ABOPLUS: ENHANCING BLOOD BANK ACCESSIBILITY WITH MOBILE APPS

BY

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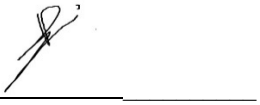

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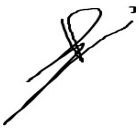
Signature : 

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Lastly, I extend my deepest gratitude to my parents and family for their steadfast encouragement and motivation during this lengthy journey.

ABSTRACT

This project aims for the development of a mobile application that will enhance the accessibility to blood banks for many people. Many potential donors may want to contribute but need guidance, while recipients may face delays in accessing blood. Thus, our project aims to develop a user-friendly mobile app for donors, recipients, hospitals, and organizations. This system will offer efficient services for blood donation and reception, allowing users to locate nearby blood banks easily. Additionally, organizations can manage blood drives and appointments through the app. It will be designed with both novice and experienced donors in mind, offering a range of features to streamline the process. Ultimately, our goal is to enhance the global healthcare system by facilitating blood donation process for those in need.

The chosen methodology for this project is Agile Development, as it is the most suitable methodology in adapting to necessary changes throughout development for each module. The features of the project are broken down into parts to be developed incrementally. Each module is tested before moving on to the next developing module. This results in a faster delivery of the product, while maintaining testing in small releases aligned to the developed module. Primarily targeting the Android platform, the app will be developed using software tools such as Visual Studio Code for coding in Dart programming language, and Firebase for database storage.

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CHAPTER 1: INTRODUCTION

1.1 Problem Statement and Motivation

High Inefficiency in Blood Drive Hosting

In the era before the widespread adoption of advanced technology, the processes of blood donation and distribution followed more traditional methods. People willingly donated blood at blood drives or donation centers, often on behalf of friends and family in need. Manual procedures were used both for managing blood drives or blood donation campaigns. Blood banks have maintained records of available blood types, and individuals in need were contacted accordingly. Occasionally, hospitals organized blood donation campaigns, promoting them through advertising and community outreach. In summary, blood donation required significant time and coordination prior to technological advancements. Nonetheless, these efforts remained vital in saving numerous lives. The utilization of current technology promises greater efficiency and accessibility in these processes, potentially saving even more lives.

Blood shortages in less populated areas

Blood shortages can occur in sparsely populated areas due to a lack of regular blood donors. Areas affected by disasters may experience increased demand for blood supplies. On another perspective, blood donation campaigns are less likely to be held on less populated areas. The key challenge lies in coordinating various organizations and hospitals to be interconnected, efficiently delivering what donors or recipient needs to these specific areas. Additionally, certain blood types, such as Type O, are in higher demand than others, further increasing the risk of shortages. Unused blood supply can also expire, leading to resource wastage. Therefore, it is imperative to unify hospital and blood bank record-keeping regarding available supplies to prevent wastage.

Lack of Recognition for Donors

Sustaining a consistent flow of blood donations in less populated areas can be challenging. Maintaining existing donors is more cost-effective than constantly recruiting new ones [1]. To motivate donors, they should feel appreciated and rewarded for their

contributions. Donors require proper incentives and recognition to encourage continued participation. Many
blood donation campaigns rely on voluntary contributions but often fail to maintain ongoing communication with donors. This lack of follow-up prevents donors from understanding how their contributions impact the lives of others, ultimately denying them the recognition they deserve. In short, the questions lie in the solution to incentivize blood donation participation while maintaining donor privacy and confidentiality.

Traditional Medical Verification Process

Furthermore, the current blood donation method requires a traditional medical verification process using "Buku Merah". Donors may find themselves be involved in many paperwork, manual checks during the whole process. Donors often find these a hassle and some might even be discouraged to participate in donations. To elaborate further, the way blood donation has been handled have remained the same since ages ago. An opportunity can be seen to make a revolutionary change to the standard and traditional blood donation process. Hence, a solution such as an integration of an electronic medical record can be useful to help healthcare professionals access to medical information of the donors quickly and safely. It will also serve as a screening tool based on the predetermined criteria to aid in the verification process for donors.

Lack of Platform for Educational Purposes

Education plays an important role for social upbringing, especially in the world of healthcare. In this case, many are interested in participating in blood campaigns for either health benefits or our of kindness. While blood donation campaigns often emphasize the importance of donating blood, there might be limited understanding among the people about the broader significance of blood donation as well as its potential educational value. Thus, this is an opportunity to create a platform for healthcare professionals to provide educational guidelines and materials that shows useful information to the people to show the impact of blood donations on a variety of aspects of healthcare. For example, blood donation guides, patient treatments, emergency interventions, as well as medical research. Hence, various visualizations such as graphs

and charts of case studies can be utilized in this platform to convey data to the public. So, the public will be able to gather more useful insights through this platform and incrementally improve.

1.2 Project Objectives

- To develop a blood bank accessibility mobile application that streamlines the process for organizing and managing blood drives to maximize donor participation and donation efficiency, minimizing resource wastage through effective resource allocation and scheduling strategies.

- To develop a blood bank accessibility mobile application that implements technological solutions to enhance the accuracy and reliability of the medical verification process for blood donors, reducing delays and administrative burdens on healthcare professionals while ensuring compliance with regulatory standards.

- To develop a blood bank accessibility mobile application that enhance the user experience of scheduling blood donation appointments by implementing intuitive interfaces and seamless booking processes to increase donor convenience and accessibility.

- To develop a blood bank accessibility mobile application that utilize leaderboards as a motivational tool to incentivize blood donation participation, foster community engagement, and recognize donor contributions while safeguarding donor privacy and confidentiality.

1.3 Project Scope

"ABOPLUS" is a mobile application with great privacy and security that allows users to make an appointment conveniently at any given moment to donate or receive blood. It will be developed as a system to provide the most efficient and convenient service to its users on blood donation and treatment. All the functionalities will be integrated in "ABOPLUS" to improve the user experience. This mobile application is accessible anytime and anywhere, as long as there is an internet connection. On the Client side, users can consist of donors wanting to donate or recipients waiting to receive blood. Appointments with various blood banks available at the moment can be made with integration of Google Map API. Gamification and leaderboards are also done on the medical history of the users to have them recognized for their achievements. Most importantly, a medical verification test is implemented to ease the process of being verified as a qualified donor. On the Admin side, healthcare administrators wanting to host blood donation campaigns or manage appointments. They also upload educational guidelines or highlights to show in the client side of the mobile application. This mobile application will be made available to all android users.

Registration and Login Module

This module allows clients to register for an account. If client already has an account, clients can login. All of this information will be stored in the Firebase. In the Admin side, they are able to login based on location and provided password.

User Authentication Module

This module only allows users with correct credentials to access the mobile application. It provides a rigid security for a secure mobile application related to medical systems. This applies to both client and admin side of the application.

Main Menu Module

This module provides a clean menu interface for users to access all the functions efficiently. A navigation bar is integrated below the user interface for basic navigation such as homepage or profile page. A side drawer is also included to aid in user

navigation. Main menu of admin side includes a grid view to include all the functions admin is capable of performing.

Medical Verification Test Module

This module provides a verification test for the clients including donor and recipient. The medical verification test is similar to the template of "Buku Merah" used in blood donation for verification. Data is obtained and stored in Firebase for further use by healthcare professionals. Clients are required to finish the verification test before gaining access to most features. On admin side, they are able to verify the applicants manually after accessing applicant information.

Leaderboards Module

This module provides a leaderboard for donors to be ranked in. Each donor with a verified account are able to participate in the leaderboard based on their participation in donation activities. Donors are ranked based on their accumulated points. Points can be obtained from participating in blood drives hosted through ABOPLUS.

Educational Guidelines Module

This module provides a page where clients can view on how to either use the features available in ABOPLUS, or to learn more about blood donation process. Admin can upload educational guidelines on their side each time they updated their rules, guidelines or policy.

Medical History Module

This module provides an interface where clients can look into their donation or receiving activities done through ABOPLUS.

1.4 Impact, Significance and Contribution

A blood bank accessibility mobile application can have a profound impact on society, signifying a pivotal contribution to healthcare systems and the well-being of individuals. Its significance extends across various dimensions, from saving lives and improving the

availability of vital resources to fostering a sense of community and raising awareness about the importance of blood donation. First and foremost, the impact of the app is unquestionably life-saving. By providing a platform that connects donors with those in urgent need of blood, it facilitates timely access to this critical resource during emergencies, surgeries, and medical treatments. With the development of this application, much time is expected to be saved with the well thought features. This will directly impact patient care and significantly reduce mortality rates, ensuring that individuals have a higher chance of recovery and improved health outcomes. The app acts as a lifeline, bridging the gap between donors and recipients, thus underscoring its paramount significance in healthcare.

Furthermore, the system is capable of connecting to a real-time database. By holding the important information in databases, it has streamlined the medical verification process significantly, as medical staff are able to access donor data faster and efficiently. This streamlined approach contributes to a more sustainable and cost-effective healthcare system, ultimately benefiting both patients and healthcare institutions.

Additionally, the development of this project will greatly contribute to community building and awareness in this generation. It fosters a culture of altruism by encouraging many in society to become regular blood donors. The sense of fulfillment and community involvement will be experienced by donors. In this case, the butterfly effect will inspire more to participate. Furthermore, the app serves as an educational tool, spreading awareness about the significance of blood donation, dispelling myths, and addressing concerns. This contribution to public awareness will potentially lead to a rather well-informed and engaged society that provide active support in life-saving initiatives.

In short, the blood bank app has a significant impact that encompasses saving lives, enhancing healthcare infrastructure, and culturing community engagement. Its significance lies in its ability to connect donors and recipients, streamlining blood donation process, and raise awareness about the critical importance of blood donation. By doing so, it makes a lasting and meaningful contribution to healthcare and the well-being of individuals and communities alike.

1.5 Background Information

Blood is a critical bodily fluid that circulates to transport essential materials, including oxygen and nutrients. It comprises red blood cells, white blood cells, platelets, and plasma, and is categorized into four main blood types: A, B, AB, and O. These types are distinguished by the presence or absence of specific antigens. For example, Type A blood contains A antigens on red blood cell surfaces and generates antibodies against Type B blood. Type B blood features B antigens and produces antibodies against Type A blood. Type AB blood possesses both A and B antigens and does not produce antibodies against either Type A or B. Type O blood lacks both A and B antigens and produces antibodies against both types. Additionally, the Rh factor system classifies blood as Rh-positive or Rh-negative based on the presence or absence of the Rh antigen. This knowledge is crucial for safe blood transfusions or surgeries involving blood, as incompatible matches can have life-threatening consequences [2].

Before the age of internet arises, blood donations relied heavily on traditional methods and offline communication such as physical advertisements, community events, and simply word of mouth. Awareness of donations were spread through blood donation campaigns. As you can tell, such traditional methods are slow, and society are rather limited in terms of accessibility about donation venues as well as their operating hours. This will greatly hinder those in need of blood at emergencies. Donors are required to call or visit the blood banks in person to make an appointment which will take time. This is very inefficiency as a healthcare system as people's lives depend on it. The paperwork would be stacked as information may not be put out easily. The slow and methodical way of paperwork management may slow down the healthcare system as it is processed by the staff of hospitals. Errors and delays would be inevitable. Additionally, donation events heavily relied on community boards and flyers, which will not reach many people at all.

As the world adapts to the advancement of technology, the blood donation process is revolutionized making it rather efficient at times of modern age. A global audience can now be reached through the internet, increasing awareness of blood donations. Donors will have more access to resources as well as donor eligibility criteria, improving

engagement with society. Also, appointments for donation can now be performed digitally, making it convenient for everybody involved. This system will help to save time and effort of many. Verification are now rather convenient in digital form as users only have to fill up information once to gain access to various features to make blood donation more convenient. Digital information will greatly reduce errors, increasing the accuracy of obtained data. With the implementation of modern technology, communities interested in the movement are now able to connect through leaderboards, increasing engagement in society, inspiring more to participate.

1.6 Report Organization

This report is well organized into 7 chapters which is Chapter 1 Introduction, Chapter 2 Literature Review, Chapter 3 System Methodology, Chapter 4 System Design, Chapter 5 System Implementation, Chapter 6 System Evaluation and Discussion, Chapter 7 Conclusion and Recommendation. The first chapter will mainly introduce the project's problem statement, objectives, scope, motivation, impact, background information and its report organization. This is followed by a Literature Review on similar mobile applications built with the same goals and objectives. Several sites are also reviewed to discover more on donation process to implement into the project. The third chapter highlights the approach to design and develop this project. System methodology is described along with Verification Plan, Use Case, Activity Diagram, System Architecture Diagram, and Timeline. Fourth Chapter will include the Entity-Relationship Diagram, System Flowchart and Sequence Diagram to show interactions between the system. Chapter 5 will showcase the Hardware and Software Required to run the application along with the configurations of tools to build the system. Furthermore, a showcase will be displayed for the entire user interface of the system. Implementation issues and challenges will also be brought up. Chapter 6 which is System Evaluation and Discussion will bring up System Performance Definition, Use Case Testing, Project Challenges, and Objective Evaluation. The last chapter includes Conclusion and Recommendation.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

There are a few blood bank mobile applications that are worth studying to identify strengths and weaknesses of each of them. Then, the strengths are applied on the project to be developed, the weaknesses will them be studied and resolved to produce the best product in the market of blood donation.

2.2 PlasmaLife

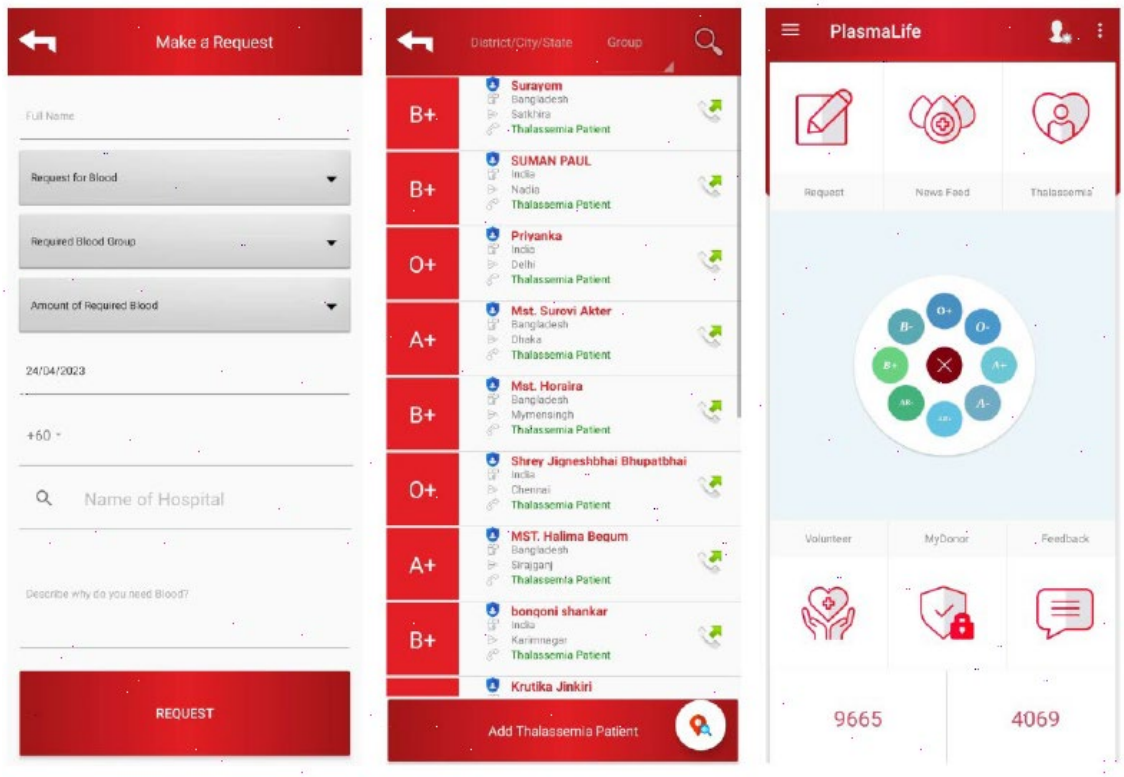


Figure 2-1 Features of PlasmaLife

PlasmaLife is a blood bank application developed by Creniputer Lab with more than 10k downloads from the Google Play Store. Creniputer Lab has experience with several mobile applications such as Multi Calculator, Fruit Smasher and much more. PlasmaLife is a blood bank application that values simplicity but harbours important features for its users.

PlasmaLife offers several features for users to use. Users can login into their own account from any devices to gain access to the application's feature. PlasmaLife also include a table showing the compatibility of blood groups to educate patients and donors regarding this matter. Furthermore, this app also shows the total users of blood compared to the total donors. Not to mention the simple round table UI that lays out the blood types for users to choose from. Users get to choose up to 8 types of blood to check if it is available near their area. This application also notifies the user if there are any requests or demands for their blood type, increasing the chances to receive a donor. Users can look into the news feed that shows the people in need of blood with name, location, supply requirement, phone number, and comment. PlasmaLife shows the people in need of blood in detail and donors can identify the authenticity of a request for blood. Furthermore, users can create communities to create a sense of social engagement in the mobile app.

Strength of PlasmaLife

- PlasmaLife has a **quick access** to identify available blood supply in all countries. Oncethe preferred blood is selected, users are able to access the list of donors who have theirblood supply available. Users can then contact the donors to gain access to the supply.

- PlasmaLife includes the **News Feed feature**, allowing users to see potential recipients. The personal information of each recipient in the feed are shown in specific detail. For example, the location, blood type required, phone number, and remarks are shown. This helps the potential recipient to receive maximum publicity so that they can receive the supply in the most efficient way in terms of time.

- PlasmaLife has a **built-in organization feature** where donors can form groups with a community name. These encourages people to form communities of donors to establish confidence between lone recipients and donors. Those in need can reach these organizations much quicker compared to searching for individual donors.

- PlasmaLife has an **advanced filtering feature** that is capable of searching pending recipients based on blood group as well as home addresses on district/ city/ state.

Weakness of PlasmaLife

- PlasmaLife only offers **its narrow-area of services** to users from India, as most of the blood bank centers are located in India. This makes the application inaccessible to users outside of India, wasting the potential of the application.

- PlasmaLife has a **slow processing speed**, as an emergency situation cannot be well sustained.

- PlasmaLife has **poor quality of user authentication** as the registration is too simple and minimal to the extent where false data can enter which can cause vulnerabilities and inaccuracies in the database.

2.3 Bloodkad

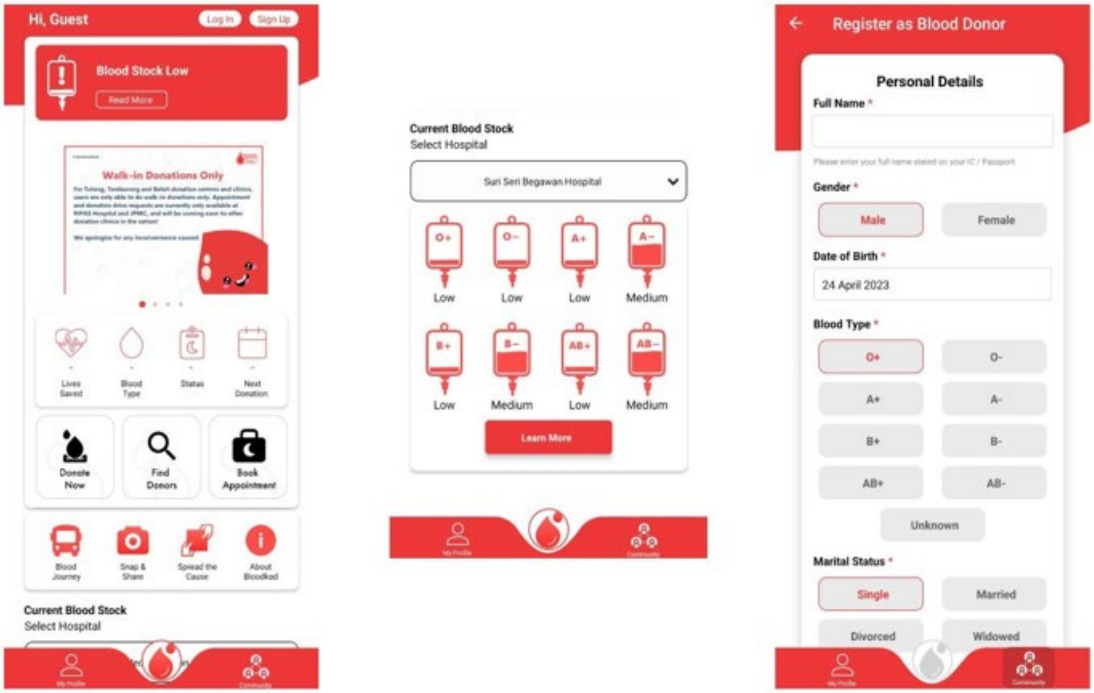


Figure 2-2 Features of Bloodkad

Bloodkad is a blood bank mobile application made by Nextacloud Technologies. This app emphasizes on data safety while maintaining the core features of a blood bank mobile application. Its main goal is to put the power to save a life in the palm of your hand. Which also means that the development goal is to streamline and ease the blood donation process. Bloodkad wishes on building and strengthening the blood donation community, as well as encouraging more regular blood donations. This app is capable of providing users with onlinepre-screening for blood donations.

Bloodkad has a rather professional touch to its design and provides users all the features at first look. Bloodkad has a special function that shows the current stock of each of their blood supply in each available hospital. The stock of blood are shown in either low, medium or full. Bloodkad also shows the status of donor's donated blood on how many lives they have saved. The status of the donor's blood is also shown as well so that donor knows if their donated blood has been used or has expired. Donors can also have a set

schedule for their next upcoming donation appointment within the application.

Furthermore, this application will also notify users if there are new blood request so donors will be aware of the demands of new potential recipients. One of the best features of this application is that this application is community driven as users are encouraged to share content related to this application involving blood donations to social media platforms such as Instagram. This will create publicity and more people will be aware of such blood donation drives.

Strength of Bloodkad

- Bloodkad has a **professional touch to the user interface** and is user-friendly, attracting many potential users to use this application. This will encourage more users to consider using this application compared to its other competitors.
- Bloodkad has an **event planner for organizations** to host blood donation drives in collaboration with the hospitals or blood banks. Donors can look into the event plannerto be notified by the upcoming blood donation drives.
- Bloodkad shows **update information** of the current available blood stock in available hospitals. This helps users in need of blood to be well aware of the availabilityof blood in respective hospitals as most of these cases are time sensitive. Hence, this will help to save time for potential recipients while looking for hospitals to receive blood transfusion.
- **Push-notification** is implemented to informed users of appointments and events.
- **Milestone badge** to showcase the achievements of frequent donors.
- Bloodkad offers **amazing rewards as incentives** for users who donates blood regularly. Donors can redeem points to obtain wonderful rewards such as bags and sunshades. Bloodkad also has redeem voucher system for users to obtain bountiful discounts on purchases on other platforms.

Weakness of Bloodkad

- The event planner of Bloodkad is accessible to not only the host of organizations, but also to individual users. This indicates the **lack of integrity** in terms of security of the

application. False attempts to create an event to trick donors to attend may occur as users may simply create an event by accident or with ill-intent.

- Bloodkad community feature is **not extensive enough** as donors can only join the available communities. The communities have a page that shows the number ofmembers and the total lives saved by the member's blood supply. However, members cannot interact with each other as there are no forums or chat function, wasting potential of this social feature.

- The availability of blood supply shown for each hospital is **not real-time information**. It is unknown whether it is frequently updated. It also seems as if it is updated manually which seems inefficient.

2.4 BloodConnect

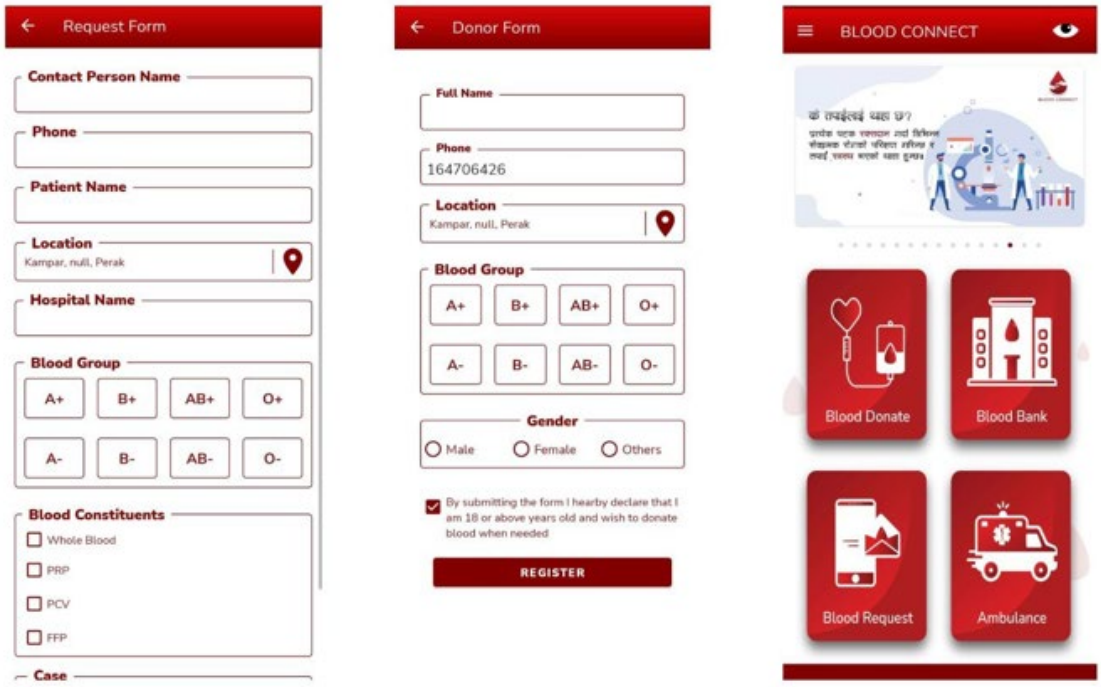


Figure 2-3 Features of BloodConnect

BloodConnect is another blood bank application that keeps things quite simple for both donors and recipients. It is developed by Sachin Parajuli and has more than 1k downloads in Google Play Store. The app consists of 4 basic functions, which is blood donate, blood request, locate blood banks near users, and ambulance. Users are to fill in their personal information manually to be able to proceed with the features. The particulars are important information for both parties involving donors and recipient.

Strength of BloodConnect

- BloodConnect has a **minimalistic menu**, reduces confusion of users and accessible to users of all ages and study background.

- **Well-built side drawer** that contains basic app functionality such as View Request, Find Donors, Privacy Policy and more. The drawer built in this app will inspire the development of drawers in proposed method.

- BloodConnect provides a **user guideline** for users new to this application. All users must do to access the features are to firstly fill in the basic particulars demanded in the application. The particulars can consist of name, phone number, location, hospital name, blood group, and remarks.

- BloodConnect integrates **locate ambulance feature** just in case of an emergency. Users can use this feature to contact the closest ambulance as this will save time compared to dialing the hospital.

Weakness of BloodConnect

- Search ambulance function is not well implemented, as it requires users to manually input their current address which is highly inefficient. No **location tracking** is implemented in a mission critical situation.

- BloodConnect **has poor verification methods** on the forms filled by the users. This leads to information leak or theft. The information obtained from the users have chances to be intercepted by intruders, putting user's personal information at risk. Users will not be using this application if they are aware that their personal information are at risk.

Features	PlasmaLife	Bloodkad	BloodConnect	Proposed Method
Professional User Interface	✓	✓		✓
Built-in Map Function				✓
Push-Notification		✓		
Highlights	✓	✓	✓	✓
Community Feature	✓			✓
Locate Nearby Blood Banks			✓	✓
Strong User Authentication	✓	✓		✓
Built-in Self-Screening				✓
Book Appointments	✓	✓	✓	✓
Educational Guidelines		✓		✓
Extensive Sidebar	✓		✓	✓
User Incentive / Milestone		✓		✓

Table 2-1 Comparisons between 3 blood bank applications

2.5 Google Map API

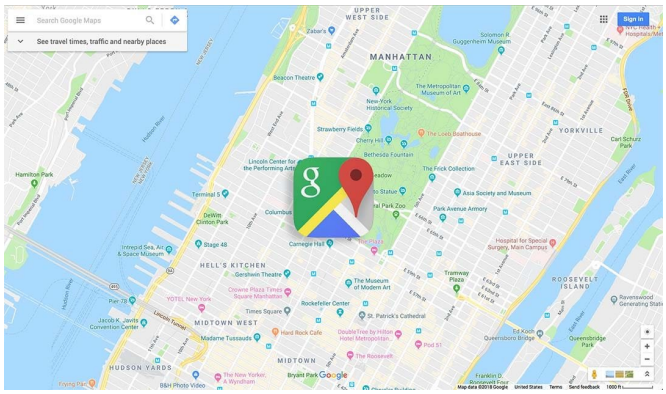


Figure 2-4 Google Map API

To fully realize the potential of the accessibility of blood banks with mobile application, Google Map is integrated into the app as it will be a core feature for identifying available blood bank locations for making an appointment. Here are some useful features provided by Google Maps to aid in the success of the development of the mobile application being built. Firstly, developers can create custom maps based on their preference with useful tools such as location markers, descriptions, images and more. Most importantly, developers will be able to utilize the Google Map view to pinpoint the location of respective blood banks and blood drives. Additionally, Google Map already has a prebuilt point of interest to help in the identification of the less popular blood banks. There are many useful features that are able to be developed along the project which includes Geocoding and Geolocation. In a further level of functionality, the locations are able to provide accurate details such as ratings, names, contact information and address.

In the perspective of users, Google Map can provide an accurate real-time location of the user, just to tell how close they are to their destination. That is due to the feature known as Geolocation, which uses the surrounding IoT end devices to identify the location of the end device. In short, the mentioned features will be helpful in the development of the blood bank accessibility mobile application. Google has provided excellent documentation regarding tutorials on the integration of Google Maps into mobile applications. This will reduce the cost spent on the integration of Google Maps API.

2.6 MySejahtera App

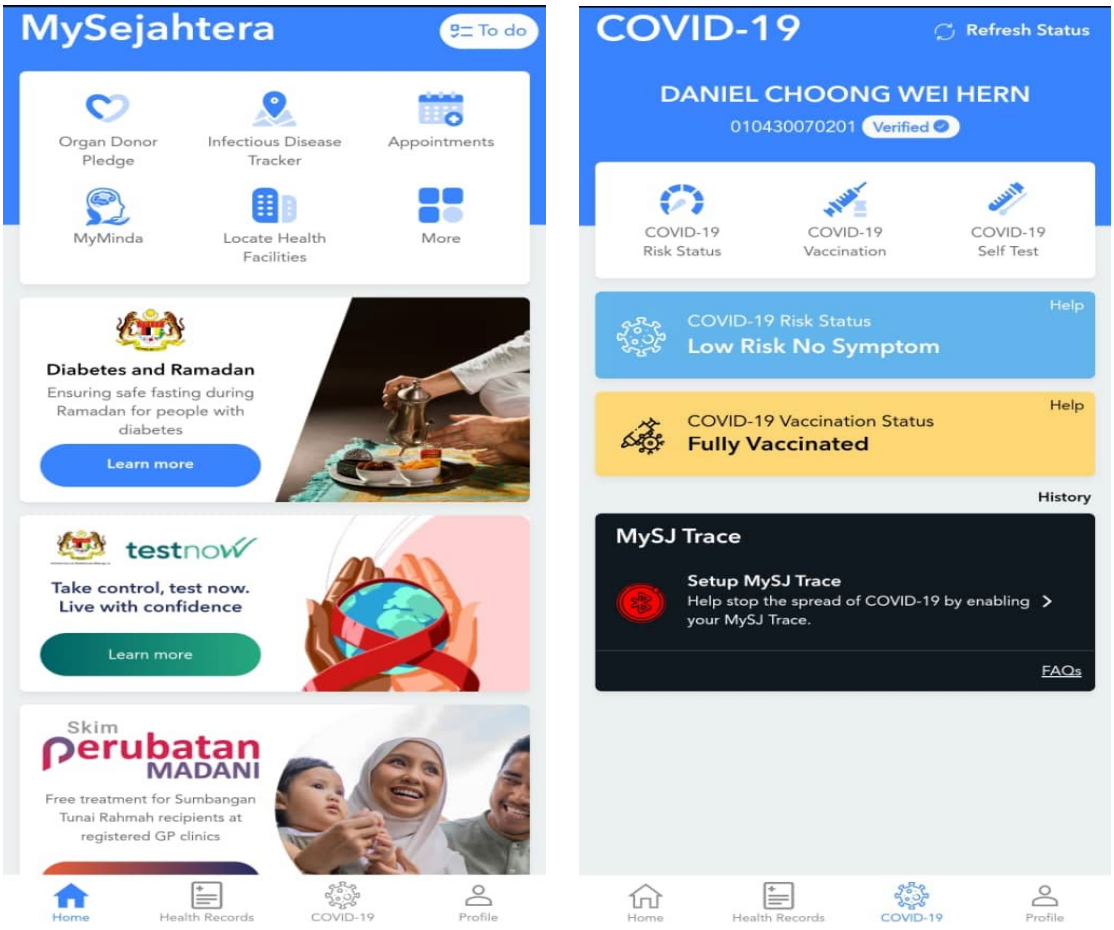


Figure 2-5 Main Feature for MySejahtera

The Malaysian Government have developed a mobile application during the COVID-19 pandemic to aid in the management within the country. MySejahtera is a rather well-built mobile application that is highly efficient and minimalistic. MySejahtera plays a great inspiration role for the development of ABOPLUS. During the pandemic era, MySejahtera is mainly used to track the infected patients by using QR scans based on user locations. Any close contact with the location affected by the infected users are marked and are advised to stay indoors until symptoms recede. Furthermore, the mobile application is also used to record the user's vaccination history. After the COVID-19 pandemic, MySejahtera have remained a useful mobile application with new implementations such as Locate Health Facilities, Infectious Disease Tracker, Organ

Donor Pledge and many more. The design of the mobile application is catered to the ease of access of users based on their needs. Overall, MySejahtera plays a crucial role in Malaysia's efforts to contain the further spread of COVID-19 by efficient contact tracing, monitoring health of public, and the facilitation of vaccination efforts. Nowadays, MySejahtera is sustaining these features with new implementations and is set to be ready for another pandemic.

2.7 Blood Donation Process by MyHealth (Ministry of Health Malaysia)

Figure 2-6 MyHealth Portal

MyHealth is an official portal created by the Ministry of Health Malaysia that provides information on various health-related topics and services. This portal includes all target audiences of the Malaysian people such as kids, teenagers, adults as well as the elderly. Health Topics that are covered are plenty which includes mental health, oral health, disease symptoms and control, nutrition approach and many more that will provide general knowledge to the Malaysian public. A particular topic known as Blood Donation Process will be further studied in this portal to be aligned with the development of the blood bank accessibility mobile application. The post emphasizes on the importance of blood to medical treatment, and also the increasing demand of blood products. At least 5% of Malaysian population are to be blood donors with a gradual increase over the years [3]. It also mentions that there are two types of blood donation, which includes whole blood donation and apheresis donation, with the former being the most common approach. The donated blood is processed in the laboratory after acquiring the supply and is differentiated into several components consisting of packed red cells, Platelet concentrate and plasma. Many requirements and criteria may affect the volume of blood collected of donor. Donors will be available to donate again after 2-3 months after their

last blood donation. Several core criteria include age, body weight, physical and mental condition, chronic medical illness history are taken into account before blood donation.

Furthermore, A person's eligibility to donate blood is assessed by either a Medical Officer or a nurse on duty. It's crucial that potential donors are in good health to ensure the safety of both the donor and the recipient of the donated blood. Blood banks adhere to strict selection procedures to maintain the quality of donated blood. In addition to physical health, individuals engaging in high-risk behaviors are prohibited from donating blood. These behaviors include sharing needles among drug users, involvement in prostitution, having multiple sexual partners, or engaging in same-gender sexual relationships. Blood donation should be approached with a sense of responsibility and a genuine desire to help those in need. Therefore, honesty during the pre-donation counseling session is paramount. Failure to disclose relevant information could pose risks to patients receiving transfusions [3].

We also learn that the donor begins by completing a blood donation registration form or card and having their body weight measured. Following this, a blood test is conducted to determine the donor's blood group and hemoglobin level. Subsequently, the donor undergoes pre-donation counseling with a Medical Officer or Nurse. If deemed eligible, the donor's details are recorded, and a blood donation book is provided. The blood donation process typically lasts between 7 to 15 minutes. After the donation is completed and the needle is removed, the donor is required to rest for a minimum of 10 minutes before leaving the donation area. Additionally, the donor is offered light refreshments following the donation [3]. In short, many topics on blood donation can be learned from this portal. The knowledge here will be crucial for the proper development of the proposed method.

2.8 Blood Donation Criteria

To integrate the screening for the users of the mobile application to be as accurate as possible, the blood donation criteria from the “Pusat Darah Negara” is referred to. This includes many criteria such as gender, age, donation attempts, weight, number of hours

slept, healthiness, medication status, sexuality, time between last donation attempts [4]. Women are asked if they are pregnant, breast feeding, or menstruation. An accurate version is to be mapped and integrated into the proposed method, to simulate the exact form of criteria screening.

CHAPTER 3: SYSTEM METHODOLOGY

3.1 Methodology

For this project, Agile development which is one of the incremental models would be the best approach as it is useful projects that require frequent changes. Most importantly, agile methodology is very effective in greatly reducing the development time required for this project. Agile have always followed 4 core principles which focuses more on individuals and interactions, working software, customer collaboration, and the adaptability to new changes in planning [5]. Agile is a suitable methodology as multiple changes are to be done on multiple modules throughout the development life cycle. Small changes can be released incrementally to gradually complete the system, starting from sub-systems. Initially, the software is to be broken down into smaller sub-systems to be incrementally developed. Then, the modules are tested after it has completed its development before proceeding to the next module for development. At this rate, the final product can be delivered with the highest speed, while retaining the quality through frequent and continuous testing. In short, Agile is picked as the approach for this project due to its adaptability, best suit this project that requires changes in any stages.

Figure 3-1 Phases of Agile Development

Planning Phase

In the Planning phase, problem statement, project objectives, scope and proposed method is planned in detail. During this phase, CASE tool (Computer-aided software engineering) such as Microsoft Visual Paradigm is used to generate many diagrams such as Use Case Diagram, Activity Diagram, System Architecture Diagram, Entity-Relationship Diagram, System Flowchart Diagram and many more. Functional and non-functional requirements are also determined using use case descriptions. The project timeline will be scheduled in advance to increase the success rate of the project. Next, a literature review will be conducted to compare the strengths and weakness of existing applications which are like the project such as PlasmaLife, Bloodkad and BloodConnect. Many government health portals are also studied to simulate a similar situation faced by users for blood donation Finally, the project's feasibility will be assessed, taking minimal risks into account. Project methodology is decided as well as the appropriate tools to develop the project such as Firebase, Visual Studio Code.

Design and Development Phase

Firstly, a system architecture diagram will be developed to understand functionalities happening between servers and end devices. Wireframes are also created as it will play a role as user stories to integrate the modules into system. The database schema is planned and integrated into Firebase collections. User authentication roles and methods are to be planned as early as possible as defects tend to cluster at this checkpoint. User requirements are also gathered iteratively and incrementally to improve product quality if fulfilled. Then, solutions are realized as it is developed through sprints and burst of quick development of modules based on user stories factoring usability, scalability and maintainability. This process continues iteratively until modules are complete.

Testing Phase

A test plan is developed to test the developed modules. The purpose of the test plan is to identify defects in developed modules and to ensure that the modules are be having as expected. After a module have completed the development phase, it will be tested in

several ways based on the test plan such as unit testing, integration testing, and acceptance testing. Static testing is also applied to the codes before releasing the module into the system.

Deployment Phase

As all modules are well tested with no defects and behaving properly, the mobile application will be deployed as a product. The client-sided application will be deployed into Google Play. The admin-sided application will be provided as verified blood banks are to contact the service providers.

3.2 Design Specifications

3.2.1 System Architecture Design

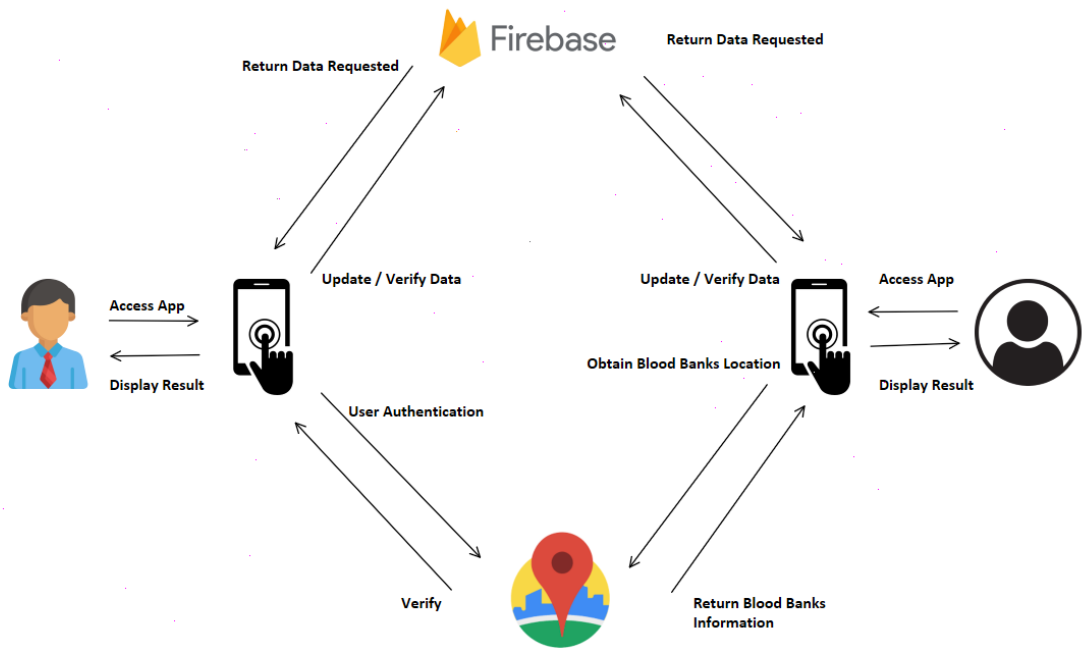


Figure 3-2 System Architecture Diagram

Based on the figure above, the system architecture used to develop this project would be client-server architecture. Client server architecture is used because it allows the separation of presentation logic which is the client-side and the business logic on the

server-side [6]. Thus,the user interface handled by the client can be designed to separate from the application logic managed by the servers. In a mobile application, the client will be on their mobile devices communicating with the server [6]. Then, the server will be responsible for processing requests, executing the necessary logic, and returning a response to the client in their respective devices. Additionally, this model is quite scalable as the servers can multitask the requests from multiple clients at the same time. Maintenance on this model should not be a difficult task as the changes on the server-side logic will not affect those on the client-side. Hence, client- server architecture creates a seamless user experience as the communication between the client and server is not hindered by any other factors.

Additionally, this project is built with Google Firebase serving as the database. The system uses Google Firebase Authentication for user login and signup. Both users and administrators access the same database, ensuring data synchronization. Firebase ensures security, usability, reliability and operability in heavy workload with maximum uptime and upkeep. This architecture enables efficient and real-time data management for the blood bank application.

- Users and Admin will operate on their mobile devices with their respective application functionalities.
- Firebase will be the database storing user data collections.
- The system requires wireless internet connection as network to run.
- Google Map API requires devices to grant user location permission to show closest blood banks.

3.2.2 Use Case Diagram

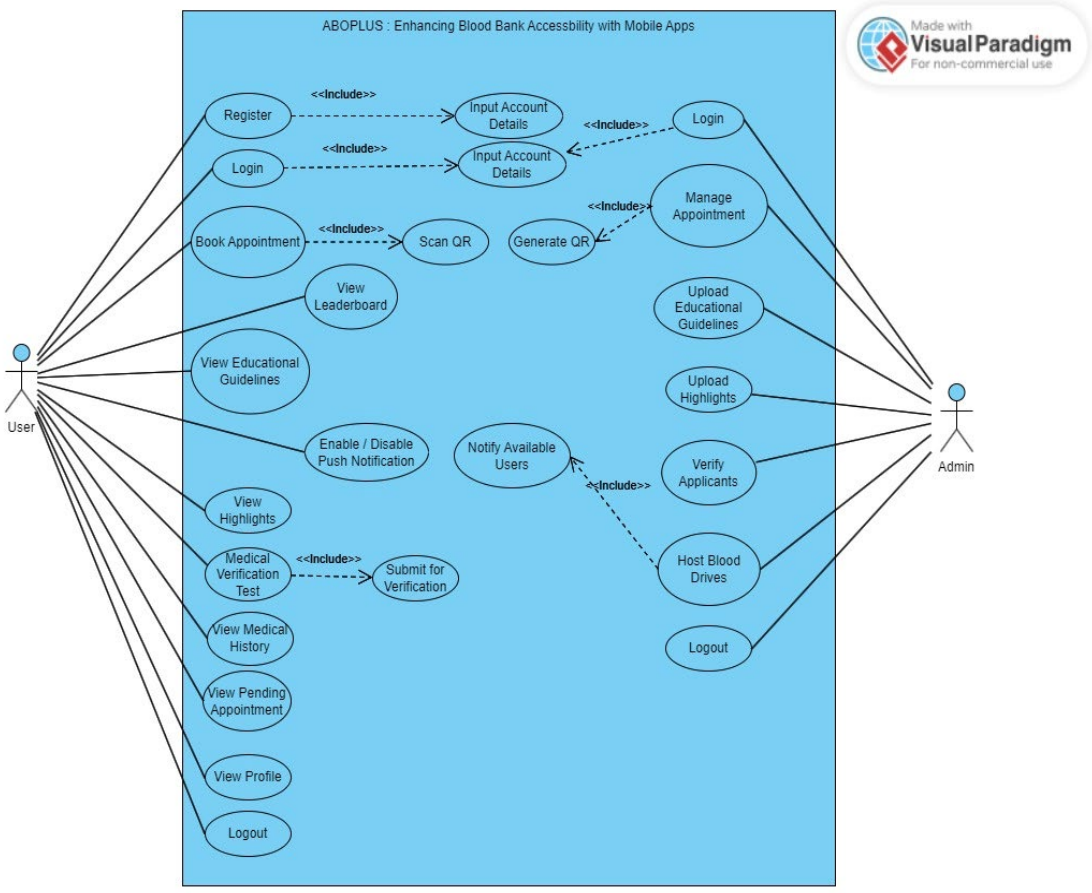


Figure 3-3 Use Case Diagram

3.2.3 Use Case Description

Use Case ID	UC001	
Feature	F001 Login	
Purpose	To allow users to login into the mobile application.	
Actor	User	
Trigger	User presses “Login”.	
Precondition	User is not authenticated, requires internet connection.	
Scenario	**Step**	**Action**
Main Flow	1	Users enter email and password.

	2	User press “Login” button.
	3	Users is authenticated with correct credentials.
	4	Users proceed to main menu.
Alternative Flow: Incorrect Email or Password	1.1	Users enter incorrect email or password.
	1.2	Error Message is displayed.
Alternative Flow: Forget Password	1.1	User forgets password of user account.
	1.2	User press “Forget Password” button.
	1.3	User is redirected to Reset Password page.
	1.4	Email is sent to user email to reset password.

Table 3-1 Use Case Description of Login for Users

Use Case ID	UC002	
Feature	F002 Login	
Purpose	To allow admins to login into the mobile application.	
Actor	Admin	
Trigger	Admin presses “Login”.	
Precondition	Admin is not authenticated, requires internet connection.	
Scenario	**Step**	**Action**
Main Flow	1	Admin enter email and password, managed by provider.
	2	Admin press “Login” button.
	3	Admin is authenticated with correct credentials.
	4	Admin proceed to main menu.
Alternative Flow: Incorrect Email or Password	1.1	Admin enter incorrect email or password.
	1.2	Error Message is displayed.
Alternative Flow: Forget Password	1.1	Admin forgets password of user account.
	1.2	Admin press “Forget Password” button.

	1.3	Admin is redirected to Reset Password page.
	1.4	Admin is sent to user email to reset password.

Table 3-2 Use Case Description of Login for Admins

Use Case ID	UC003	
Feature	F003 Register	
Purpose	To allow users to register into the mobile application.	
Actor	User	
Trigger	User presses “Register”.	
Precondition	User is not authenticated, requires internet connection. User account does not exist.	
Scenario	**Step**	**Action**
Main Flow	1	Users presses “Register Account” button.
	2	Users are redirected to Registration page.
	3	Users input the required fields and register.
	4	Users are sent back to the “Login” page.
Alternative Flow: Invalid Email or Password	1.1	Users enters invalid email or password, such as existing account information.
	1.2	Error Message is displayed.

Table 3-3 Use Case Description of Registration for Users

Use Case ID	UC004
Feature	F004 Book Appointment
Purpose	To allow users to book appointment as either donor or recipient.
Actor	User
Trigger	User presses “Book Appointment”.
Precondition	User is Verified and Authenticated with internet connection. Users give permission for system to access ‘User Device Location’

Scenario	**Step**	**Action**
Main Flow	1	Users presses “Book Appointment” button.
	2	Users are redirected to Appointment page.
	3	Users are required to allow Google Map to access their location, followed by selecting desired location.
	4	Users are to select appointment date and time after confirming location.
	5	Users are shown all appointment details to confirm.
	6	Users are redirected to homepage after confirmation of appointment.
Alternative Flow: Missing Appointment Date and Time	5.1	System informs user to select valid Date & Time for appointment booking.

Table 3-4 Use Case Description of Book Appointment for Users

Use Case ID	UC005	
Feature	F005 Manage Appointment	
Purpose	To allow admin to manage appointment based on their location.	
Actor	Admin	
Trigger	Admin presses “Manage Appointment”.	
Precondition	Admin is authenticated with internet connection.	
Scenario	**Step**	**Action**
Main Flow	1	Admin presses “Manage Appointment” button.
	2	Admin are redirected to Manage Appointment page.
	3	Admin is shown a list of appointments.
	4	Admin selects an appointment and is redirected to the Appointment Details page.
	5	Admin accepts the appointment.

	6	Admin can mark attendance or cancel the appointment.
Alternative Flow: Appointment Declined	4.1 4.2 4.3	Admin declines an appointment shown. The appointment is deleted from the list. Users are notified for the cancelled appointment.
Alternative Flow: Appointment Cancelled	3.1 3.2 3.3 3.4	Admin selects already confirmed appointments. Admin selects 'Cancel' to delete appointment. The appointment is deleted from the list. Users are notified for the cancelled appointment.

Table 3-5 Use Case Description of Manage Appointment for Admins

Use Case ID	UC006	
Feature	F006 View Leaderboard	
Purpose	To allow users to view leaderboards and current points.	
Actor	User	
Trigger	User presses "Leaderboards".	
Precondition	User is authenticated with internet connection.	
Scenario	**Step**	**Action**
Main Flow	1 2 3 4	User presses "Leaderboards" in Main Menu. User is redirected to Leaderboards page. User is shown a list of top donors with highest accumulated points with ranking. User is displayed his own rank and points in the same page based on donation attempts.

Table 3-6 Use Case Description of View Leaderboards for Users

Use Case ID	UC007
Feature	F007 Upload Educational Guidelines

Purpose	To allow admin upload educational guidelines.	
Actor	Admin	
Trigger	Admin presses “Upload Educational Guidelines”.	
Precondition	Admin is authenticated with internet connection. Permission granted to access Gallery.	
Scenario	**Step**	**Action**
Main Flow	1	Admin presses “Upload Educational Guidelines” button.
	2	Admin is redirected to Upload Educational Guidelines page.
	3	Admin is shown a list of existing images obtained from the database.
	4	Admin press on the “Upload” button to upload desired image.
	5	Admin selects image from gallery.
	6	New poster image is uploaded in the database. New poster image is now available for display on client-side.
Alternative Flow: Incorrect Upload File Format	5.1	Admin selects incorrect file format such as non-image files to upload.
	5.2	Error Message is displayed.
Alternative Flow: Delete Images	3.1	Admin clicks on “Delete” button for image to remove from database respectively.
	3.2	Database removes the image entirely.

Table 3-7 Use Case Description of Upload Educational Guidelines for Admins

Use Case ID	UC008	
Feature	F008 Upload Highlights	
Purpose	To allow admin to upload highlights to showcase new live events.	
Actor	Admin	
Trigger	Admin presses “Upload Highlights”.	
Precondition	Admin is authenticated with internet connection.	
Scenario	**Step**	**Action**

Main Flow	1	Admin presses “Upload Highlights” button.
	2	Admin is redirected to Upload Highlights page.
	3	Admin is shown a list of existing images obtained from the database.
	4	Admin press on the “Upload” button to upload desired image.
	5	Admin selects image from gallery.
	6	New poster image is uploaded in the database. New poster image is now available for display on client-side.
Alternative Flow: **Incorrect Upload File Format**	5.1	Admin selects incorrect file format such as non-image files to upload.
	5.2	Error Message is displayed.
Alternative Flow: **Delete Images**	3.1	Admin clicks on “Delete” button for image to remove from database respectively.
	3.2	Database removes the image entirely.

Table 3-8 Use Case Description of Upload Highlights for Admins

Use Case ID	UC009	
Feature	F009 View Educational Guidelines	
Purpose	To allow users to view educational guidelines for application manual or blood donation general knowledge.	
Actor	User	
Trigger	User presses “View Educational Guidelines”.	
Precondition	User is authenticated with internet connection.	
Scenario	**Step**	**Action**
Main Flow	1	User presses “View Educational Guidelines” button.
	2	User is redirected to View Educational Guidelines page.
	3	User is shown a list of existing posters uploaded by administration for educational purposes on blood donation or user manual.
Alternative Flow:	3.1	User wants to enlarge the poster for better view.

Enlarge poster	3.2	User clicks on one of the posters to view full screen.

Table 3-9 Use Case Description of View Educational Guidelines for Users

Use Case ID	UC010	
Feature	F010 View Highlights	
Purpose	To allow admin to manage appointment based on their location.	
Actor	Admin	
Trigger	User presses “Login” Button and is redirected to Homepage.	
Precondition	Admin is authenticated with internet connection. User needs to be in Main Menu.	
Scenario	**Step**	**Action**
Main Flow	1 2	Users logged in successfully and is redirected to Homepage. Users are shown the highlights uploaded by admin.
Alternative Flow: **Enlarge poster**	2.1 2.2	User wants to enlarge the poster for better view. User clicks on one of the posters to view full screen.

Table 3-10 Use Case Description of View Highlights for Users

Use Case ID	UC011	
Feature	F011 Medical Verification Test	
Purpose	To allow users to fill a form to submit for screening purposes.	
Actor	User	
Trigger	User presses “Get Verified” button.	
Precondition	User is authenticated with internet connection. User has not been verified as account status is fresh.	
Scenario	**Step**	**Action**
Main Flow	1 2	User presses “Get Verified” button in homepage. User are redirected to Medical Verification page.

	3 4 5	User is shown a form to be filled for submission. User submits the filled form to database for admins to verify. Users are redirected back to homepage after submission. "Get Verified" button is changed to "Pending" text.
Alternative Flow: **Incorrect data filled in form**	3.1 3.2	User fills in inappropriate format of IC Number given that mask of IC is ####-##-####. User is not allowed to submit and is prompted to fill correct details.
Alternative Flow: **Missing fields on Submission**	3.1 3.2	User has an incomplete field on submission. User is prompted to complete the missing field in the form before submitting.

Table 3-11 Use Case Description of Medical Verification Test for User

Use Case ID	UC012	
Feature	F012 Verify Applicants	
Purpose	To allow admin to verify pending applicants of their submitted forms.	
Actor	Admin	
Trigger	Admin presses "Verify Applicant".	
Precondition	Admin is authenticated with internet connection. At least one application from client-side is submitted and pending.	
Scenario	**Step**	**Action**
Main Flow	1 2 3 4 5 6 7	Admin presses "Verify Applicant" button. Admin are redirected to Verify Applicant page. Admin is shown a list of pending applicants to be verified. Admin selects an applicant from the list. Admin is shown the details of the selected applicant. Admin verifies the applicant. "Verified" text is now displayed on client-side for verified applicant.

Alternative Flow: Application Rejected	5.1 5.2 5.3	Admin rejects the application of the applicant shown. Admin is redirected back to “Verify Applicant” page. Client-side now shows “Ineligible to Donate”.

Table 3-12 Use Case Description of Verify Applicants for Admins

Use Case ID	UC013	
Feature	F013 View Pending Appointment	
Purpose	To allow users to manage pending appointment.	
Actor	User	
Trigger	User presses “Pending Appointment”.	
Precondition	User is authenticated with internet connection.	
Scenario	**Step**	**Action**
Main Flow	1 2 3	User presses “Pending Appointment” button. User are redirected to Pending Appointment page. User is shown a list of appointments done on “Book Appointment”.
Alternative Flow: Admin cancels or rejects the appointment	3.1	User will see “Cancelled” status as with red card.
Alternative Flow: Admin confirms the appointment	3.1	User will see “Confirmed” status of appointment with green card.
Alternative Flow: Admin marks attendance of appointment	3.1	Appointment is removed from pending list.
Alternative Flow:	3.1	User will see “Pending” status with blue card.

Appointment is pending for admin		

Table 3-13 Use Case Description of View Pending Appointment for User

Use Case ID	UC0014	
Feature	F014 View Medical History	
Purpose	To allow users to view medical history.	
Actor	User	
Trigger	User presses “View Medical History”.	
Precondition	User is authenticated with internet connection.	
Scenario	**Step**	**Action**
Main Flow	1	User presses “View Medical History” button.
	2	User is redirected to View Medical History page.
	3	User is shown a list of appointment history based on completed appointments as either donor or recipient.

Table 3-14 Use Case Description of View Medical History for User

Use Case ID	UC015
Feature	F015 View Profile
Purpose	To allow user to view own profile and upload profile picture.
Actor	User
Trigger	User presses “Profile”.
Precondition	User is authenticated with internet connection. User has completed the medical verification test. User grants permission to “Gallery” given that user wishes to upload profile picture.

Scenario	Step	Action
Main Flow	1	User presses “Profile” button.
	2	User are redirected to Profile page.
	3	User is shown details of information of own profile.
Alternative Flow: Upload Profile Picture	2.1	User presses on “Edit Profile Picture” button.
	2.2	User selects image from Gallery.
	2.3	System updates the new profile picture of the user.
Alternative Flow: Invalid Format for Profile Picture	2.2.1	User selects file format that is invalid.
	2.2.2	System displays error message.

Table 3-15 Use Case Description of View Profile for User

Use Case ID	UC016	
Feature	F016 Logout	
Purpose	To allow user or admin to logout from mobile application.	
Actor	User & Admin	
Trigger	User or Admin presses “Logout”.	
Precondition	User or Admin is logged in with their current account.	
Scenario	**Step**	**Action**
Main Flow	1	User or Admin opens the drawer on the left on each application respectively.
	2	User or Admin presses “Logout” button.
	3	System redirects both to Login page out of user authentication.

Table 3-16 Use Case Description of Logout for User & Admin

3.3 Verification Plan

Based on the project, verification plans will be done on the developed modules. This section will include fundamental system requirements such as functional and non-

functional requirements.

3.3.1 Functional Requirements

User Login Module:

- System allows existing registered users to login with email and password.
- System shows an error message given that email is invalid.
- System shows an error message given that password is invalid.

User Registration Module:

- System allows users to register an account with email and password.
- System shows an error message if the email used for registration is invalid.
- System shows an error message if the password used for registration is invalid.

Admin Login Module:

- System allows self-registered admins to login with email and password.
- System shows an error message given that email is invalid.
- System shows an error message given that password is invalid.

User Menu Module:

- System shows the main menu with features including navigation bar and sidebar.
- System shows the main menu with all existing features, such as Verification Test, Leaderboards, Medical History, View Educational Guidelines.
- Navigation Bar includes Homepage, View Pending Appointments, Book Appointments, View Profile.
- Sidebar includes Change Password and Logout.

Admin Menu Module:

- System shows the main menu with features including navigation bar.
- System shows the main menu with all existing features, such as Upload Highlights,

Upload Educational Guidelines, Verify Applicants, Manage Appointments.

- Sidebar includes Change Password, Logout.

User Medical Verification Test Module:

- System allows users to fill in particulars for submission.
- System shows error messages when particulars are not fill for submission.
- System will disable visibility of this module when applicants are pending or verified.
- System will show different particulars for submission in form when conditions are met, such as gender differences.

Admin Verify Applicant Module:

- System should show all pending applicants in list.
- System should allow admin to view pending applicant details.
- System should allow admin to approve or reject applications.

User View Educational Guidelines Module:

- System should allow users to view recently updated educational guidelines in real-time.

Admin Upload Educational Guidelines Module:

- System should allow admins to upload educational guidelines with images to allow client-side to display on real-time.
- System should allow admins to replace old existing photos with new ones.

Admin Upload Highlights Module:

- System should allow admins to upload highlights with images to allow client-side to display on real-time.
- System should allow admins to replace old existing photos with new ones.

User Profile Module:

- System should display the user information in detail in this page.
- System should allow users to upload profile picture to database.
- System should display the user profile picture and the corresponding badge based on user points.

User Book Appointment Module:

- System should allow users to select locations on the Google Map to book an appointment based on their roles.
- System should display the location details with precise information.
- System should allow users to pick the time and date for the appointment.
- System should allow users to confirm or cancel appointment.

User Pending Appointment Module:

- System should allow users to manage pending appointments based on book appointments.
- System should add points to user after attending to appointment.
- System should allow users to see appointment status such as pending, accept, or cancelled.

User Leaderboards Module:

- System should display a list of users with highest donation points and provide ranking system.

User Medical History Module:

- System should show a list of completed appointments based on roles such as donor or recipient with 2 differentiating colors.

Admin Manage Appointments Module:

- System should display a list of pending appointments to the admin.
- System should allow admin to decline or accept the appointments.

- System should display the appointment and user information to the admin.
- System should allow admin to mark the attendance of appointment.
- System should allow admin to cancel appointments.

3.3.2 Non-Functional Requirements

Security Requirements:

- Users shall be authenticated for login and registration with Firebase rules.
- Admin shall be authenticated for login with Firebase rules.
- Password change shall be requested on email verification link based on Firebase.

Performance Requirements:

- The developed system must be fast enough to operate in a streamlined manner.
- The system must be available all the time.

Usability Requirements:

- Users must have easy accessibility to all features available in the system.
- The user interface must be minimalistic, highly accessible, and easy to understand.

Operational Requirements:

- The developed system must be operational on all Android devices.
- The developed system must be functional with internet connectivity.

3.4 Activity Diagram

3.4.1 Activity Diagram for User to Login and Register

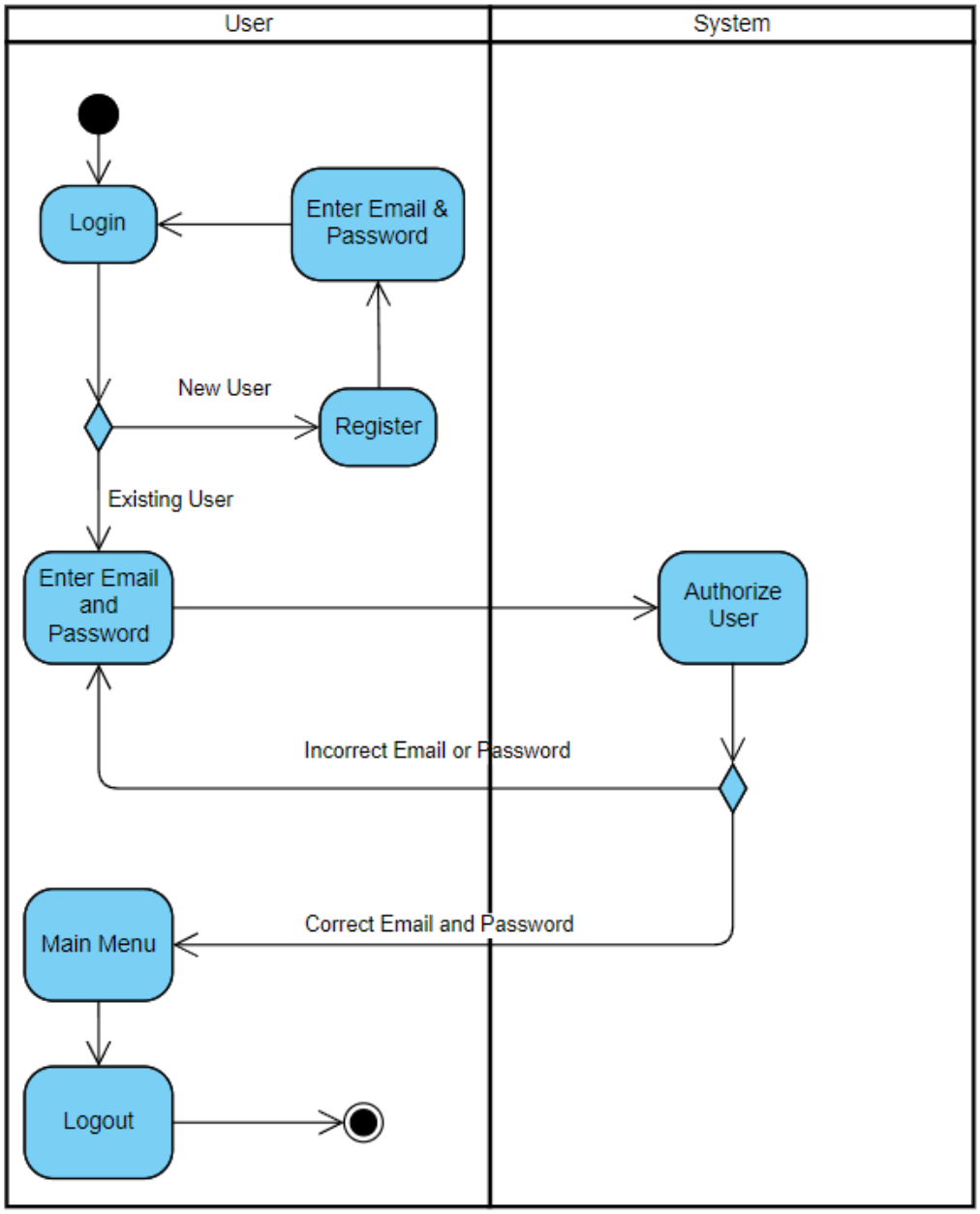


Figure 3-4 Activity Diagram for User to Login and Register

3.4.2 Activity Diagram for Admin to Login

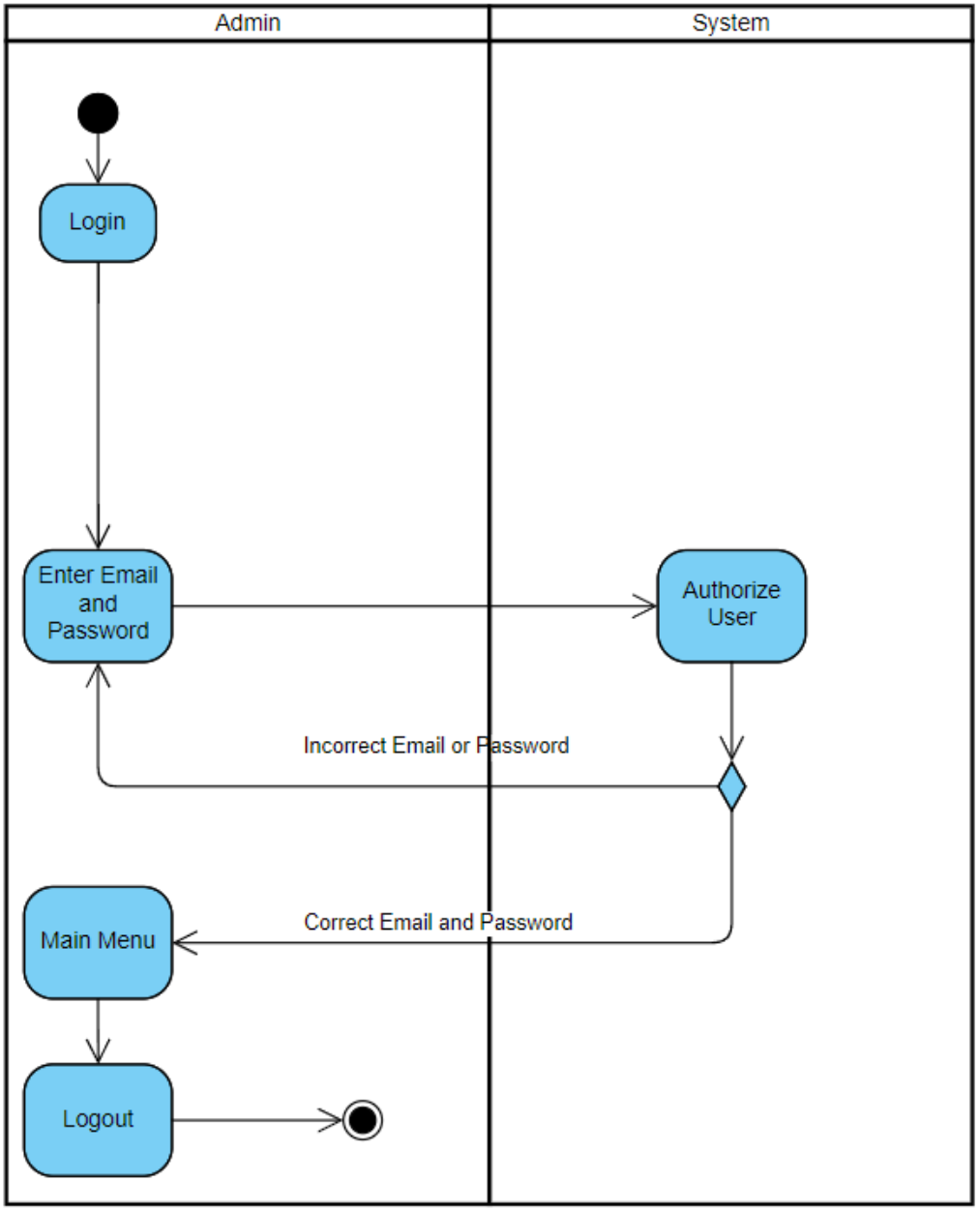


Figure 3-5 Activity Diagram for Admin to Login

3.4.3 Activity Diagram for User to fill Medical Verification Test

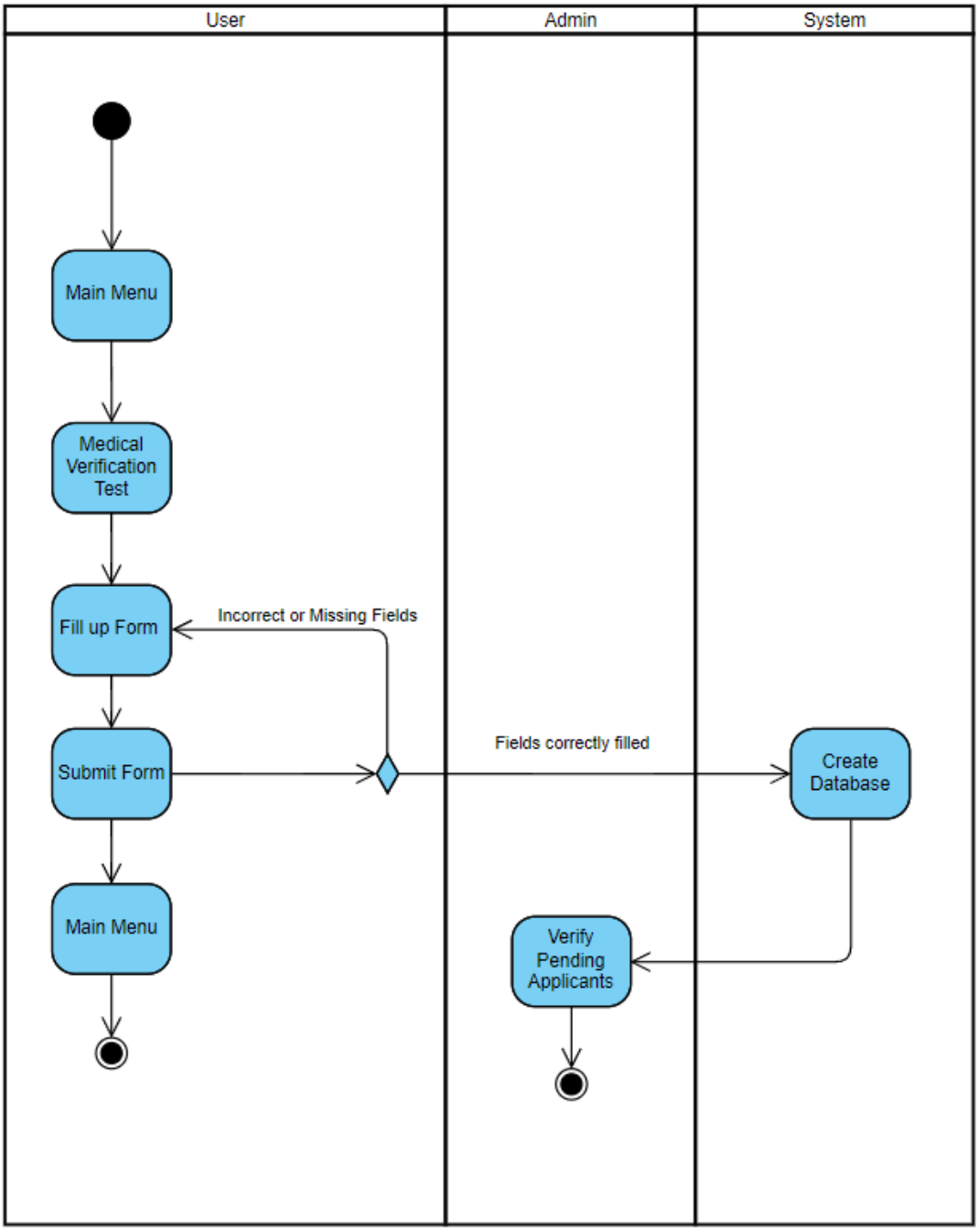


Figure 3-6 Activity Diagram for User to fill Medical Verification Test

3.4.4 Activity Diagram for Admin to Verify Applicants

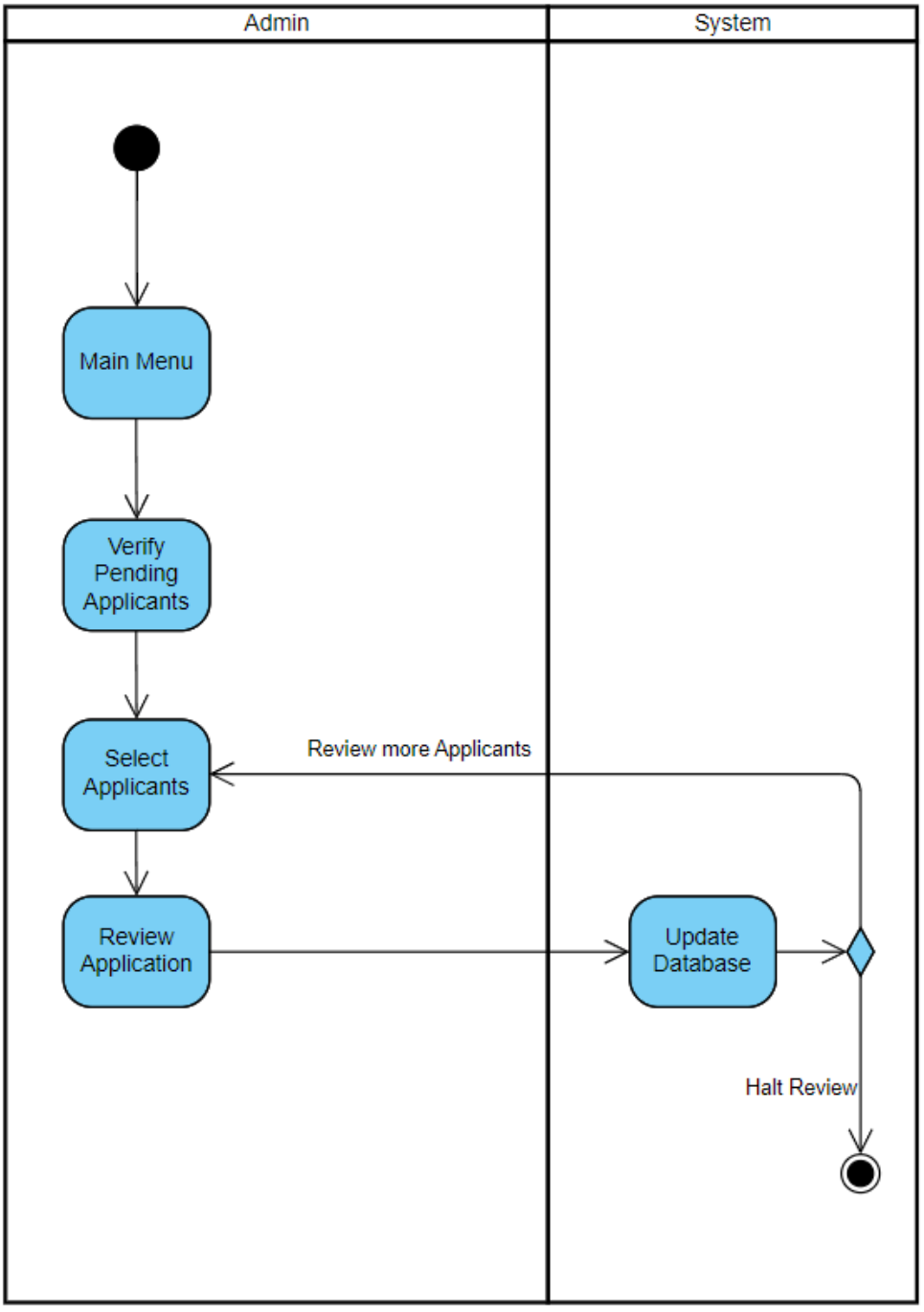


Figure 3-7 Activity Diagram for Admin to Verify Applicants

3.4.5 Activity Diagram for Users View Educational Guidelines

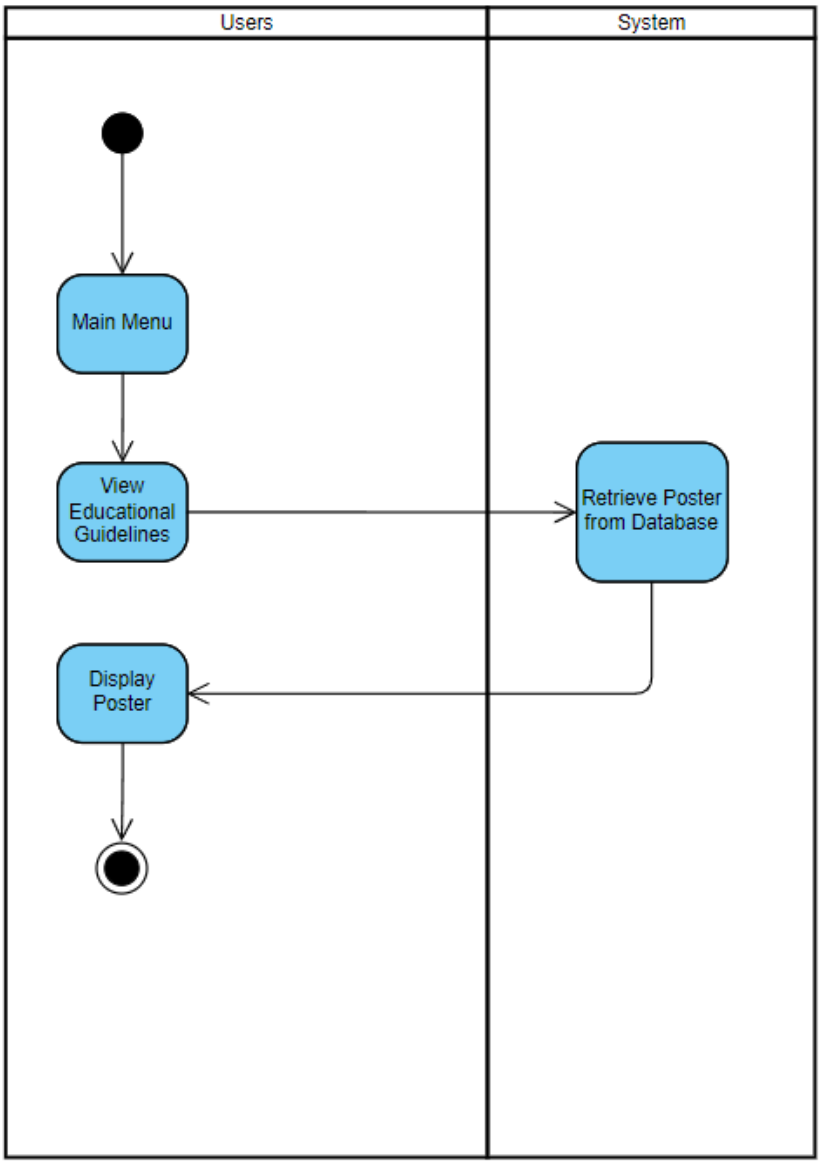


Figure 3-8 Activity Diagram for Users View Educational Guidelines

3.4.6 Activity Diagram for Admin to Upload Educational Guidelines

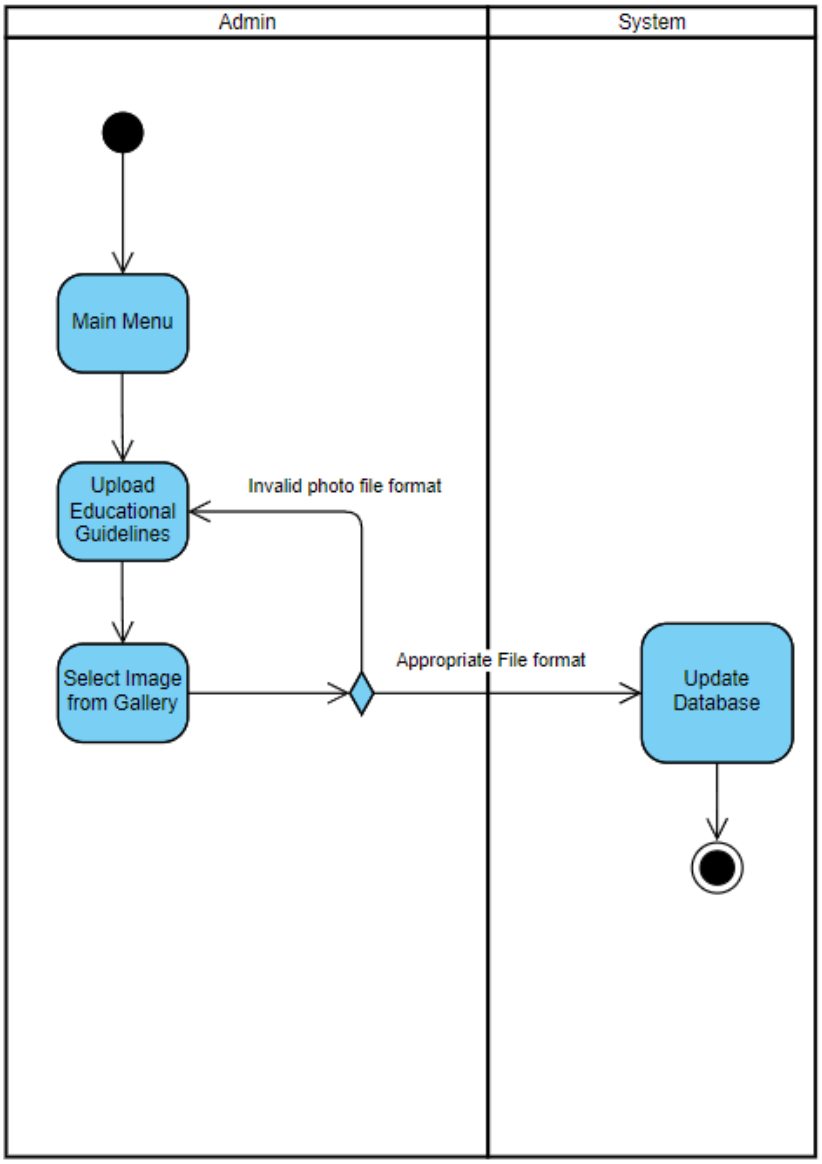


Figure 3-9 Activity Diagram for Admin to Upload Educational Guidelines

3.4.7 Activity Diagram for Admin to Upload Highlights

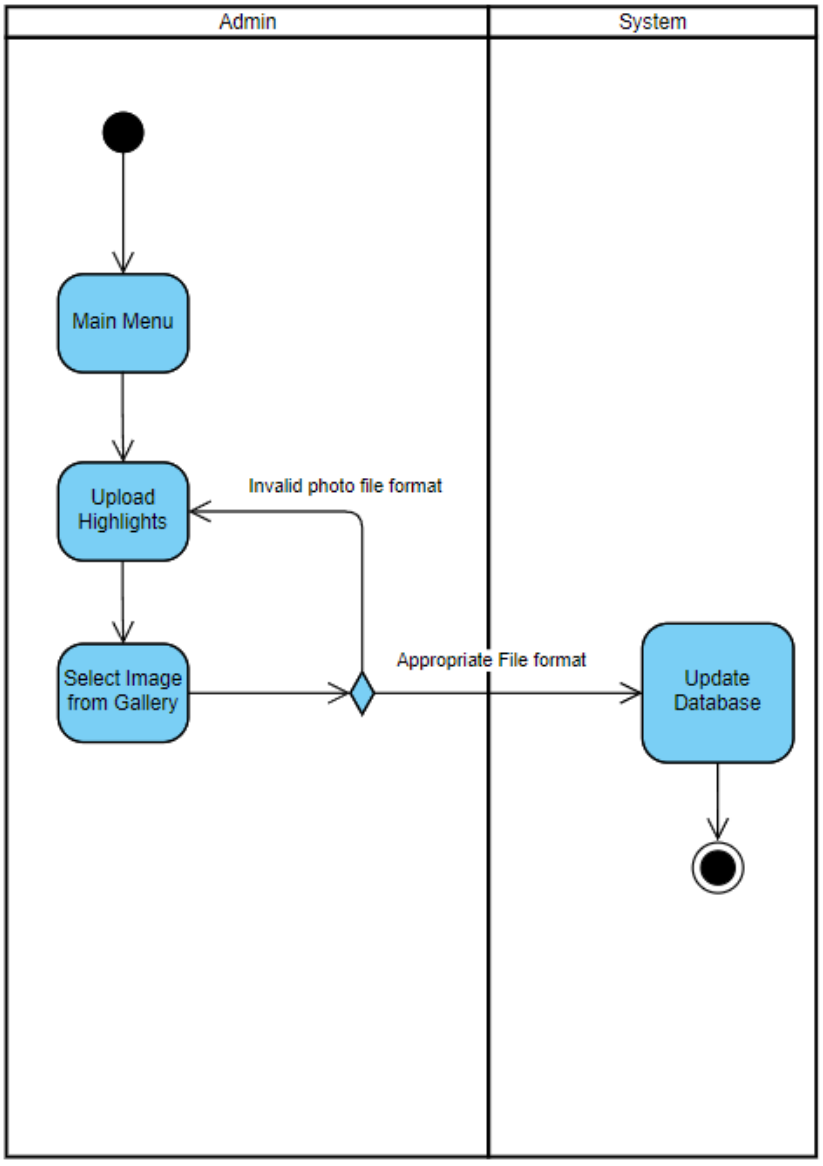


Figure 3-10 Activity Diagram for Admin to Upload Highlights

3.4.8 Activity Diagram for User to View Profile

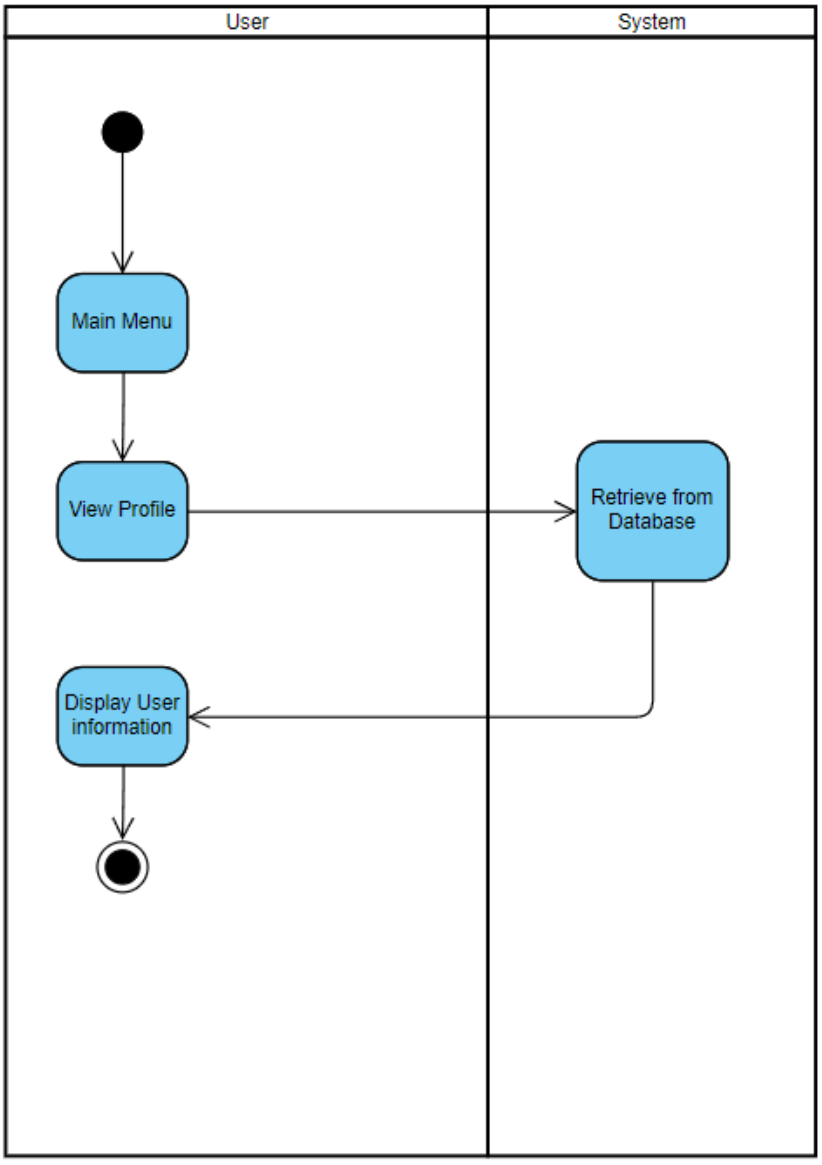


Figure 3-11 Activity Diagram for User to View Profile

3.4.9 Activity Diagram for User to Book Appointment

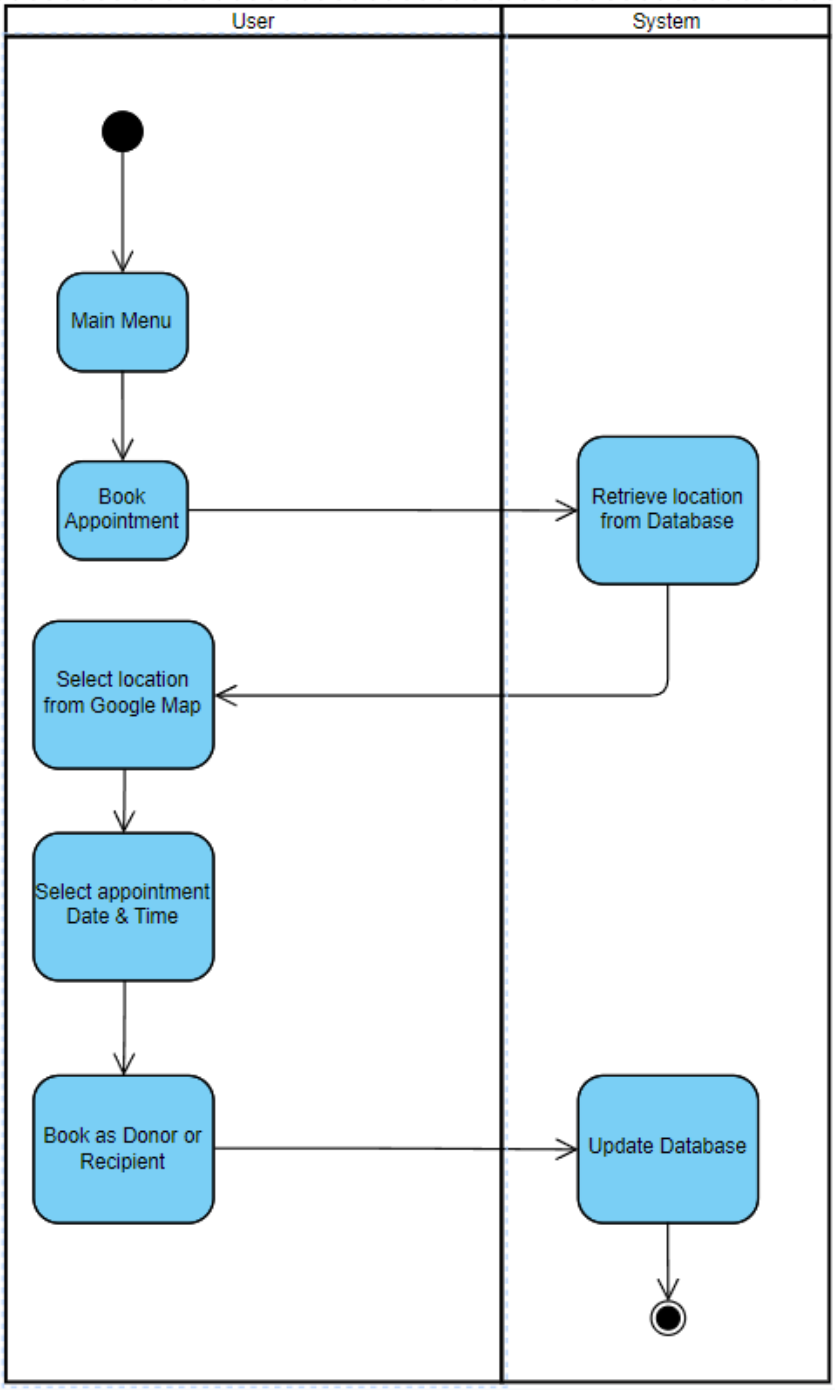


Figure 3-12 Activity Diagram for User to Book Appointment

3.4.10 Activity Diagram for User to Manage Pending Appointment

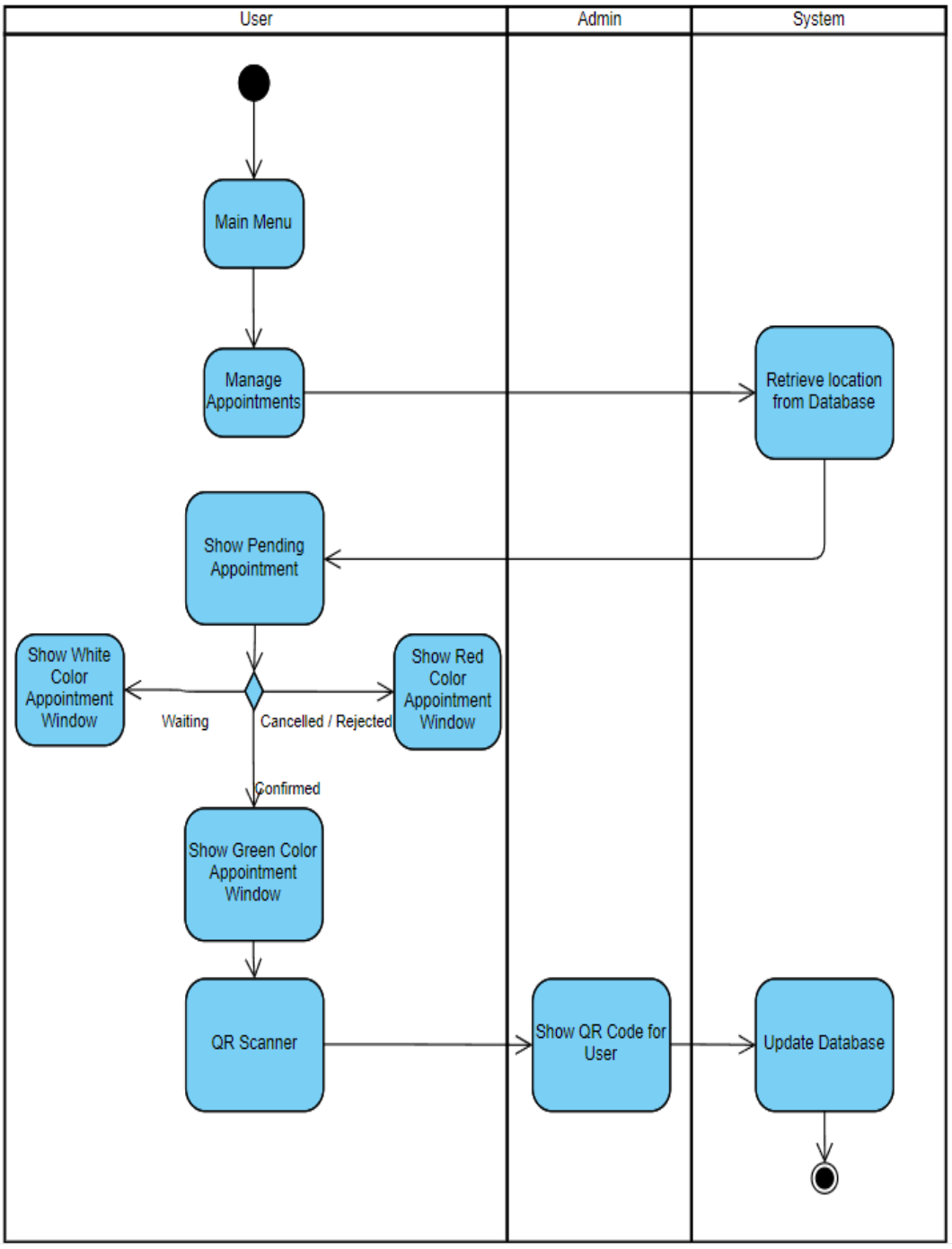


Figure 3-13 Activity Diagram for User to Manage Pending Appointment

3.4.11 Activity Diagram for User to View Leaderboards

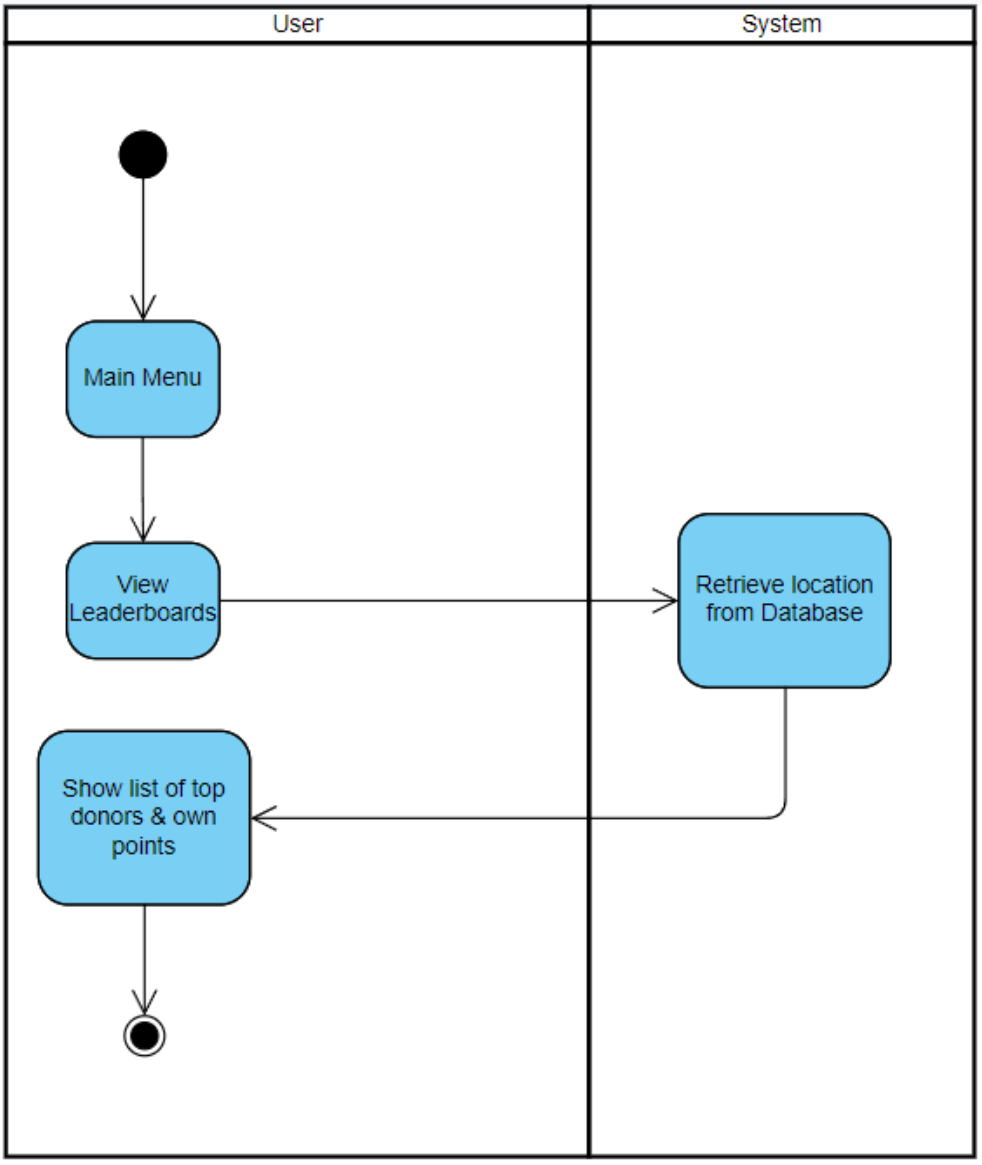


Figure 3-14 Activity Diagram for User to View Leaderboards

3.4.12 Activity Diagram for User to View Medical History

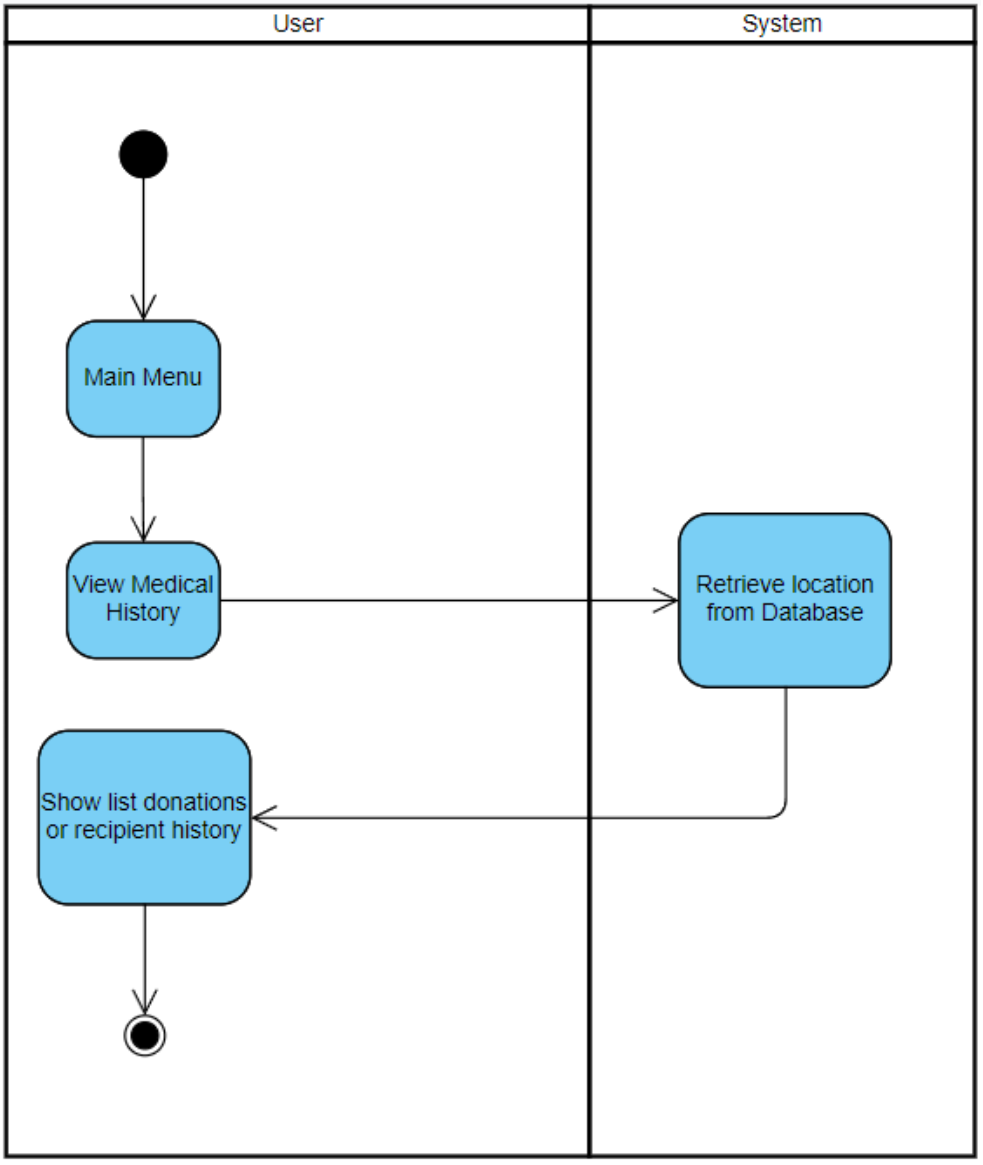


Figure 3-15 Activity Diagram for User to View Medical History

3.4.13 Activity Diagram for Admin to Manage Appointments

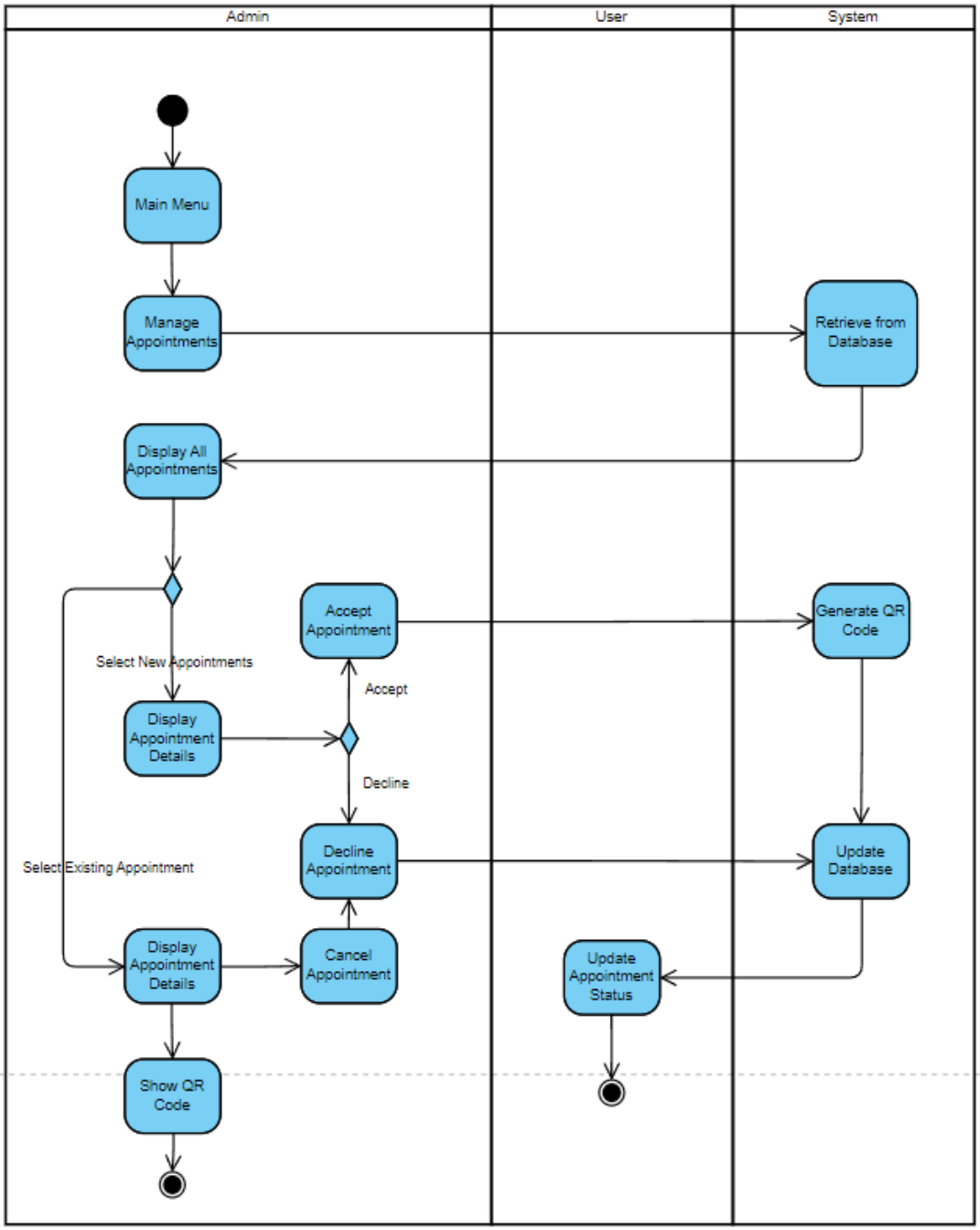


Figure 3-16 Activity Diagram for Admin to Manage Appointments

3.4.14 Activity Diagram for User and Admin to Reset Password

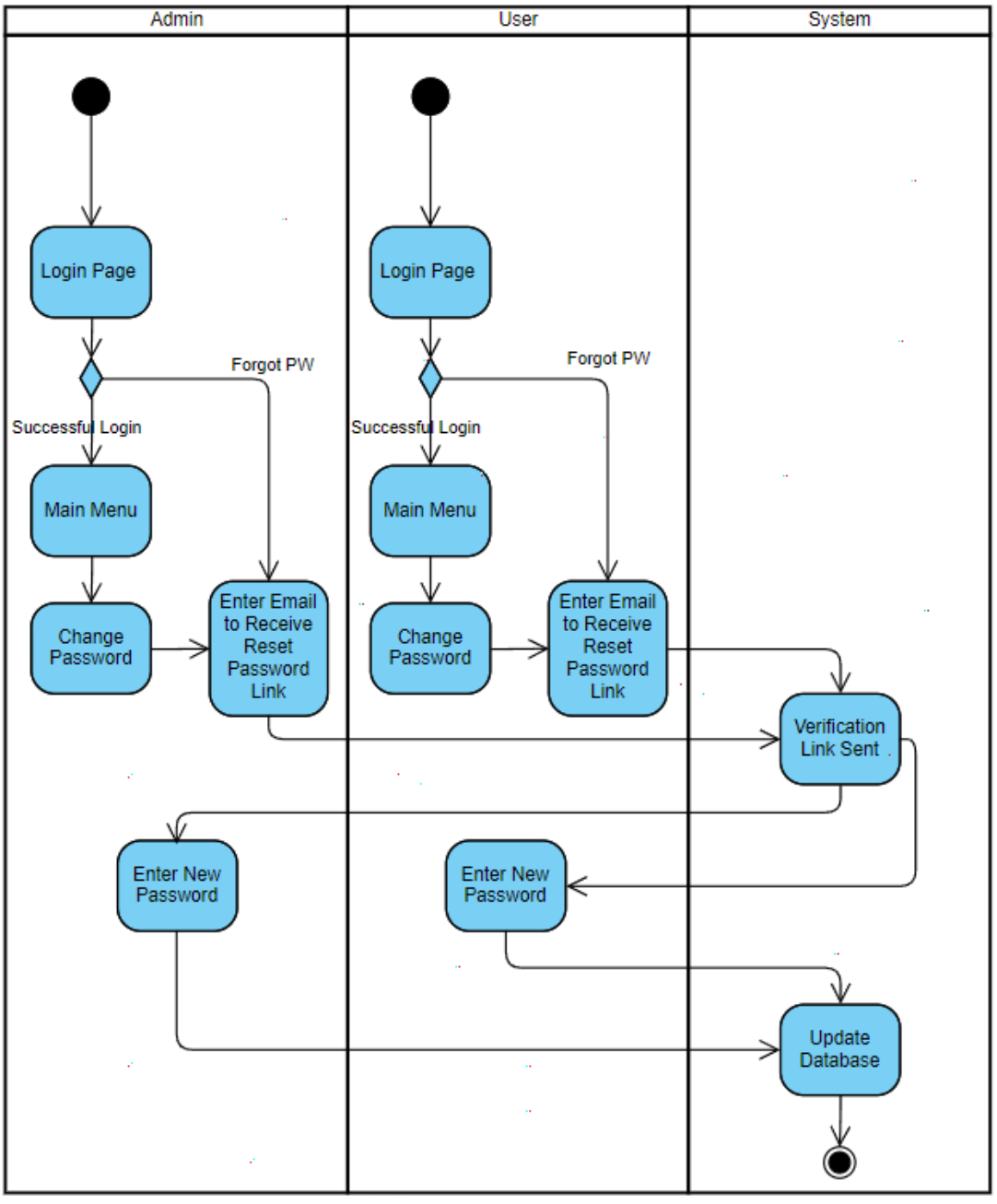


Figure 3-17 Activity Diagram for User and Admin to Reset Password

3.5 Timeline

Task Description	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13
Literature Review													
Database Design and Development (C/A)													
Develop Login and Register Function (C/A)													
Develop Main Menu Interface (C/A)													
Testing of System Version 1 (C/A)													
Develop Medical Verification Test Function (C)													
Develop Verify Applicant Function (A)													
Develop Profile Page Interface (C)													
Develop View Educational Guideline Function (C)													
Develop Upload Educational Guideline Function (A)													
Develop Upload Highlights Function (A)													
Testing of System Version 2 (C/A)													
Develop Book Appointment Function (C)													
Develop Manage Appointment Function (A)													
Develop Pending Appointment Function (C)													
Develop Medical History Function (C)													
Testing of System Version 3 (C/A)													
Develop Leaderboards Function (C)													
Develop Activate Push-Notification Function (C/A)													
Testing of System Final Version (C/A)													
Report Writing													

Figure 3-18 Gantt Chart of Project Timeline

CHAPTER 4: SYSTEM DESIGN

4.1 System Flowchart

4.1.1 User System Flowchart

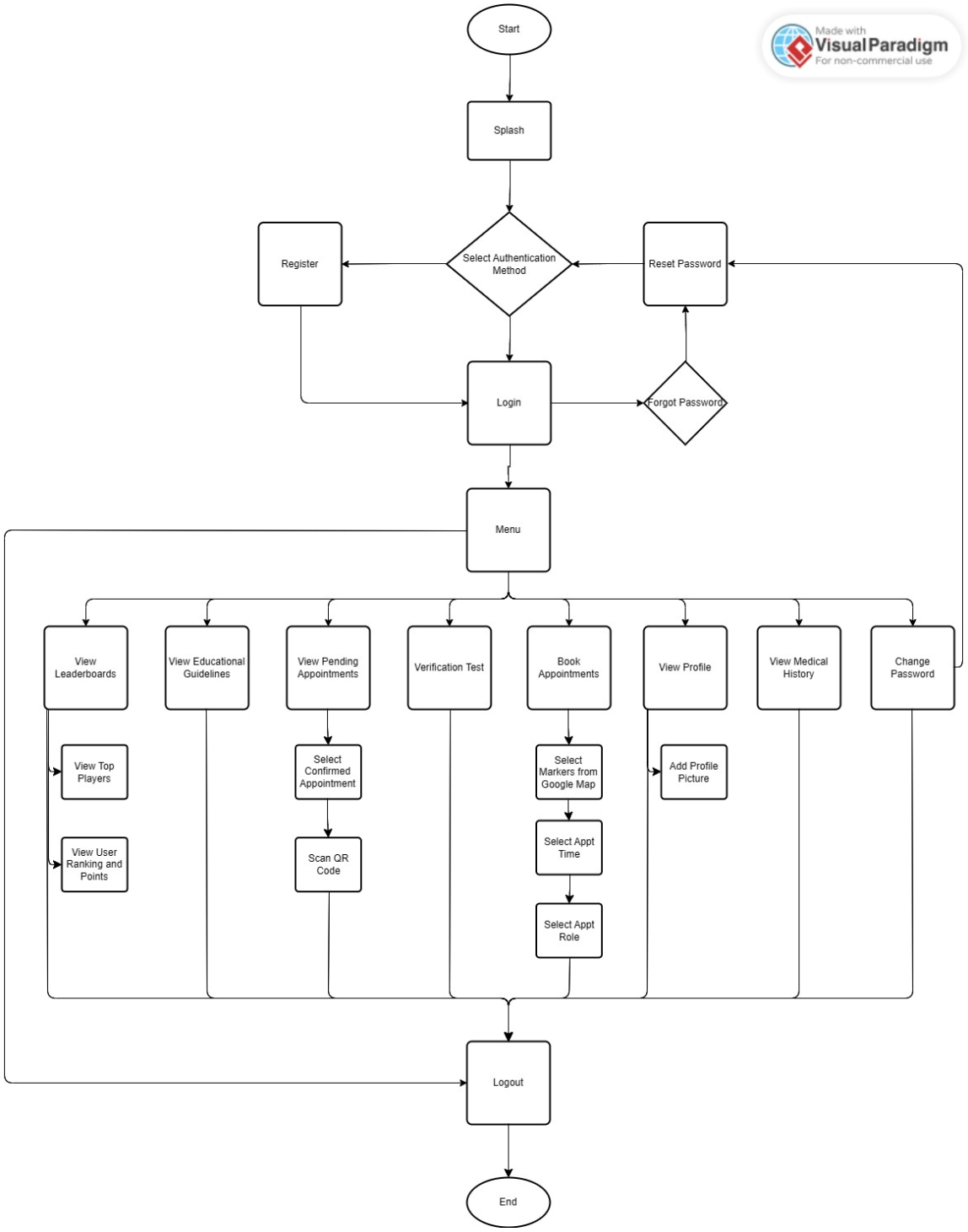


Figure 4-1 User System Flowchart

4.1.2 Administrator System Flowchart

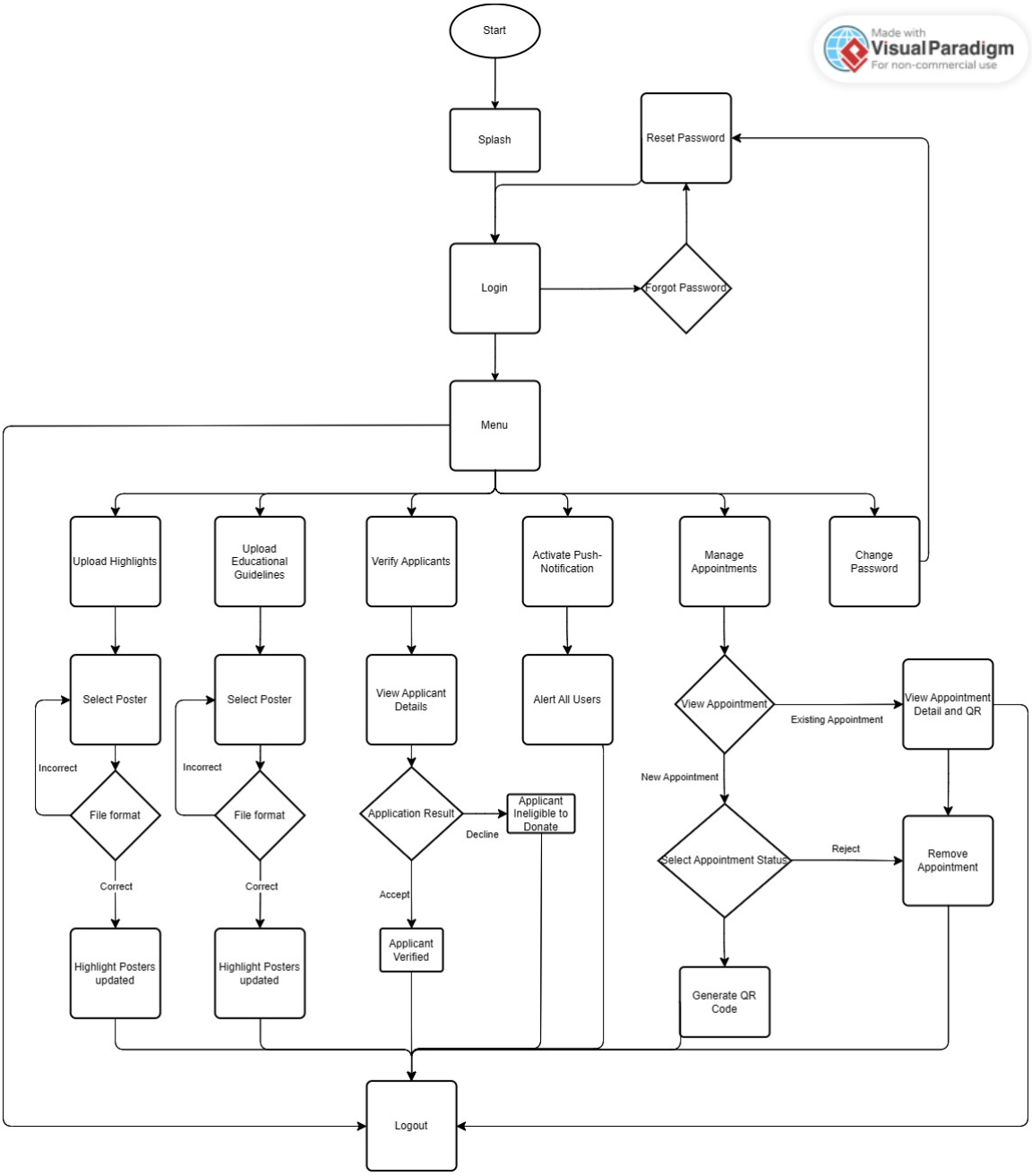


Figure 4-2 Admin System Flowchart

4.2 Entity-Relationship Diagram

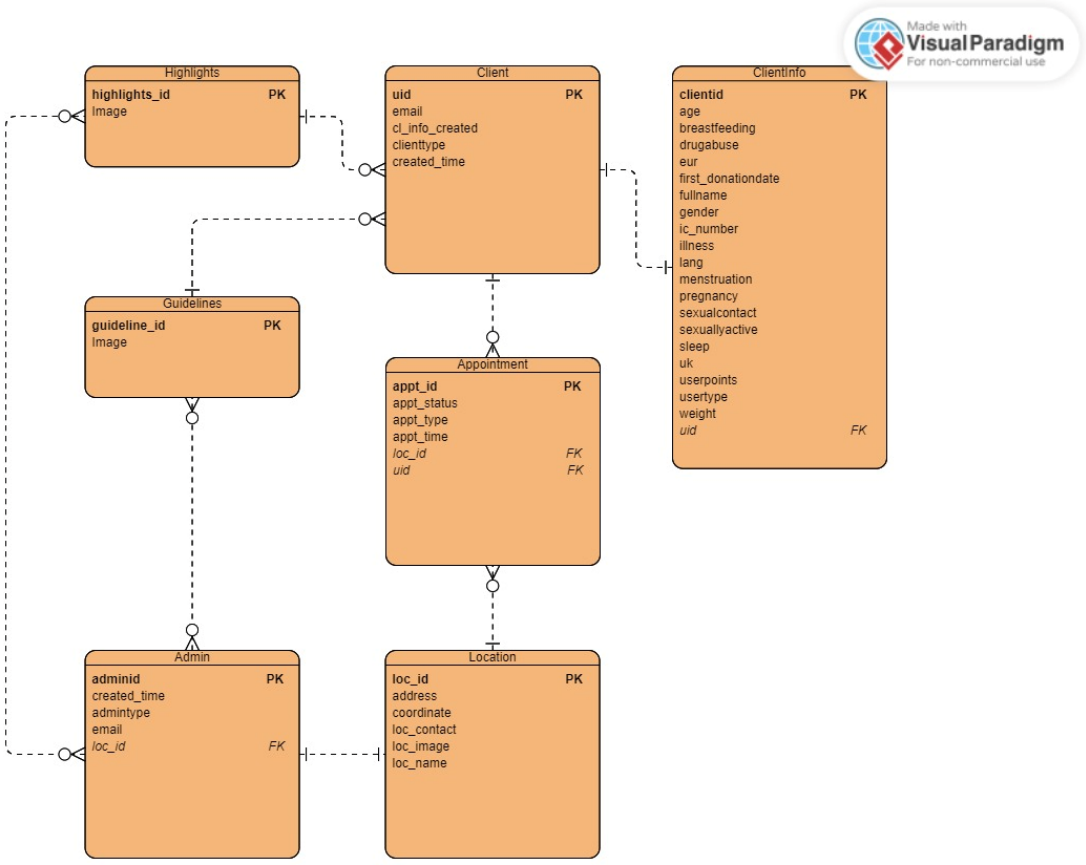


Figure 4-3 Entity-Relationship Diagram

CHAPTER 5: SYSTEM IMPLEMENTATION

5.1 Hardware Requirements

Laptop Device

Operating System	Windows 11
Processor	AMD Ryzen 5 5600H
RAM	16GB

Table 5-1 Laptop Device Specifications

Smartphone Device

Operating System	MIUI 13.0.9 / ANDROID 12
Processor	Snapdragon 695
RAM	8 GB

Table 5-2 Smartphone Device Specifications

5.2 Software Requirements

Integrated Development Environment (IDE): Visual Studio Code

For the development of 'ABOPLUS', VS Code is preferred as an integrated development environment for the programming language Dart. This IDE runs on Windows aligned to the hardware requirements. VS Code offers many extensions and plugins which will be helpful to the development of the project. VS Code also provides a built-in terminal which allows easy runs and testing on the go for console. Commands can be run for development, resulting in a streamlined flow of development, saving more time. Furthermore, it is also a lightweight IDE which is easier to use and look at, increasing productivity of developers. Documentation on how to use VS Code is also widely available in the net by the internet community. These are widely available in tutorials, Youtube, Forums and much more. As a conclusion, Visual Studio Code is well aligned and compatible with the development needs as it provides powerful tools and environment to develop mobile application.

Programming Language: Dart

Dart is a well-known programming language for mobile applications development. Using the Flutter Framework, applications can be built with high speeds in a short time, while sustaining the quality of development. Mobile applications with pleasant looking UI with great performance can be created. Furthermore, emulators with instant reloads are a feature that allows developers to instantly see the changes to UI and System Behavior based on the code changed. This feature will be the main purpose of using Dart, which will significantly speed up development of components based on our project methodology which is Agile. Many UI and widget components can be implemented very easily, which will enhance development experience.

Additionally, is a modern programming language for mobile application development as it is capable of precise syntax, asynchronous programming support, faster compilation. The non-functional improvements such as strong typing can greatly increase quality of code produced, as well as reduce the bugs found. Lastly, Dart is recommended and supported by Google with its great documentation available in the net, with a community behind it guiding novice developers to building their first project.

Database: Google Firebase

For the development of 'ABOPLUS', Google Firebase is the best choice for database as it is a versatile and comprehensive platform for app developers, offering a wide range of services that simplify the development process and enhance the functionality of mobile and web applications. Its real-time database, authentication, and cloud functions enable developers to build responsive and collaborative apps with ease. Firebase's hosting, storage, and Firestore database options provide plenty scalable solutions for the mobile apps. Furthermore, its security features are top notch. Integration with other Google services make it an ideal choice for development of the blood bank mobile application [7]. Time and effort might as well be saved as Firebase manages the backend services of the system.

Application Programming Interface (API): Google Map API

Google Map API is implemented into the project to allow users to interact with locations of blood banks in the app. Users will be able to view locations and interact with the markers displayed. That way, user experience is enhanced as the blood bank location can be identified easily instead of just showing the address. Furthermore, users can customize what they can see based on their roles and needs. As a donor, they can choose to see nearby blood drives to participate in donation activities. As a recipient, they can look for nearby open blood banks to request for an appointment. The customizability allows the creation of unique experience based on user needs. It is noteworthy that Google Map API can be implemented easily with the documentation provided by Google and Flutter. Google Map API is also known for its reliability as the location details are to be linked with the data in Firebase. Its security is remarkable with the use of firebase authorization so blood bank details cannot be simply changed.

Visual Paradigm Online

We will use this online drawing tool to draw the UML diagrams for this project. It is easy to use, user-friendly and free of charge.

5.3 System User Interface Design

5.3.1 Splash Activity (User)

Splash Screen

Figure 5-1 User Splash Screen

Splash Screen will show as users open the mobile application. Users will be redirected to Login Page if not authenticated and the main menu if authenticated.

5.3.2 Login, Registration, and Forgot Password Page (User)

Login Page	Registration Page	Forgot Password Page

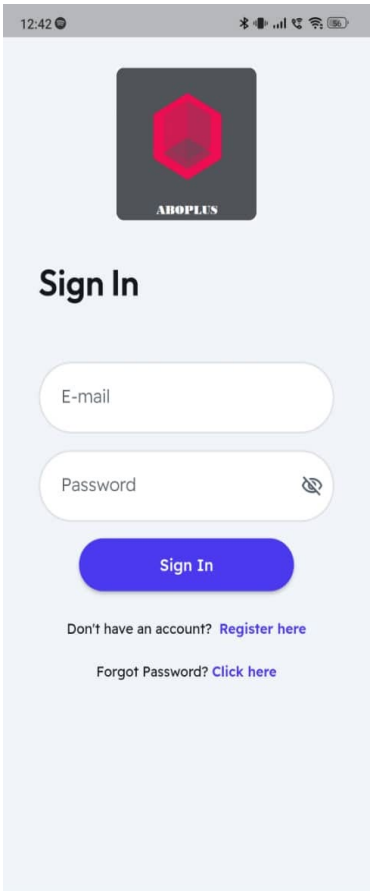
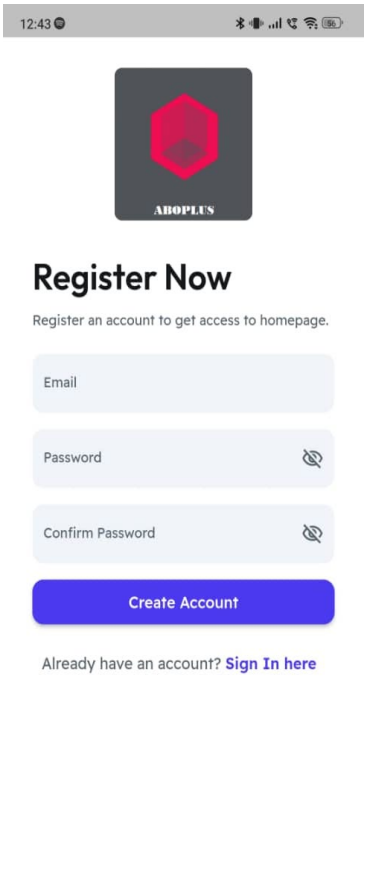
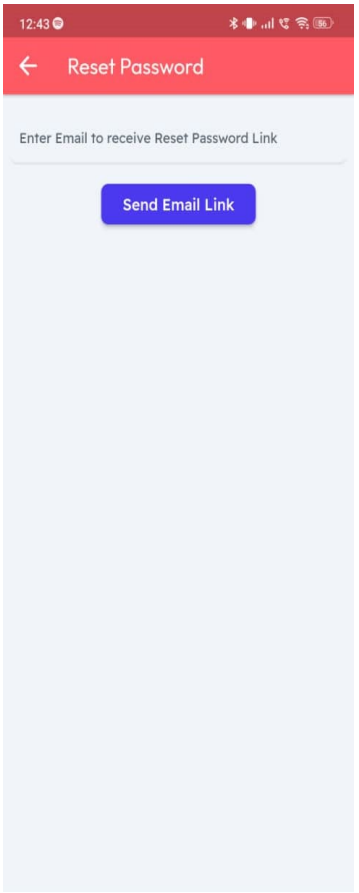

		

Figure 5-2 User Login Page	**Figure 5-3 User Registration Page**	**Figure 5-4 User Forgot Password Page**

5.3.3 Main Menu (User)

Main Menu	Drawers

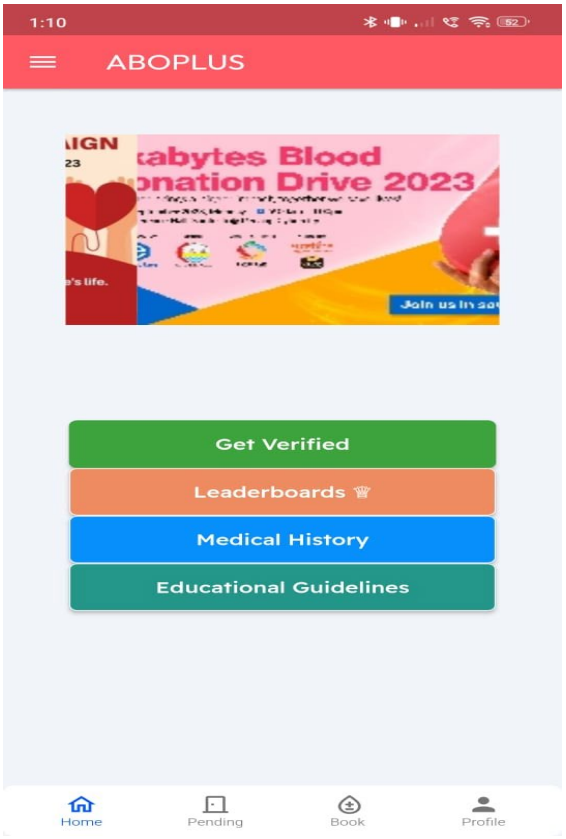
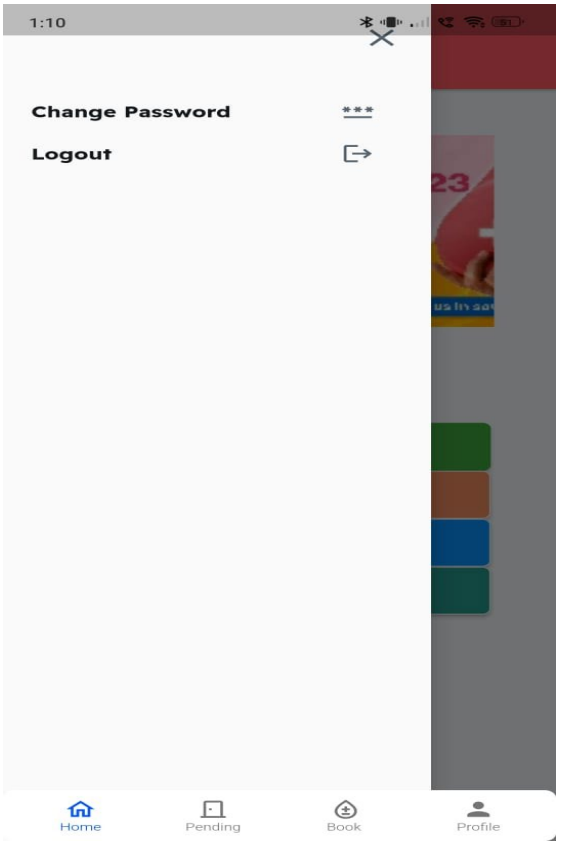

	

Figure 5-5 User Homepage	**Figure 5-6 User Drawer**

Highlights can be seen in the main menu. Get Verified button can be seen depending on the client applicant status. If client is new, “Get Verified” button is shown. Once user submits the form, “PENDING” will show, followed by “VERIFIED” if verified. Menu shows “Ineligible to Donate” if application form is rejected.

Pending	Verified	Rejected

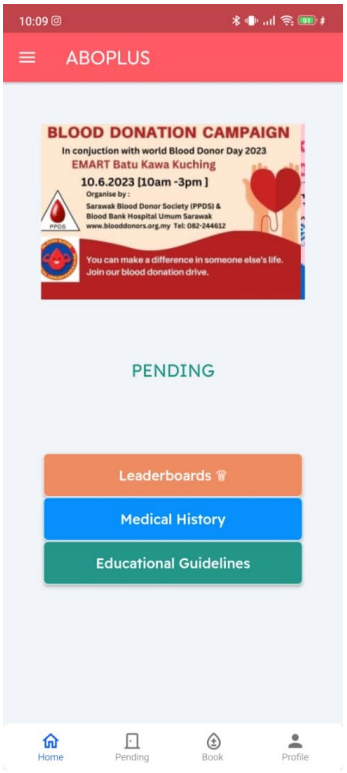
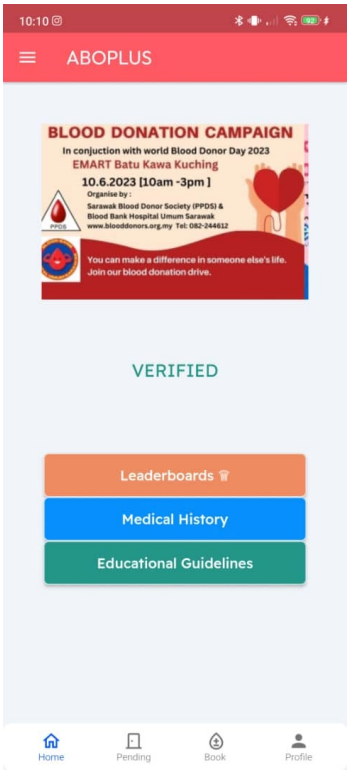
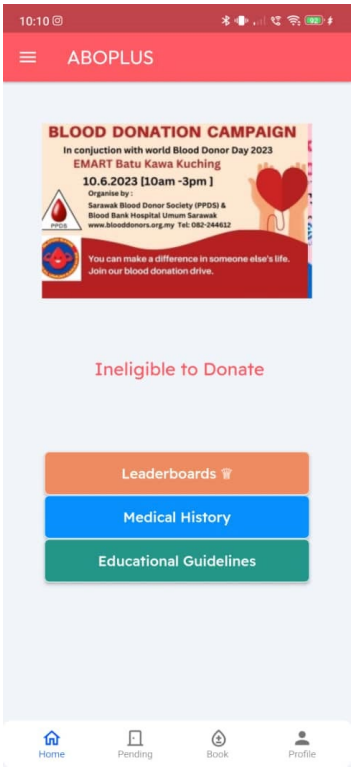

		

Figure 5-7 Pending	**Figure 5-8 Verified**	**Figure 5-9 Rejected**

5.3.4 Medical Verification Test (User)

Medical Verification Test

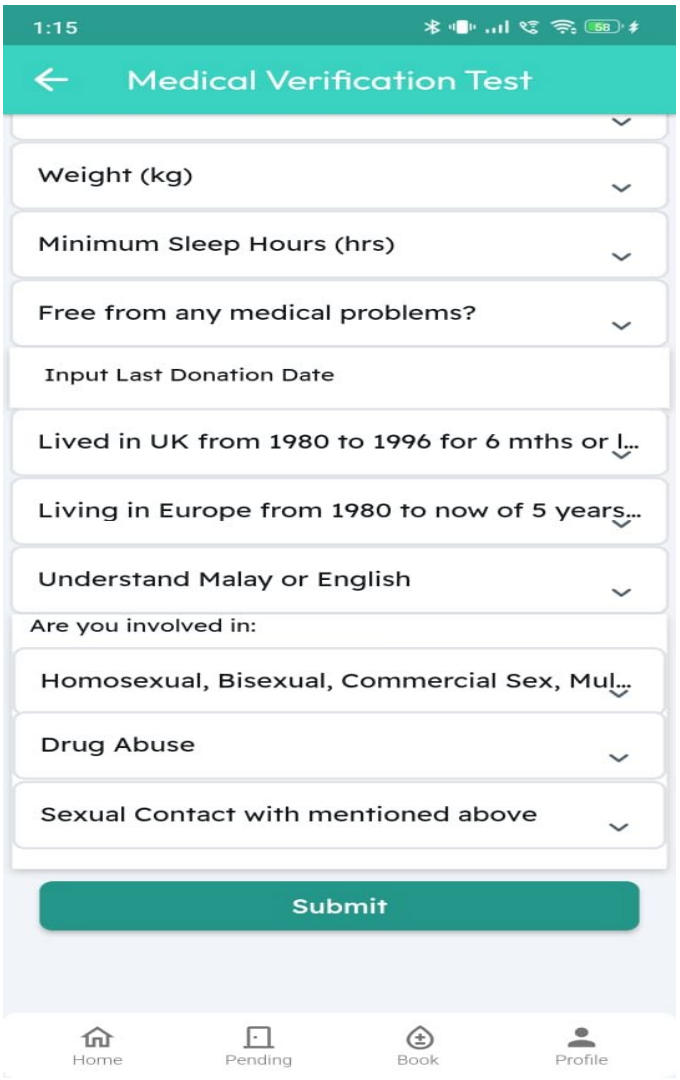


Figure 5-10 Verification Form

Validation will be performed on all fields. Program will check for all missing or invalid fields.

5.3.5 View Educational Guideline (User)

Educational Guideline

Figure 5-11 Education Guidelines

Users will see the same collection of posters uploaded by admin, with read only.

5.3.6 Profile Page (User)

Profile Page

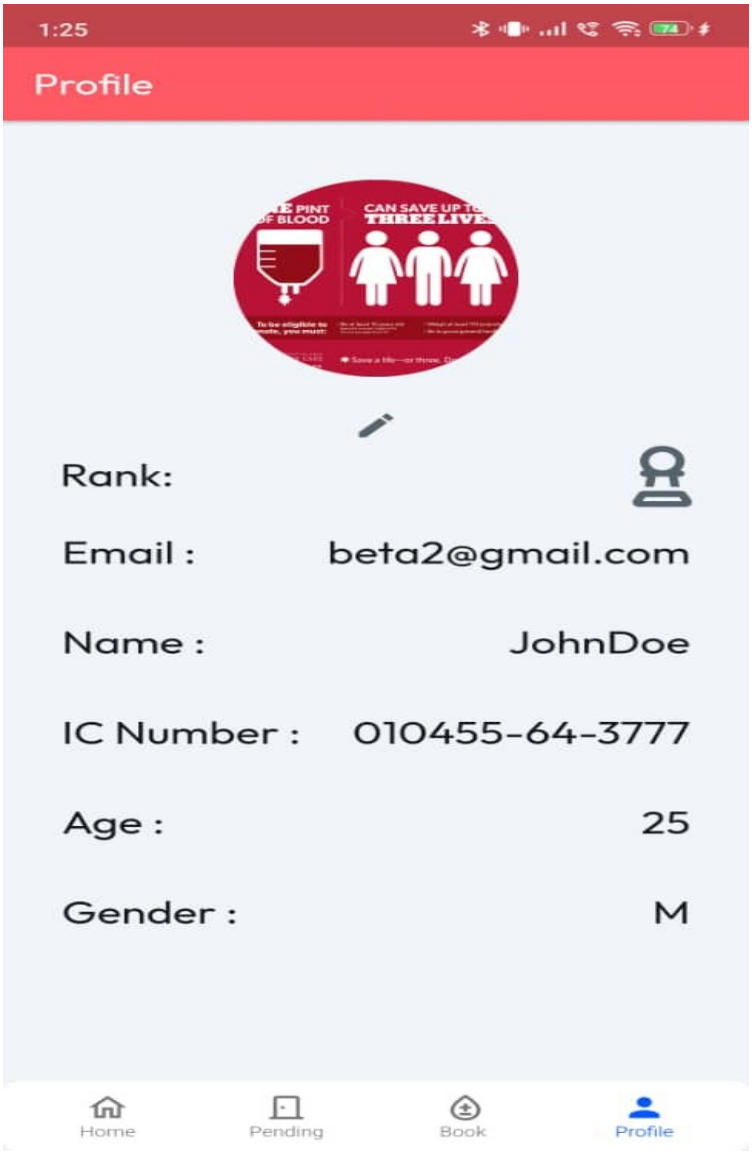


Figure 5-12 Profile Page

Users can upload profile picture with edit button.

5.3.7 Google Map API, Book Appointment (User)

Google Map API	Location Detail	Appointment Details

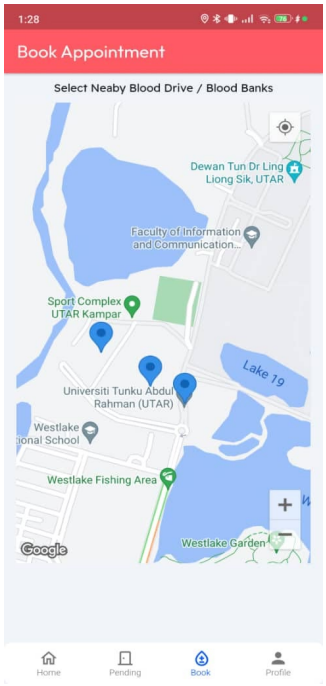
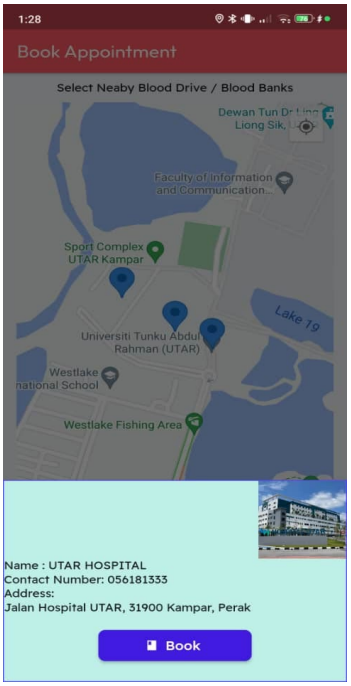
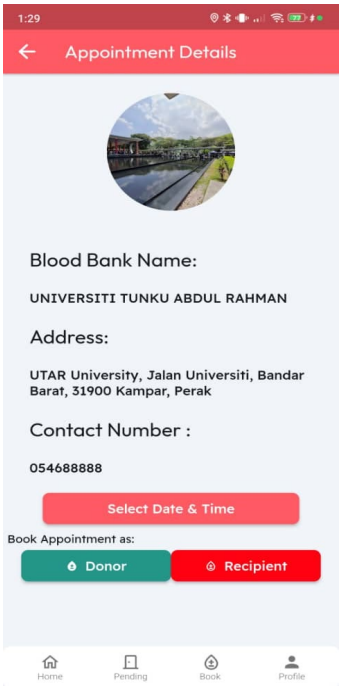

		

Figure 5-13 Google Map API	**Figure 5-14 Selected Location Detail**	**Figure 5-15 Booking Confirmation**

5.3.8 Pending Appointments (User)

Pending Appointment

Figure 5-16 Pending Appointments

Pending Appointments will be in blue. Confirmed appointments will be in Green. Cancelled or Rejected Appointments will be in Red.

5.3.9 Leaderboards (User)

Leaderboard

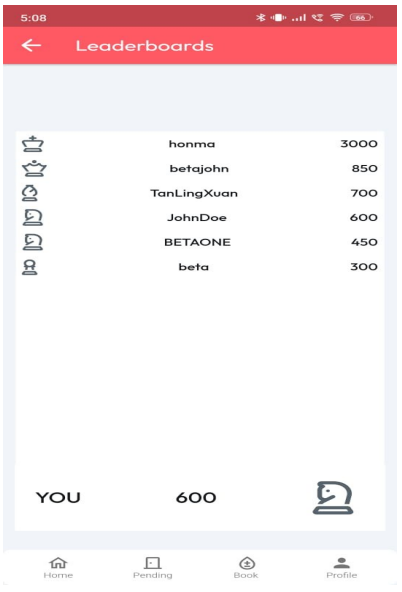


Figure 5-17 Leaderboards

Users begin with 300 points. Users will gain 100 points on each successful attendance of appointment made through ABOPLUS. 50 points if verification form is successfully verified. Top users with highest rank will be displayed in the list.

5.3.10 Medical History (User)

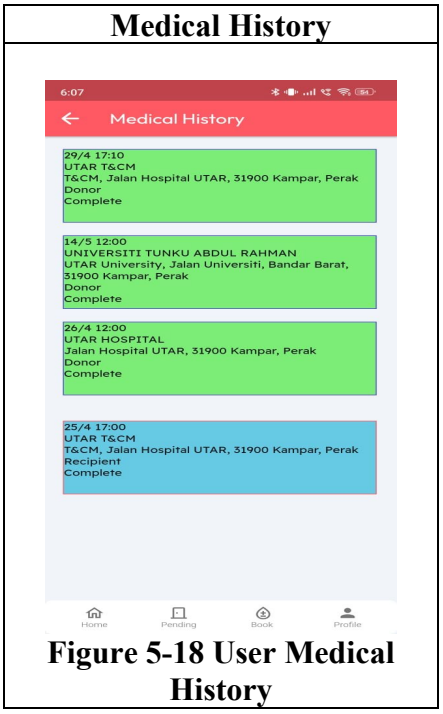


Figure 5-18 User Medical History

Only Attended Appointments are shown here. Card is green if attendee is a donor. Card is blue if attendee is a recipient.

5.3.11 Splash Activity (Admin)

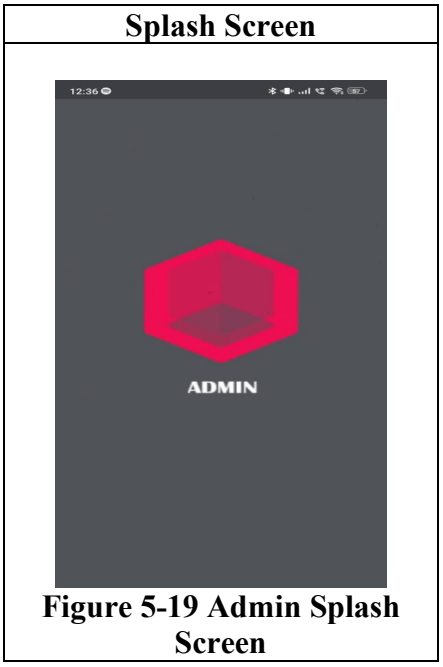


Figure 5-19 Admin Splash Screen

5.3.12 Login Page (Admin)

Login Page	Forgot Password

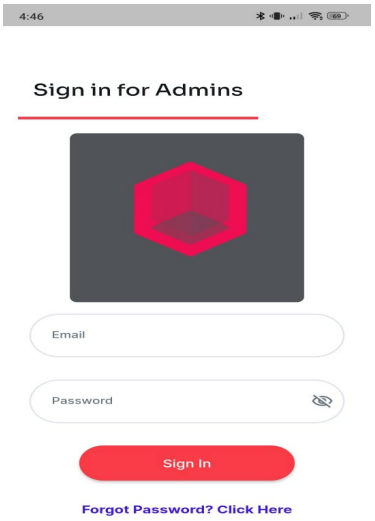
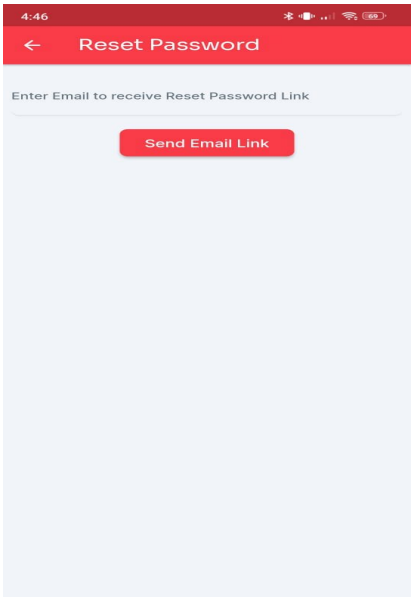

	

Figure 5-20 Admin Login Page	**Figure 5-21 Admin Forgot Password**

Admins are required to register with service provider (developer of this app) to create account for security measures. Potential admins are to provide location to be in charged with to create an account.

5.3.13 Main Menu (Admin)

Main Menu	Drawer

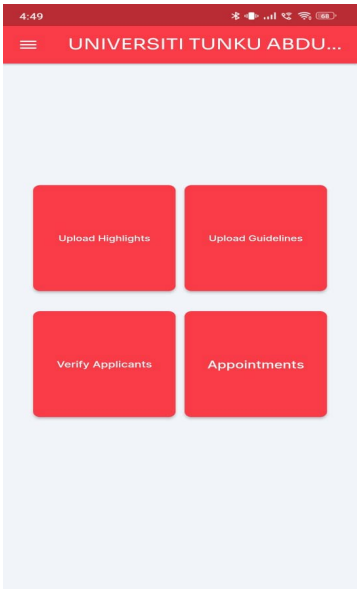
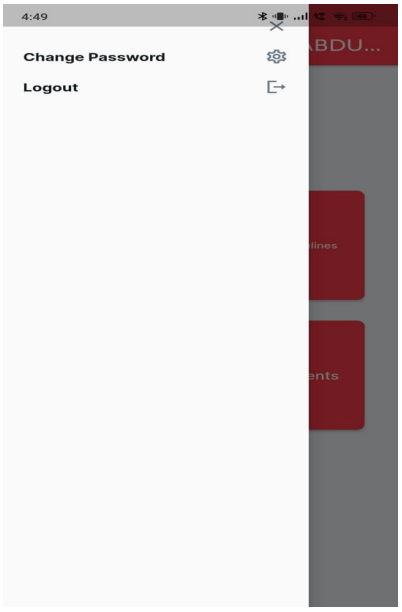

	

Figure 5-22 Admin Homepage	Figure 5-23 Admin Drawer

5.3.14 Verify Applicants (Admin)

Applicant List	Applicant Detail

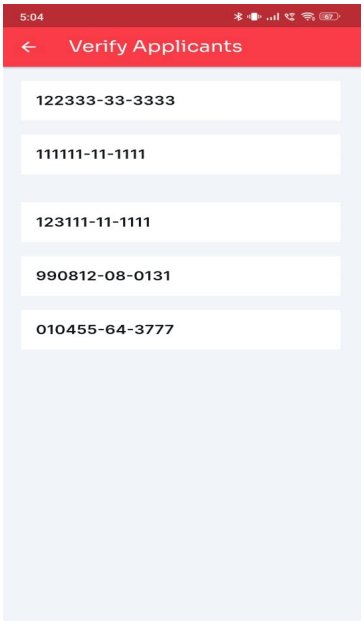
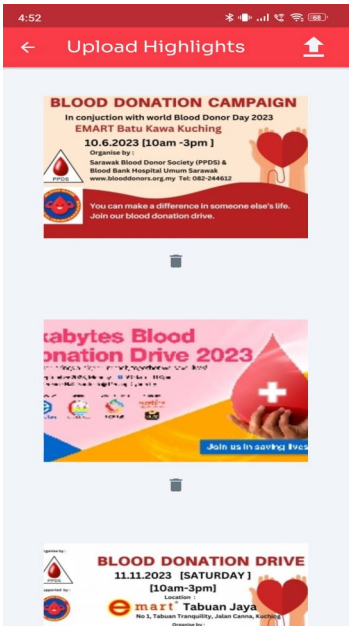



Figure 5-24 Applicant List	Figure 5-25 Applicant Detail

5.3.15 Upload Educational Guidelines & Highlights (Admin)

Upload Education Guideline	Upload Highlights
	
Figure 5-26 Upload Educational Guideline	**Figure 5-27 Upload Highlights**

5.3.16 Manage Appointments (Admin)

Appointment List	Appointment Details	Appt Detail (After)

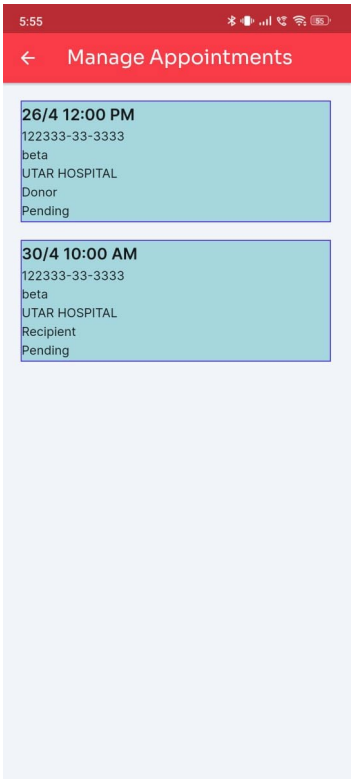
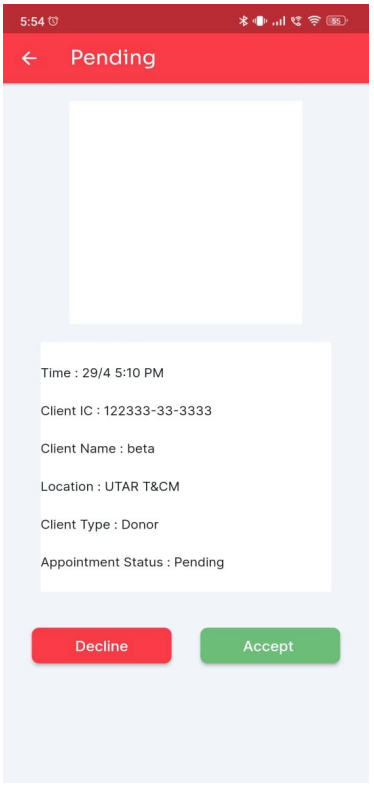
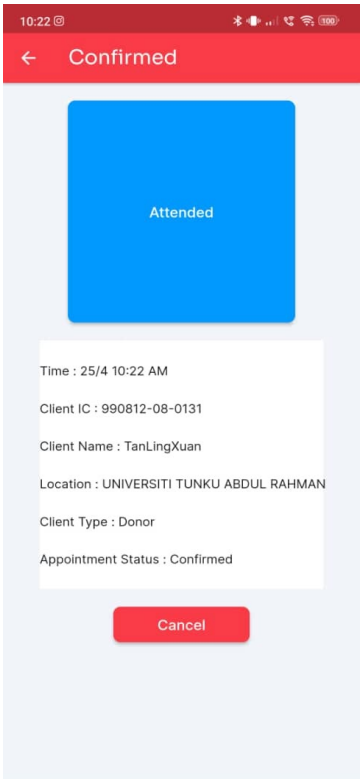

		

Figure 5-28 Manage Appointment	**Figure 5-29 Manage Appointment (Details)**	**Figure 5-30 Manage Appointment (After Confirmed)**

"Attended" button is generated after appointment is confirmed. Admin can cancel the confirmed appointment.

5.4 Implementation Issues and Challenges

Based on the project, several obstacles are met when developing this ambitious mobile application. Initially developed in Java using Android Studio, an overhaul decision is done to ensure the success in completing the project due to unsatisfactory design. However, it is a wise choice indeed as the project seems to be set up for success as of now. Adapting to another IDE and language is an accumulation of plenty of effort and time, as much as making full use of the time to gather resources way before the project

overhaul is developed.

Ultimately, the steep learning curve is inevitable as the development moves in the direction of several overhaul to meet project requirements. Setup and configuration needs be redone to provide suitable project environment. Furthermore, knowledge on developing appropriate database design, coding infrastructure, modules, functionalities, user interfaces are a necessity to uplift the project to success. All of this will cost time, effort, and energy, but in return a great success.

On the technical terms, debugging and testing of the code and modules will be one of the core challenges met throughout the development cycle. Even with the Agile methodology, many errors emerged are required to be debugged, which will be time consuming. Even then, system behaviors that are not met with testing requirements are required to be fixed. Hence, we can learn that a project single-handedly developed can be extremely exhaustive to a person.

Lastly, adapting to development time constraints pose a challenge as always. Hence, it is important to have excellent time management skills, as well as a well-developed timeline and schedule to follow.

5.5 Concluding Remark

To end this chapter, we must come to terms that system implementation is a crucial part of development. That is because this phase of development is responsible for turning project ideas into tangible and developed solutions. It simply is the most technical part of the project, and one must be well-prepared in terms of skillset and development tools to ensure a great outcome for the development. It is also important that the developed solutions meet all the project requirement and user needs. With the consistent, iterative, incremental way of development, it is safe to assume that the project requirements are well achieved.

CHAPTER 6: SYSTEM EVALUATION AND DISCUSSION

6.1 System Performance Definition

Based on the project, we will be developing a mobile application for enhanced blood bank accessibility purposes. This mobile application will triumph in terms of features compared to other mobile applications in this similar topic. Users are to expect a different experience, especially when how they interact with the application using the new product.

Target interactions as Users:

- Online Screening and Verification Test for eligibility for blood donation using mobile application.
- Strong user authentication for login and registration with implementation of user roles.
- Book appointments based on with different roles through nearby blood bank locations with Google Map API.
- Enhanced user accessibility with well implemented main menu, topped with interactive sidebar and navigation bar for accessibility.
- Enhance Learning experience of users with dynamic Educational Guideline content and real-time events based on Highlights uploaded.
- Leaderboards to provide incentives for users, also to encourage community to participate more in blood donation events.
- Manage Pending Appointments with seamless transition.

Target interactions as Admins:

- Upload new highlights and educational guidelines based on what the audience need to see.
- Verify pending applicants that are interested in accessing full feature of the mobile application.
- Manage Appointments, and mark attendance or cancel appointment sessions.

6.2 Project Challenges

Some of the common issues of installing Flutter SDK are met, such as system PATH incorrect binary directory issue which allows Flutter commands to run from any prompt window. Flutter Doctor commands are used to diagnose any problems that occur as Flutter SDK is installed. Based on Flutter Doctor outputs, several missing dependencies are required to be installed such as VS Code extensions and Android Studio. The installation process took a lot of time to complete, as there are many package missing or dependency issues.

An overhaul for this project reuses some of the old materials available from scraps. Login, Registration, Drawers, Database Systems took inspiration from the old project before the overhaul. Scrapping old material to move to the new IDE requires debugging to fix errors, followed by system behavior testing. In short, the translation of previous coding materials in Java to a new format to support Flutter and Dart requires patience to complete.

After the development is completed, maintenance will be a problem as Google Maps API key and Flutter Versions will not support the current version without long-term planning. Sustainability and Maintainability of the project in this scale will require more people to participate.

6.3 Use Case Testing

6.3.1 UC001 Login (User)

Use Case	Condition	Input	Expected Output	Actual Output	Result
Login (User)	Main Flow	Correct Email and Password	System authenticates user and redirects to main menu.	System authenticates user and redirects to main menu.	Pass
	Alternative Flow: Incorrect Email or Password	Incorrect Email and Password	Display Error Message.	Display Error Message.	Pass
	Alternative Flow: Forget Password	Enter email to receive mail to reset password	User receives mail to reset password.	User receives mail to reset password.	Pass

Table 6-1 UC001 Login (User)

6.3.2 UC002 Login (Admin)

Use Case	Condition	Input	Expected Output	Actual Output	Result
Login (Admin)	Main Flow	Correct Email and Password	System authenticates admin and redirects to main menu.	System authenticates admin and redirects to main menu.	Pass
	Alternative	Incorrect	Display	Display	Pass

	Flow: Incorrect Email or Password	Email and Password	Error Message.	Error Message.	
	Alternative Flow: Forget Password	Enter email to receive mail to reset password	Admin receives mail to reset password.	Admin receives mail to reset password.	Pass

Table 6-2 UC002 Login (Admin)

6.3.3 UC003 Register (User)

Use Case	Condition	Input	Expected Output	Actual Output	Result
Register (User)	Main Flow	Input Valid Non-Existing Email and Password	System registers new user and redirect to Login page	System registers new user and redirect to Login page	Pass
	Alternative Flow: Invalid Email or Password	Input already existing Email and Invalid Password	Display Error Message.	Display Error Message.	Pass

Table 6-3 UC003 Register (User)

6.3.4 UC004 Book Appointment (User)

Use Case	Condition	Input	Expected	Actual	Result

			Output	**Output**	
Book Appointment	Main Flow	Input Valid Non-Existing Email and Password	System registers new user and redirect to Login page	System registers new user and redirect to Login page	Pass
	Alternative Flow: Missing Appointment Date and Time	No selection of appointment date and time.	Display Error Message	Display Error Message	Pass

Table 6-4 UC004 Book Appointment (User)

6.3.5 UC005 Manage Appointment (Admin)

Use Case	**Condition**	**Input**	**Expected Output**	**Actual Output**	**Result**
Manage Appointment	Main Flow	Select Appointment and Confirm the appointment. Then, mark the attendance of appointment	System marks the attendance of the user.	System marks the attendance of the user.	Pass
	Alternative	Admin	System	System	Pass

	Flow: Appointment Declined	rejects the appointment	deletes appointment from admin-side. User appointment list updated.	deletes appointment from admin-side. User appointment list updated	
	Alternative Flow: Appointment Cancelled	Admin cancel the appointment after confirmation	System deletes appointment from admin-side. User appointment list updated	System deletes appointment from admin-side. User appointment list updated	Pass

Table 6-5 UC005 Manage Appointment (Admin)

6.3.6 UC006 View Leaderboard (User)

Use Case	Condition	Input	Expected Output	Actual Output	Result
Book Appointment	Main Flow	Select View Leaderboards in menu	Show top players with rank and points, as well as current user.	Show top players with rank and points, as well as current user.	Pass

Table 6-6 UC006 View Leaderboard (User)

6.3.7 UC007 Upload Educational Guidelines (Admin)

Use Case	Condition	Input	Expected Output	Actual Output	Result

Upload Educational Guidelines	Main Flow	Upload Image File	Uploaded image is now in database	Uploaded image is now in database	Pass
	Alternative Flow: Incorrect Upload File Format	Upload incorrect file format. ETC: webp	Display Error Message	Display Error Message	Pass
	Alternative Flow: Delete Images	Delete desired existing images from database	Image is removed from database	Image is removed from database	Pass

Table 6-7 UC007 Upload Educational Guidelines (Admin)

6.3.8 UC008 Upload Highlights (Admin)

Use Case	**Condition**	**Input**	**Expected Output**	**Actual Output**	**Result**
Upload Highlights	Main Flow	Upload Image File	Uploaded image is now in database	Uploaded image is now in database	Pass
	Alternative Flow: Incorrect Upload File Format	Upload incorrect file format. ETC: webp	Display Error Message	Display Error Message	Pass
	Alternative Flow: Delete	Delete desired	Image is removed	Image is removed	Pass

	Images	existing images from database	from database	from database	

Table 6-8 UC008 Upload Highlights (Admin)

6.3.9 UC009 View Educational Guidelines (User)

Use Case	Condition	Input	Expected Output	Actual Output	Result
View Educational Guidelines	Main Flow	Click on "View Educational Guidelines" in Main Menu	System show list of existing Educational Guidelines	System show list of existing Educational Guidelines	Pass
	Alternative Flow: Enlarge Poster	Click on existing images.	Image is enlarged	Image is enlarged	Pass

Table 6-9 UC009 View Educational Guidelines (User)

6.3.10 UC010 View Highlights (User)

Use Case	Condition	Input	Expected Output	Actual Output	Result
View Highlights	Main Flow	User logs in and redirects to menu	System shows list of existing Highlights	System shows list of existing Highlights	Pass
	Alternative Flow:	Click on existing	Image is enlarged	Image is enlarged	Pass

	Enlarge Poster	images.			

Table 6-10 UC010 View Highlights (User)

6.3.11 UC011 Medical Verification Test (User)

Use Case	Condition	Input	Expected Output	Actual Output	Result
Medical Verification Test	Main Flow	All fields filled correctly	User form is sent to Admin "Verify Applicant" List	User form is sent to Admin "Verify Applicant" List	Pass
	Alternative Flow: Incorrect data filled in form	Invalid Input in field on Submit	Display Error Message	Display Error Message	Pass
	Alternative Flow: Missing fields on Submission	Empty Fields on Submit	Display Error Message	Display Error Message	Pass

Table 6-11 UC011 Medical Verification Test (User)

6.3.12 UC012 Verify Applicants (Admin)

Use Case	Condition	Input	Expected Output	Actual Output	Result
Verify Applicants	Main Flow	All fields filled correctly	User form is sent to Admin "Verify Applicant" List	User form is sent to Admin "Verify Applicant" List	Pass
	Alternative Flow: Incorrect data filled in form	Invalid Input in field on Submit	Display Error Message	Display Error Message	Pass

Table 6-12 UC012 Verify Applicants (Admin)

6.3.13 UC013 View Pending Applicants (User)

Use Case	Condition	Input	Expected Output	Actual Output	Result
View Pending Applicants	Main Flow	User Books an Appointment, followed by pressing "Pending Appointment" in menu	User sees a list of appointments	User sees a list of appointments	Pass
	Alternative Flow: Admin cancels or	Appointment status is now cancelled or rejected	Appointment card is red and shows "Cancelled"	Appointment card is red and shows "Cancelled"	Pass

	rejects the appointment				
	Alternative Flow: Admin confirms the appointment	Appointment status is now confirmed	Appointment card is green and shows "Confirmed"	Appointment card is green and shows "Confirmed"	Pass
	Alternative Flow: Admin marks attendance of appointment	Appointment status is now complete	Appointment card is removed from the list	Appointment card is removed from the list	Pass
	Alternative Flow: Appointment is pending for admin	Appointment status is pending or untouched.	Appointment card is blue and shows "Pending"	Appointment card is blue and shows "Pending"	Pass

Table 6-13 UC013 View Pending Applicants (User)

6.3.14 UC014 View Medical History (User)

Use Case	Condition	Input	Expected Output	Actual Output	Result
View Medical History	Main Flow	User press "View Medical History" in Menu	Show "Completed" Appointments	Show "Completed" Appointments	Pass

Table 6-14 UC014 View Medical History (User)

6.3.15 UC015 View Profile (User)

Use Case	Condition	Input	Expected Output	Actual Output	Result
View Profile	Main Flow	User press "Profile"	System shows User Profile, Profile picture, rank, and data.	System shows User Profile, Profile picture, rank, and data.	Pass
	Alternative Flow: Upload Profile Picture	Upload image as profile picture	Profile picture of user is updated	Profile picture of user is updated	Pass
	Alternative Flow: Invalid Format for Profile Picture	Upload incorrect format of image as profile picture	Display Error Message	Display Error Message	Pass

Table 6-15 UC015 View Profile (User)

6.3.16 UC016 Logout

Use Case	Condition	Input	Expected Output	Actual Output	Result
Logout	Main Flow	User press	System logs	System logs	Pass

		"Logout" in Drawer	user out	user out	

Table 6-16 UC016 Logout

6.4 System Testing (Verification Plan)

6.4.1 Functional Testing

Module	Result
User Login	Pass
User Registration	Pass
Admin Login	Pass
User Menu	Pass
Admin Menu	Pass
User Medical Verification Test	Pass
Admin Verify Applicant	Pass
User View Educational Guidelines	Pass
Admin Upload Educational Guidelines	Pass
Admin Upload Highlights	Pass
User Profile	Pass
User Book Appointment	Pass
User Pending Appointment	Pass
User Leaderboards	Pass
User Medical History	Pass
Admin Manage Appointments	Pass

Table 6-17 Functional Testing

6.4.2 Non-Functional Requirements Testing

Feature	Result
Security	Pass
Performance	Pass
Usability	Pass
Operational	Pass

Table 6-18 Non-Functional Requirements Testing

6.5 Objective Evaluation

Project Objectives	Achievement
Streamlines the process for organizing and managing blood drives to maximize donor participation and donation efficiency, minimizing resource wastage through effective resource allocation and scheduling strategies.	Achieved
Implements technological solutions to enhance the **accuracy and reliability of the medical verification process** for blood donors, reducing delays and administrative burdens on healthcare professionals while ensuring compliance with regulatory standards.	Achieved
Enhance the user experience of scheduling blood donation appointments by implementing intuitive interfaces and seamless booking processes to increase donor convenience and accessibility.	Achieved
Utilize leaderboards as a motivational tool to incentivize blood donation participation, foster community engagement, and recognize donor contributions while safeguarding donor privacy and confidentiality.	Achieved

Table 6-19 Objective Evaluation

6.6 Concluding Remark

To conclude this chapter, unit testing plays a pivotal role in ensuring the developed project meets the project requirements entirely. To meet high quality is to also ensure that the system behavior is operating as desired. By consistently testing the individual modules in isolation, many clustering defects can be identified and fixed as early as possible in any time of the project lifecycle. With this approach, the usability, reliability, maintainability and sustainability is greatly enhanced, with effectively less bugs and defects in the system. This can greatly boost the confidence of the users using this mobile application as system behavior meets user expectations. However, we cannot claim that the final product is entirely bugs-free, as exhaustive testing is not possible at the moment.

CHAPTER 7: CONCLUSION AND RECOMMENDATION

7.1 Conclusion

In conclusion, the primary objective of this project is to develop a blood bank accessibility mobile application to solve the problems the existing blood bank mobile applications based on the study in literature reviews. Despite technological advancements, only individuals well-versed with technology can easily locate suitable donation drives or suitable blood banks, leaving those unfamiliar with technology at a disadvantage in connecting with donation communities. Therefore, the development of the blood bank mobile application marks a substantial advancement in utilizing technology to improve the efficiency, accessibility, and efficacy of blood donation processes. Also, it serves as a vital link between blood donors and recipients, this app facilitates life-saving transactions and encourages a culture of regular blood donation.

Additionally, the integration of strong security protocols, privacy settings, and user authentication builds trust, confidence and assurance among users and administration, protecting their confidential data and fostering a safe environment for donation procedures. Utilizing Google Firebase as the backend infrastructure not only bolsters reliability and scalability but also optimizes real-time data handling, guaranteeing smooth and continuous service provision.

As the market for blood bank accessibility app continues to grow and expand, it holds the promise of significantly influencing public health, ultimately saving lives and enhancing community well-being. It is crucial to persist in refining and broadening the app's functionalities, actively involving the user community for valuable feedback, and fostering collaborations with healthcare entities to fully extend its possible reach and efficacy.

This ultimately leads to the development of “ABOPLUS”, solving the problems of pre-existing blood bank mobile applications. Both donors and recipients have easy access to

the mobile application, using the core features with ease. Admins can also manage users and appointments easily with this system.

In a world where timely access to blood can mean the difference between life and death, this mobile application serves as a powerful testament to the transformative potential of technology in addressing vital healthcare needs. Its role in facilitating the seamless coordination of blood donations and requests emphasizes the significance of innovation in enhancing healthcare services. Ultimately, it reinforces our shared dedication to the welfare of society and underscores the immense impact technology can have in saving lives and improving public health outcomes.

7.2 Recommendation

Based on the current project achievements, there are several recommendations and future work that can be implemented to improve functionalities and user experience.

- Allow donors to **track health metrics** such as hemoglobin levels and blood pressure with the app. This is followed by personalized health insights and recommendations for donors to keep good health and sustain eligibility for blood donation.

- Allow blood bank administration to showcase **real-time updates on blood supply** for potential recipients.

- A **virtual online screening** can be performed by healthcare professionals which includes activities such as consultations to address donor concerns, as well as aid interested potential donors in specialized cases.

- **Social Media Sharing Integration** to utilize the leaderboards functionality which includes rankings and donor points. That is to incentivize donors to donate blood and to encourage the community through sharing achievements in social media

platforms to participate as well.

- **AI Blood Donation Tools** for blood bank administrators to predict blood supply needs based on their registered location. Additionally, AI can be utilized to predict seasonal trends for need of blood drives based on data from user history. This in return helps donation centers to predict demands and improve blood drive planning.

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APPENDICES

POSTER

Faculty of Information Communication and Technology

ABOPLUS: ENHANCING BLOOD BANK ACCESSIBILITY WITH MOBILE APPS

by Daniel Choong Wei Hern

Background

Blood donation relied on manual processes before technology, but advancements promise improved efficiency and accessibility. Blood shortages in less populated areas stem from a lack of regular donors and coordination, necessitating better connectivity and supply management. Recognizing and incentivizing donors while providing ongoing communication is crucial for sustaining blood donation. Also, the traditional medical verification process for blood donation is cumbersome, suggesting the need for electronic integration. Lack of education about blood donation's significance calls for a platform to provide educational materials and guidelines for public engagement.

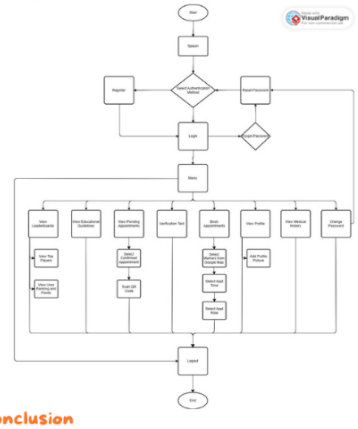
Objective

- Streamlines the process for organizing and managing blood drives .
- Enhance the accuracy and reliability of the medical verification process.
- Enhance User experience
- Utilize Leaderboards to motivate more users to participate in blood donation.

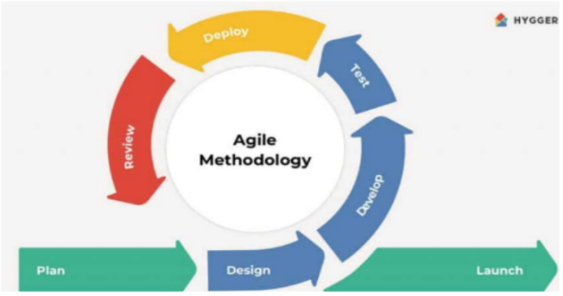
Contribution

- A blood bank accessibility mobile app can profoundly impact society by saving lives, improving healthcare infrastructure, and fostering community engagement.
- It facilitates timely access to critical resources by connecting donors with those in need, reducing mortality rates, and enhancing patient care.
- Streamlines the medical verification process contributing to a more sustainable healthcare system.
- Promote regular blood donation and spreading awareness, cultivating a sense of altruism and community involvement, ultimately making a meaningful contribution to public health.

System Flowchart



Methodology



Conclusion

The development of the "**ABOPLUS**" blood bank accessibility mobile application addresses existing issues with current blood bank apps by improving efficiency, accessibility, and security, thereby facilitating life-saving transactions and promoting a culture of regular blood donation. Through strong security protocols, user-friendly features, and continuous refinement based on user feedback, "**ABOPLUS**" embodies the transformative potential of technology in enhancing healthcare services and ultimately saving lives.

BLOOD DONATION CRITERIA

NATIONAL BLOOD CENTRE Kuala Lumpur	**QUALITY FORM**	Doc No	:PDN/RP/WI-01/G01E
		Version No.	:02
	CRITERIA TO DONATE BLOOD	Issue Date	: 17 April 2017
		Page	: Page 1 of 1

YOU ARE ELIGIBLE TO DONATE BLOOD IF:

1. You are in good health.
2. Eligible age to donate :
   a) Age between 18–65 years old (at least have donated blood once before with National Blood Centre).
   b) Age between 18- 60 years old (1st time blood donor).
   c) 17 years old (must obtain parent's/ guardians written consent).
3. Your weight is 45kg and above.
4. Minimum of 5 hours of sleep.
5. Free from any medical problem.
6. Taken light meal before donating blood.
7. Not involved in any of the following high risk behaviours:
   - Homosexual relationship.
   - Bisexual relationship.
   - Commercial sex relationship.
   - Multiple sexual partners.
   - Drug abuse (*Intravenous*).
   - Sexual contact with those mentioned above.
8. Interval of three months from your last donation.
9. Female ;not pregnant, not having menstruation, not breast feeding.

10. Do not donate blood if:
    - Lived in the United Kingdom (England, Northern, Ireland, Scotland, Wales, Isle of Man or the Channel Island or Republic Ireland from 1980 to 1996 for a period of **6 months** (accumulative) or longer.
    - You have been living in Europe from 1980 to the present for a period of 5 years (accumulative) or longer

11. You have to show one of the following **ORIGINAL** documents when register yourself to donate blood:

MALAYSIAN	FOREIGNER
MyKad/ Armforce Card/ Police Card	Must have lived in Malaysia not less 1 year
Driving license	Passport
Working pass with identity card number and photograph	Work permit with passport number and photograph
Student pass with IC number and photograph	Student pass with passport number and photograph
Blood donors book (**PDN 2**) only for repeat donors	-

12. The following documents will not be accepted when you register yourself to donate blood:

MALAYSIAN	FOREIGNER
Photocopy of Identity Card	Photocopy of Passport
-	PATI (Illegal Immigrants)
-	UNHCR

13. Must be able to understand Malay or English language.

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: T3Y3	**Study week no.: 1**
Student Name & ID: DANIEL CHOONG WEI HERN 1901259	
Supervisor: Dr. Ana Nabilah binti Sa'uadi	
Project Title: ABOPLUS: ENHANCING BLOOD BANK ACCESSIBILITY WITH MOBILE APPS	

1. WORK DONE

IDE and Plugins Setup

2. WORK TO BE DONE

Identifying FYP 1 issues, project planning and literature review.

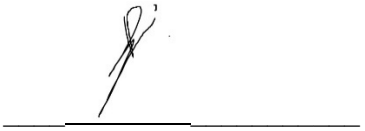
3. PROBLEMS ENCOUNTERED

None

4. SELF EVALUATION OF THE PROGRESS

Beginning of the project.

Supervisor's signature



Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: T3Y3	**Study week no.: 4**
Student Name & ID: DANIEL CHOONG WEI HERN 1901259	
Supervisor: Dr. Ana Nabilah binti Sa'uadi	
Project Title: ABOPLUS: ENHANCING BLOOD BANK ACCESSIBILITY WITH MOBILE APPS	

1. WORK DONE

Database Design, Literature Review, Login, Register, Main Menu functions

2. WORK TO BE DONE

System Version 1 Testing for Client & Admin App.

3. PROBLEMS ENCOUNTERED

Reusing code from FYP 1 mostly not working, need to translate code with useful functionality.
Firebase expired, need to create a new one.

4. SELF EVALUATION OF THE PROGRESS

Humble beginnings.

Supervisor's signature

Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: T3Y3	**Study week no.: 6**
Student Name & ID: DANIEL CHOONG WEI HERN 1901259	
Supervisor: Dr. Ana Nabilah binti Sa'uadi	
Project Title: ABOPLUS: ENHANCING BLOOD BANK ACCESSIBILITY WITH MOBILE APPS	

1. WORK DONE

Testing of System Version 1
Profile Page Interface for Client

2. WORK TO BE DONE

Complete development of Verification Test function on Client and Admin App

3. PROBLEMS ENCOUNTERED

System behavior not as expected, need to fix behavior of the form. Form validation not working at the moment.

4. SELF EVALUATION OF THE PROGRESS

Need more effort in this part.

Supervisor's signature

Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: T3Y3	**Study week no.: 8**
Student Name & ID: DANIEL CHOONG WEI HERN 1901259	
Supervisor: Dr. Ana Nabilah binti Sa'uadi	
Project Title: ABOPLUS: ENHANCING BLOOD BANK ACCESSIBILITY WITH MOBILE APPS	

1. WORK DONE

Verification test done on Client Side.
Verify Applicant Function on Admin Side almost complete.

2. WORK TO BE DONE

Test the Verification Functions on both sides.

3. PROBLEMS ENCOUNTERED

Need to rethink schedule and planning to adjust to time constraints.

4. SELF EVALUATION OF THE PROGRESS

Decent

Supervisor's signature

Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: T3Y3	**Study week no.: 10**
Student Name & ID: DANIEL CHOONG WEI HERN 1901259	
Supervisor: Dr. Ana Nabilah binti Sa'uadi	
Project Title: ABOPLUS: ENHANCING BLOOD BANK ACCESSIBILITY WITH MOBILE APPS	

1. WORK DONE

Completed Uploading functions for Admin.
Testing of System Version 2

2. WORK TO BE DONE

Appointment Function on Client and Admin App.
Debugging and behavior fixing with use case testing.

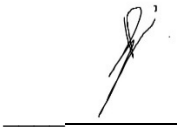
3. PROBLEMS ENCOUNTERED

Several parameters not passing properly, still learning how to handle data obtain from database for each page and module.

4. SELF EVALUATION OF THE PROGRESS

Working on it.

Supervisor's signature



Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: T3Y3	**Study week no.: 12**
Student Name & ID: DANIEL CHOONG WEI HERN 1901259	
Supervisor: Dr. Ana Nabilah binti Sa'uadi	
Project Title: ABOPLUS: ENHANCING BLOOD BANK ACCESSIBILITY WITH MOBILE APPS	

1. WORK DONE

Appointment function almost complete for client and admin side.

2. WORK TO BE DONE

Testing for completed modules and functionality.
Report Writing and Polishing.

3. PROBLEMS ENCOUNTERED

Unexpected system behavior, data pixel overload, data passing incorrectly.

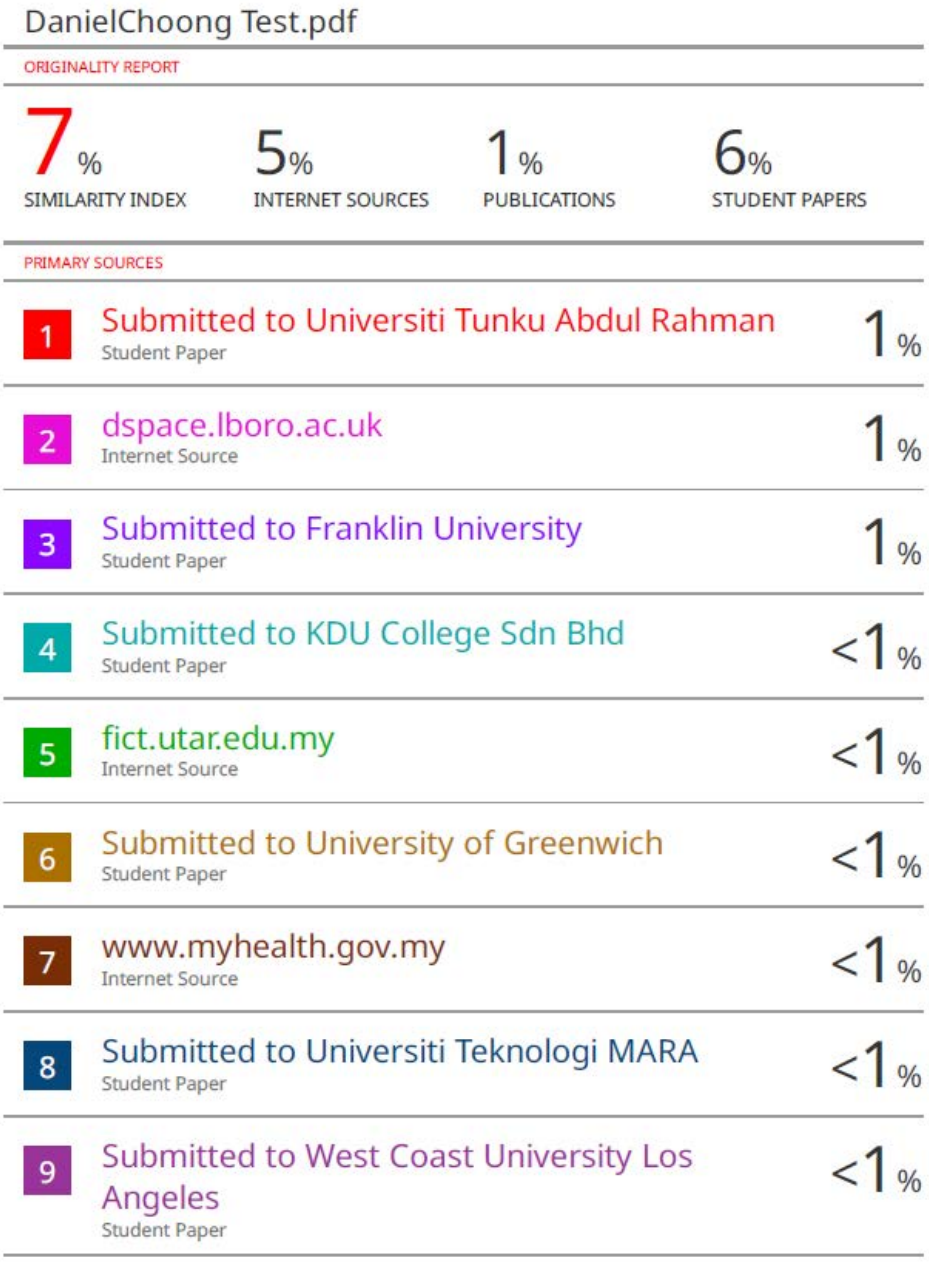
4. SELF EVALUATION OF THE PROGRESS

Crunch week to finish the project.

Supervisor's signature

Student's signature

PLAGIARISM CHECK RESULT



DanielChoong Test.pdf

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7%	5%	1%	6%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to Universiti Tunku Abdul Rahman Student Paper	1%
2	dspace.lboro.ac.uk Internet Source	1%
3	Submitted to Franklin University Student Paper	1%
4	Submitted to KDU College Sdn Bhd Student Paper	<1%
5	fict.utar.edu.my Internet Source	<1%
6	Submitted to University of Greenwich Student Paper	<1%
7	www.myhealth.gov.my Internet Source	<1%
8	Submitted to Universiti Teknologi MARA Student Paper	<1%
9	Submitted to West Coast University Los Angeles Student Paper	<1%

Universiti Tunku Abdul Rahman			
Form Title : Supervisor's Comments on Originality Report Generated by Turnitin for Submission of Final Year Project Report (for Undergraduate Programmes)			
Form Number: FM-IAD-005	Rev No.: 0	Effective Date: 01/10/2013	Page No.: 1of 1

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

Full Name(s) of Candidate(s)	Daniel Choong Wei Hern
ID Number(s)	19ACB01259
Programme / Course	Bachelor of Computer Science (Honours)
Title of Final Year Project	ABOPLUS: ENHANCING BLOOD BANK ACCESSIBILITY WITH MOBILE APPS

Similarity	**Supervisor's Comments (Compulsory if parameters of originality exceeds the limits approved by UTAR)**
Overall similarity index: 7 % **Similarity by source** Internet Sources: 5 % Publications: 1 % Student Papers: 6 %	
Number of individual sources listed of more than 3% similarity: None	

Parameters of originality required and limits approved by UTAR are as Follows:

(i) Overall similarity index is 20% and below, and

(ii) Matching of individual sources listed must be less than 3% each, and

(iii) Matching texts in continuous block must not exceed 8 words

Note: Parameters (i) – (ii) shall exclude quotes, bibliography and text matches which are less than 8 words.

Note Supervisor/Candidate(s) is/are required to provide softcopy of full set of the originality report to Faculty/Institute

Based on the above results, I hereby declare that I am satisfied with the originality of the Final Year Project Report submitted by my student(s) as named above.

Signature of Supervisor

Name: Ana Nabilah Binti Sa'uadi

Date: 26/04/2024

Signature of Co-Supervisor

Name: _____

Date: _____

UNIVERSITI TUNKU ABDUL RAHMAN

FACULTY OF INFORMATION & COMMUNICATION TECHNOLOGY (KAMPAR CAMPUS)

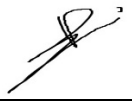
CHECKLIST FOR FYP2 THESIS SUBMISSION

Student Id	19ACB01259
Student Name	Daniel Choong Wei Hern
Supervisor Name	Dr. Ana Nabilah binti Sa'uadi

TICK (√)	DOCUMENT ITEMS Your report must include all the items below. Put a tick on the left column after you have checked your report with respect to the corresponding item.
√	Title Page
√	Signed Report Status Declaration Form
√	Signed FYP Thesis Submission Form
√	Signed form of the Declaration of Originality
√	Acknowledgement
√	Abstract
√	Table of Contents
√	List of Figures (if applicable)
√	List of Tables (if applicable)
	List of Symbols (if applicable)
	List of Abbreviations (if applicable)
√	Chapters / Content
√	Bibliography (or References)
√	All references in bibliography are cited in the thesis, especially in the chapter of literature review
√	Appendices (if applicable)
√	Weekly Log
√	Poster
√	Signed Turnitin Report (Plagiarism Check Result - Form Number: FM-IAD-005)
√	I agree 5 marks will be deducted due to incorrect format, declare wrongly the ticked of these items, and/or any dispute happening for these items in this report.

*Include this form (checklist) in the thesis (Bind together as the last page)

I, the author, have checked and confirmed all the items listed in the table are included in my report.



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