJ Interface, which is used for Android application development. The reason for the Author choosing this IDE to develop this mobile android application is that it provides comprehensive tools and features such as pre-installed packages and Android Emulators, which allows the Author to test the mobile application on a physical Android phone, which enables the development of mobile applications to be more accessible and effortless to develop (Android Studio features | Android Developers, 2021).

6 Testing and Results

6.1 Testing and Results Overview

The final result of this process is a software system that was created to cater for an android application. This system consists of various technologies and incorporates the use of chat services, geo location, and accessibility features to successfully implement an application to communicate with people with/without disability. All the software components were tested to ensure that the functionalities operate as defined which in turn helps developing better cases for the system. The three types of software testing's that were conducted for this application were:

- Functional Testing
- Usability Testing
- Security Testing

6.2 Software Testing

6.2.1 Functional Testing

Test Case Name:	Create Account
Test Case ID	#001
Test Priority	
Test Executed By	
Date of Test Execution	
Description/Summary of Test	
Pre-Condition	
Test Steps	
Expected Results	
Post-Condition	
Status (Fail/Pass)	
Notes/Comments/Questions:	
Requirements	
Automation? (Yes/No)	

Attachments:

F

This is one of the test cases. Please check Appendix A for the complete set of functional test cases conducted for this project.

6.2.2 Usability Testing

6.2.3 Security Testing

7 Discussion

7.1 Overall Product Quality

7.2 Project Improvement

7.3 Cost and Expenditure

7.4 Drawbacks of the system

8 Conclusion

8.1 Summary and Improvements

8.2 Benefits to people with/without disability

8.3 Future Work

Appendix A – Complete set of Functional Test Cases

Login

Test Case Name:	Create Account
Test Case ID	#001
Test Priority	
Test Executed By	
Date of Test Execution	
Description/Summary of Test	
Pre-Condition	
Test Steps	
Expected Results	
Post-Condition	
Status (Fail/Pass)	
Notes/Comments/Questions:	
Requirements	
Automation? (Yes/No)	

Attachments:

F

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