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Blood Donation Management Application on Android Platform

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Abstract: Mobile-Based Red Donor Application System is an application which would help blood bank department to manage the donation events occur smoothly. The retrieval of blood donors' records and blood stocks-related data are easier through this application. This application allows user and the hospital staff to register all the donors, manage blood collection details and blood type issued details. This android project provides the easiest and fastest way to search for blood donors' details via their identification number. The adaptation of mobile-based technology, which are Android Studio, Firebase database and Java language is implemented during the system construction. The application is also designed to support the government hospital to meet the demand of blood by collecting the information about the possible volunteer donors and keep their records safely. The application is expected to assist hospital staffs involved during blood donation events by easily manage donors' data.

Keywords: Blood Donors, Blood Donation, Android

1. Introduction

Globally, blood is recognized as the most precious element that sustains life. It saves numerous lives across the world in a variety of conditions. The project "Red Donor Management App" is a mobile-based application developed for the android devices in which the blood donors' details are stored in the database. The project contains a database, which is the hospital website and is accessible only by the manager of blood bank of the hospital. The mobile application is developed in android and it is designed for staffs who involved in blood bank department of the hospital.

The prevalent functionality of the application is to manage blood donors' details who are voluntarily attend to donate blood. It replaces the manual process with a mobile user interface with a guard safety of the data taken. The retrieval of blood donors' records and blood stocks-related data are easier through this application. Using the application, user or staff of the hospital will register all the donors, manage blood collection details and blood type issued details.

This android project provides the easiest and fastest way to search for blood donors' details via their identification number. Users can easily find the details of the donation through their mobiles. The

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information about donors can be found in an easy and simple way which does not take any time or effort. Whereas the administrator of the Red Donor application will be able to administer information on blood donor's name, address, and other such personal information along with their details of blood group and other significant information. The administrator will store the specific information and the details of donor will be stored in the donor's profile.

2. Literature Review

In developing the Blood Donor Application, literature survey has been done in order to ensure that the system developed reflects both the advantage and disadvantage. There are several researches that has been done regarding application about blood donation to ensure that the development of the project runs smoothly by reviewing the advantages and disadvantages of other systems. Identified disadvantages in the other systems can be used as a guide in order to be avoided by the Blood Donor Application. The advantages of these systems also provide guidance to improve the quality of the application. In addition, a literature survey also gives knowledge about the various types of facilities that can be added and provided in this application. Furthermore, there is a way to obtain an idea to introduce new elements which makes Blood Donor Application different and much more interesting than the existing application. Table 1 shows the comparison of the advantages and disadvantages found in the existing application.

Table 1: Comparison of the advantages and disadvantages of the existing system

Features	Blood Donor Mobile Application	Life Donor Application	NZ Blood Donor Application
User	Individual, Admin	Individual	Individual, Admin
Language	English	English	English
User Interface	Arranged in regular form, very systematic and flexible	Less usage of graphics components and simple user interface	Attractive interface, colourful and well organised
Login and Register	Yes (Using email id and password)	Yes (Using email id and password)	Yes (Using email id and password)
Database	Yes	Yes	Yes
Feedbacks	No	No	Yes
Statistics	No	No	Yes
Location	No	No	Yes
User Support System (Administrator)	Yes	Yes	Yes

2.1 Blood Donation

Over a million blood units are collected from donors every year; nevertheless, many more millions still need to be collected to meet the global demand and ensure sufficient and timely provision of blood [1]. This shows that blood donation is a highly relevant issue worldwide that calls for the government commitment to it as well as research in this field. Blood donation is one of the noblest donations someone can ever make in his life.

2.2 Blood Donor

Blood donation plays an important role in maintaining the mental and physical health. According to a report by the Mental Health Foundation, helping donate blood to others can reduce stress, improve our emotional well-being, help get rid of negative feelings and benefit our physical health [2]. What encourages an individual to donate blood? Answers to this question make it possible for blood collection

agencies to determine which individuals are likely to be new donors and enable to make predictions of prospective donors. The factors that influence an individual's decision to give blood is a collection of an individual's specific observable characteristics such as socio-demographic factors and unobservable characteristics such as the degree of altruism.

2.3 Blood Types

Blood groups were discovered at the beginning of the twentieth century when Landsteiner noticed that plasma from some agglutinated the red cells from others [3]. Human blood groups are unique surface membrane structures of red blood cells, characterized by inherited polymorphisms. More than 300 red cell antigens have been identified and further categorized into 30 major discrete systems. Their distribution varies in different communities and ethnic groups. Blood groups are determined by the genes that inherit from parents. A blood type (also known as blood group) is a classification of blood which is based on the presence and absence of antibodies and inherited antigenic substances on the surface of red blood cells. There are four main blood groups defined by the ABO system, such as A, B, AB and O.

2.4 Android Application

Android software development is the process by which new applications are created for devices running the Android operating system. The Android operating system was developed by Google. It is based on the Linux kernel user interface. The operating system is designed for smartphones and tablet computers and allows users to engage with it through a touchscreen interface. Software development for mobile devices poses new challenges due to the unique features of this activity. The need to cope with various platforms, standards, protocols and network technologies, limited device capacity ─although its constant evolution─, and market time demands are but a few of the issues faced. For this reason, software development for mobile devices is considerably different from traditional development [4]. Features of android is open source and freely available to manufacture for customization, there are no fixed hardware or software configuration. However, Android support itself by the features such as storage, connectivity, media support, multi-tasking, multi-touch, flash support and web browser [5].

3. Methodology

Methodology refers to the whole process of the development of the system where the systematic, theoretical analysis of the methods is applied to a field of study. It comprises the theoretical analysis of the body of methods and principles associated with a branch of knowledge. Typically, it encompasses concepts such as paradigm, theoretical model, phases and quantitative or qualitative techniques [6]. The development Red Donor Application System is by using the Software Development Object Orientation methodology approach or better known as Object-Oriented System Development (OOSD) methodology which has three main phase such as analysis, design and implementation.

3.1 Object Oriented Analysis

Identifying classes and relationships and defining system requirements in developing this application that should be carried out in the analysis phase. Studies need to be carried out in detail before the system is developed so that there is no error during or later in the development of the system. Studies on software, application management systems, data management information will be done in this phase. Information on system constraints and requirements is also identified. To meet this need, observation techniques and questionnaires have been implemented. Observation techniques and questionnaires have been employed. Observations are made on the most needed and rare types of blood types. Meanwhile, collection of blood types information was done by meeting the higher board of Hospital Sultanah Nora Ismail Batu Pahat. Reviews of books, journals, magazines and reports are also made in the primary stage. As a result of the study, several key points have been identified such as problem background, system objectives, scope of action and potential application users. In addition, a

Gantt chart is also used to plan the system development process for activities in each phase of the Software Development Object Orientation (OOSD) methodology.

The planning phase is the first phase in the process of system development initiated by the proposed project. Next, get the organization in accordance with the project title. Then, the process of collecting information through observation, reference and research through the internet. The planning phase is conducted to identify the issues involved with the project. The planning phase has started by several surveys that has been done about blood donation, blood types and android application. Research has been done in government hospital in Batu Pahat.

3.2 Object Oriented Design

The design model and the architecture design of the system is developed in this phase. Unified Modelling Language (UML) is used to design the application system by a use case diagram, class sequence diagram and activity diagram.

This phase is carried out to enable the development process for a system to run according to the specifications. These components are closely linked to each other to ensure that the system developed meets the needs and requirements of the user. In fact, to ensure that the system works properly according to the specifications set. While, design is a set of processes or models to produce a desired program. In the development of a system, design plays an important role and determines how the system should be developed. For the development of this system, the design process will determine the interface of the system to be built according to the identified needs.

3.2.1 Use Case Diagram

The use case diagram is the basic diagram used in the development of the Red Donor Application System. There are two actors in the use case diagram that are administrators (hospital administrators) and users (hospital staffs). There are ten use cases consisting of admin logins, view user details, blood donation details, user registration, create new event, user login, profile view and update, create new blood donor, questionnaire submit, health check report submit and blood donation update. Each use case diagram is a key component of this system. In this system, administrators of the system control, access and update the information of blood donations and user to manage the donor's details during blood donation time. Figure 1 shows the use case diagram of the Red Donor Application System.

3.2.2 Sequence Diagram

Sequence diagrams help to identify a set of cooperative objects involved in the use case scenario. These sequence diagrams are used to illustrate the interactions involved between the actors and the order or arrangement of each event, such as how messages are sent and received between multiple objects. These sequence diagrams are used to illustrate the interactions involved between the actors and the order or arrangement of each event that occurs within each module developed. The sequence diagram can be referred to in Appendix A1 until Appendix A8.

3.2.3 Class Diagram

Class diagrams are the classes that exist in the application of a system and the relationships between each of the other classes involved. Class diagrams also provide graphical notation for each of the entities' modelling and relationship classes by describing the objects that are present. The class diagram refer to appendix B.

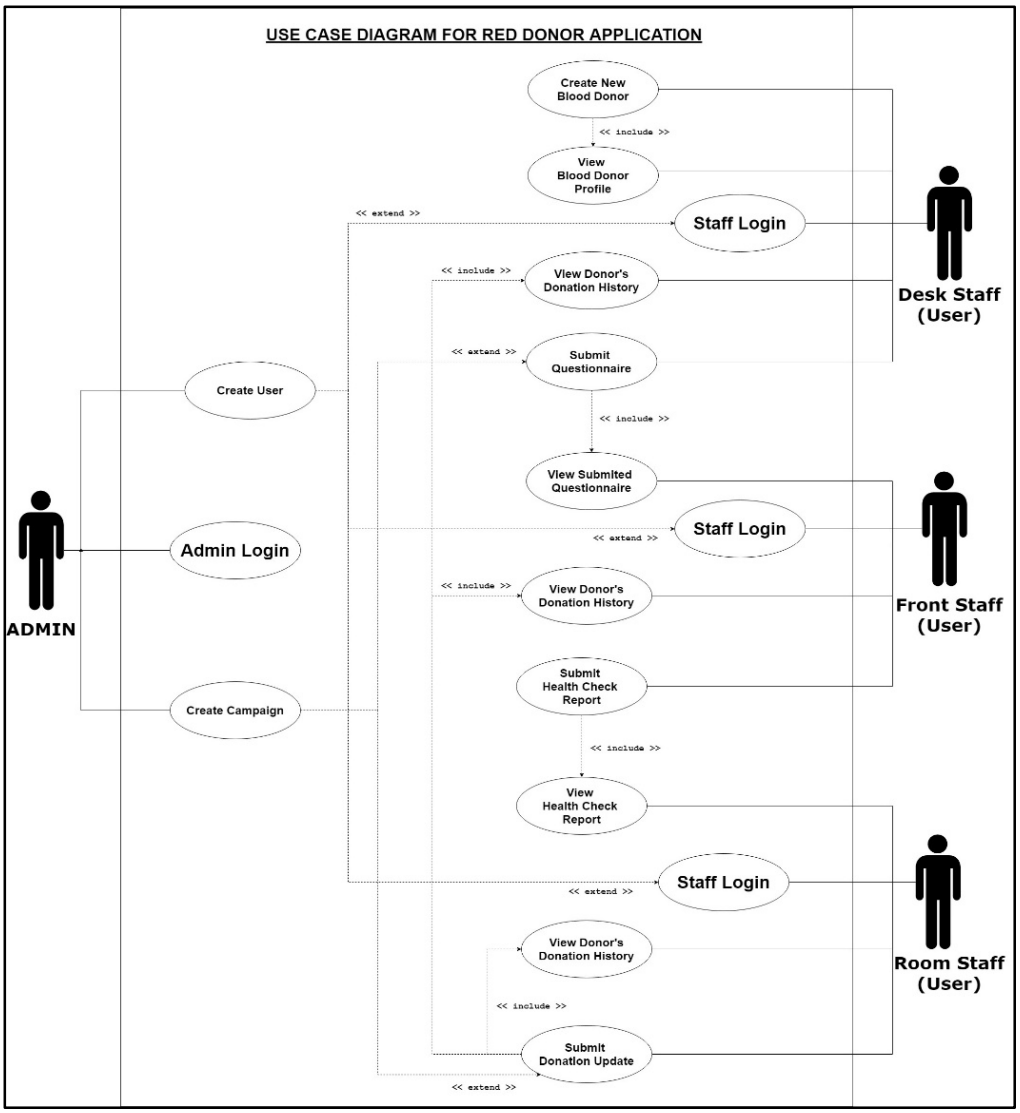


Figure 1: Use Case Diagram

3.3 Object Oriented Implementation

Through this phase, interfaces and modules will be transformed into programs and linked together in a database to fulfil all the functionality set. The interface design to be developed is based on the system interface sketch performed in the previous phase. In addition, prototype building based on each module built to determine whether the system meets the user requirements. Refer to appendix C 1 until appendix 16 for interface design.

This section focuses on the description of the implementation of the developed system. In order to implement the interface and database design previously built, the software that needs to be installed is firebase console and Android Studio 1.4. The main activity in this phase is programming. Writing code programs is important because it is part of the activity that will be realized and executing all the plans and designs that have been made before. The objective of the implementation phase is to ensure that the system is developed in accordance with the project planning guidelines in the Object Orientation Requirements and Design Object Orientation phase.

3.3.1 Connection to the Database

Android Studio is used as a programming development tool for connecting Firebase databases and it as its own assistant which easier to connect into the database as shown in Figure. 2. Firebase database have all of features that already set on the android platform. Such as, Cloud messaging, authentication, real-time database, storage and so on.

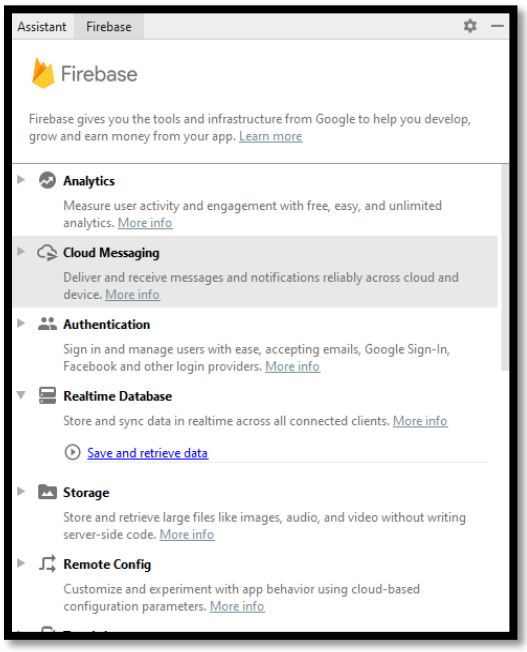


Figure 2: Assistant for Firebase Connection

4. Results and Discussion

Once the application system has been developed, the system needs to go through the testing process to determine the system built to work successfully as to achieve the objective of the project. Testing is the process of ensuring that the system being developed meets the needs of the system's users. In addition, this testing process can detect any problems encountered during the system's development. Tables 1 until Table 9, presents results of testing performed on the system's functionalities.

Table 1: Testing for Registered User Login

Num.	Type of Testing	Expected Results	Actual Results
1	User entered Username and Password: Correct	Login is successful and a message box with the message "Successful Login" will be displayed.	Login is successful and a message box with the message "Successful Login" is displayed
2	User entered Username and Password: Incorrect	If login is unsuccessful, a message box with the message "Login failed" will appear.	Login failed and a message box with "Login failed" message appears.

Table 2: Testing for Edit and Update Staff Profile

Num.	Type of Testing	Expected Results	Actual Results
1	Staff profile edit and update function: Select	When edit the selected data must be updated and pop up "Updated" message.	It was function well when user edit data and pop up "Updated" message.

Table 2: (cont.)

Num.	Type of Testing	Expected Results	Actual Results
2	Staff profile edit and update function: Unselect	When edit the selected data must be updated and pop-up message "Updated".	Failed when no data selected to update.

Table 3: Testing for Create New Blood Donor

Num.	Type of Testing	Expected Results	Actual Results
1	All the required field must insert data.	If there is empty in any of the required field, "field is empty" message should pop up.	A pop a message was appear "field is empty" when a data not inserted.
2	Check the entered "IC number" and data exist or not.	When the user inserted data is already registered, a pop message show "donor already exist".	A pop message was appear "donor already exist", the data already in records.
3	Create new blood donor: Correct	After all data entered and click create button, the data should record to the database and appear "Donor Successfully Created" message.	A message "Donor Created Successfully" was appear once the donor data registered and data was record on the database.

Table 4: Testing for the Submission Questionnaire E-Form

Num.	Type of Testing	Expected Results	Actual Results
1	Questionnaire E-form: Radio Button field must tick or selected	If there is empty in any of the radio button field required, "field is empty" message should pop up.	A pop a message was appear "field is empty" when some survey question's radio button not selected.
2	Submit the Questionnaire E-form: Correct	After all tick on radio button of the question required and click "submit" button, the data should record to the database and appear "Questionnaire Created" message.	A message "Questionnaire Created" was appear once the donor's questionnaire data submitted and data was recorded on the database.

Table 5: Testing for Submission Health Check Data

Num.	Type of Testing	Expected Results	Actual Results
1	Heath Check Form: All the required field must insert data.	If there is empty in any of the required field, "field is empty" message should pop up.	A pop a message was appear "field is empty" when a data not inserted.
2	Submit Health Check Data: Correct	After all data entered and click "submit" button, the data should record to the database and appear "Data Sent" message.	A message "Data Sent" was appear once the donor's health data submitted and data was recorded on the database.

Table 6: Testing for Submission Donation Update

Num.	Type of Testing	Expected Results	Actual Results
1	Donation Update Form: All the required field must insert data.	If there is empty in any of the required field, “field is empty” message should pop up.	A pop a message was appear “field is empty” when a data not inserted.
2	Submit Donation Update Data: Correct	After all data entered and click “submit” button, the data should record to the database and appear “Data Sent” message.	A message “Data Sent” was appear once the donation data was submitted and data was recorded on the database.

Table 7: Testing for Administrator Login

Num.	Type of Testing	Expected Results	Actual Results
1	Admin entered Username and Password: Correct	Login is successful and a message box with the message "Successful Login" will be displayed.	Login is successful and a message box with the message "Successful Login" is displayed
2	Admin entered Username and Password: Incorrect	Login is successful and a message box with the message "Successful Login" will be displayed.	Login failed and a message box with “Login failed” message appears.

Table 8: Testing for Register New User (Staff)

Num.	Type of Testing	Expected Results	Actual Results
1	The required field must insert data.	When the required field is empty a message appear “Field is Empty”.	A pop a message was appear “field is empty” when a data not inserted.
2	Check the inserted data already exist or not.	If the data entered is already exist, should appear a message “User Already Exist”.	A pop message was appear “donor already exist”, the data already in records.
3	Register New Staff: Correct	After the data entered and click “register” button, the data should record to the database and appear “Donor Successfully Created” message.	A message “User Registered” was appear once new user registered and the data was record on the database.

Table 9: Testing for Create New Blood Donation Event

Num.	Type of Testing	Expected Results	Actual Results
1	The required field must insert data.	When the required field is empty a message appear “Field is Empty”	A pop a message was appear “field is empty” when a data not inserted.
2	Staff profile edit and update function: Incorrect	If the data entered is already exist, should appear a message “User Already Exist”.	A pop message was appear “donor already exist”, the data already in records.
3	Create New Event: Correct	After the data entered and click “Create” button, the data should record to the database and appear “Donor Successfully Created” message.	A message “Event Created Successfully” was appear once the event data created and the data was record on the database.

5. Conclusion

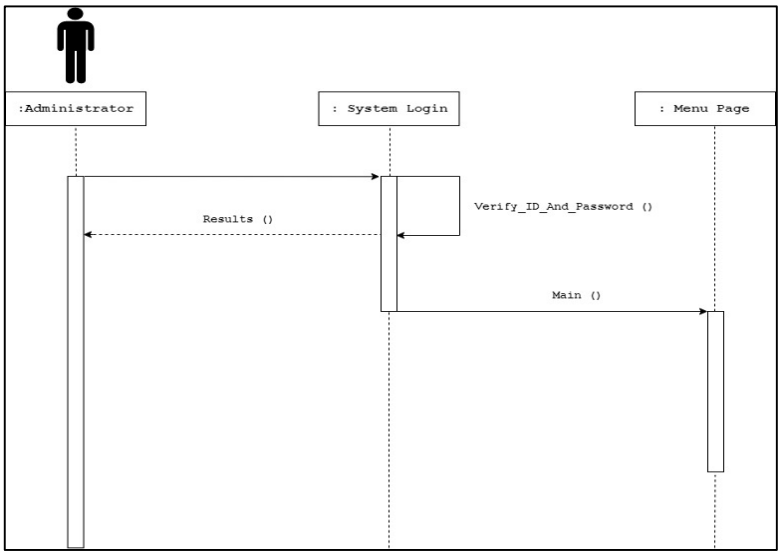
In conclusion, the Blood Donation Management Application has achieved all the objectives to perform as one of the tools to support hospitals' blood bank by collecting information of the blood donators and the donation of blood by the blood types. This system can be easily used by the staffs to manage the blood donation events by records the blood donor's details. Moreover, the application system developed is also expected to be further improvements. In the future, QR codes can be implemented so that the user can access into the application just by scanning the code and have it available on iOS platform.

Acknowledgement

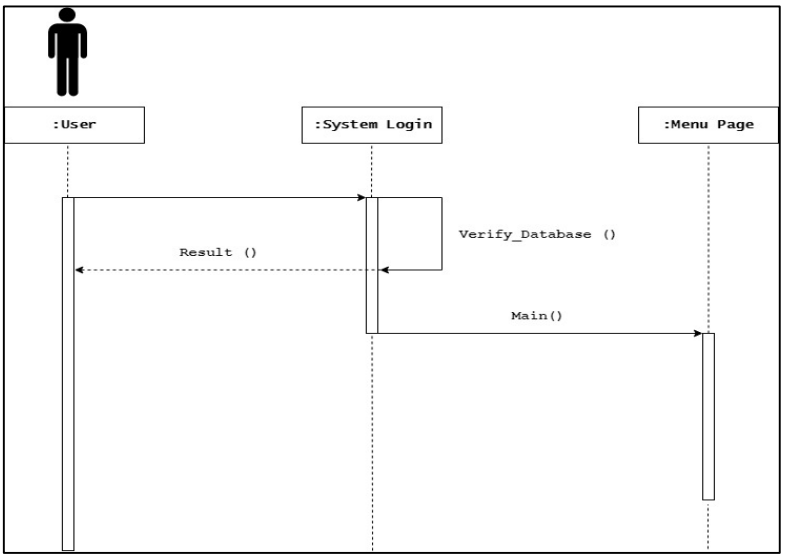
The authors would like to thank the Faculty of Computer Science and Information Technology, Universiti Tun Hussein Onn Malaysia for its support and encouragement throughout the process of conducting this study.

Appendix A

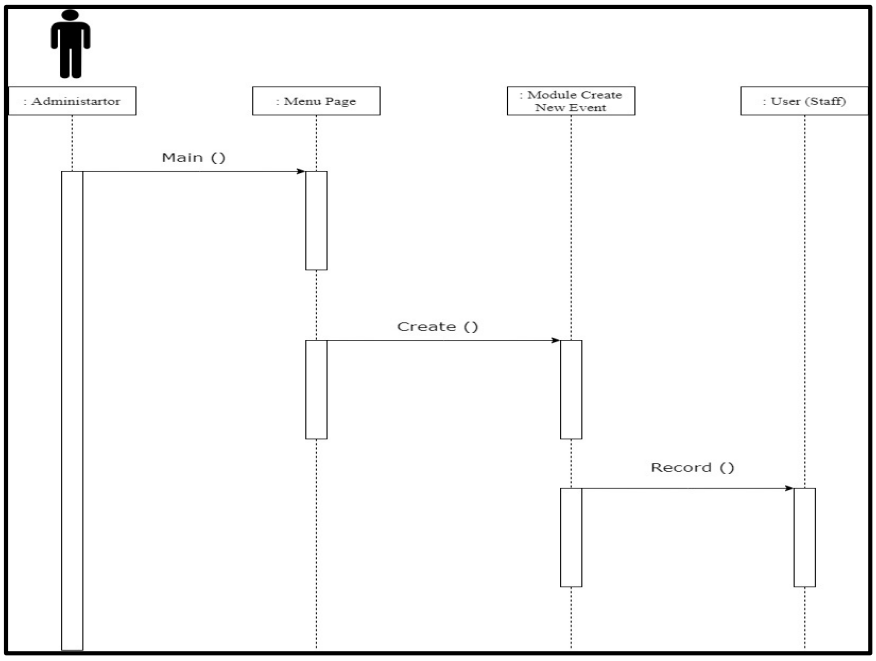
Appendix A1: Sequence Diagram for Administrator Login



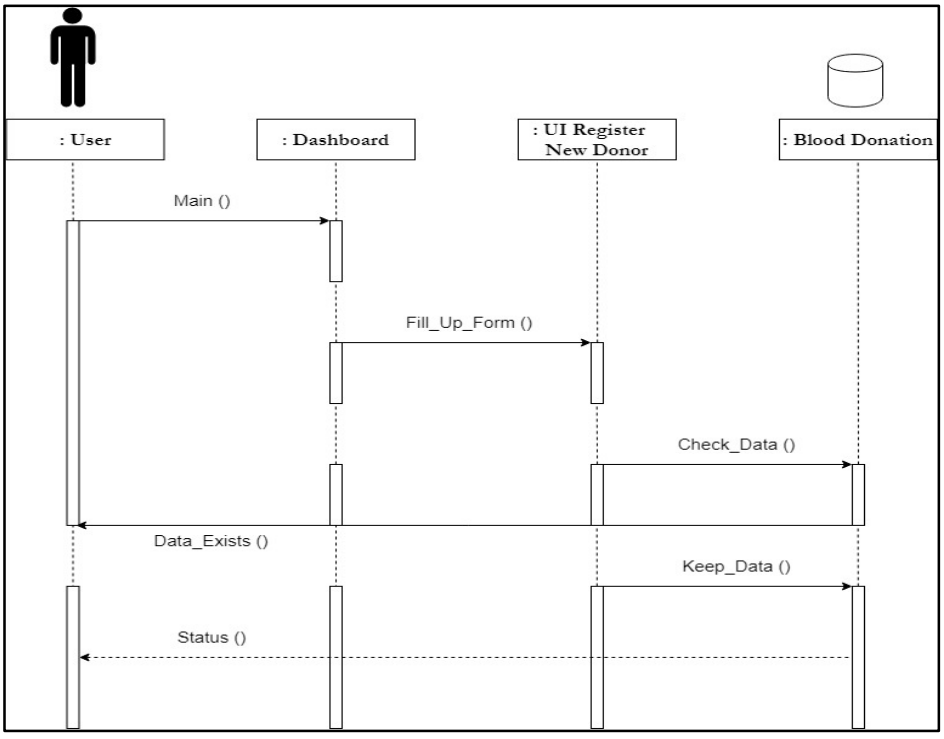
Appendix A2: Sequence Diagram for User Registration



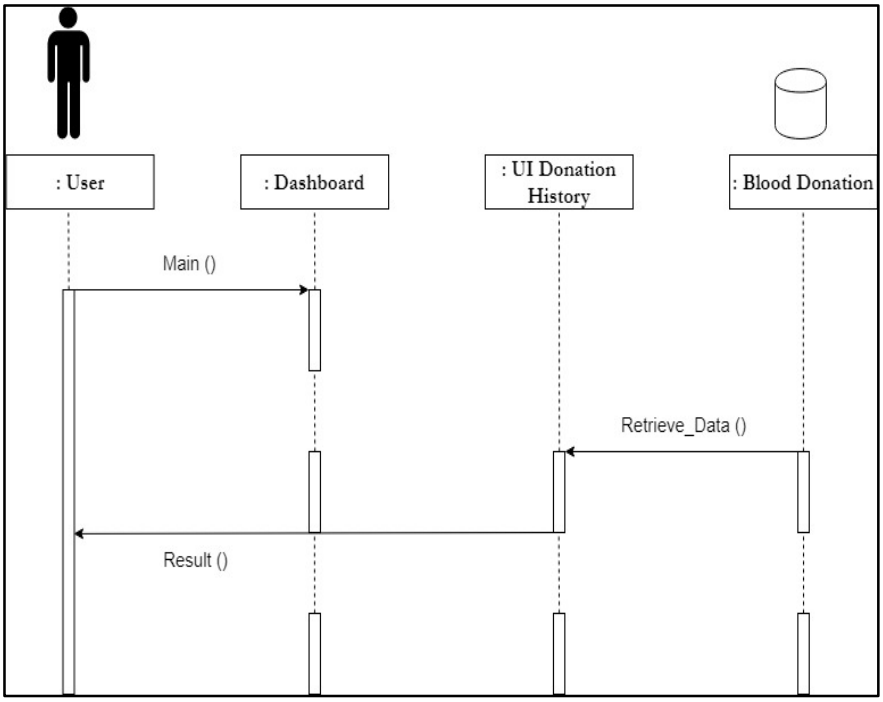
Appendix A3: Sequence Diagram for Create New Event



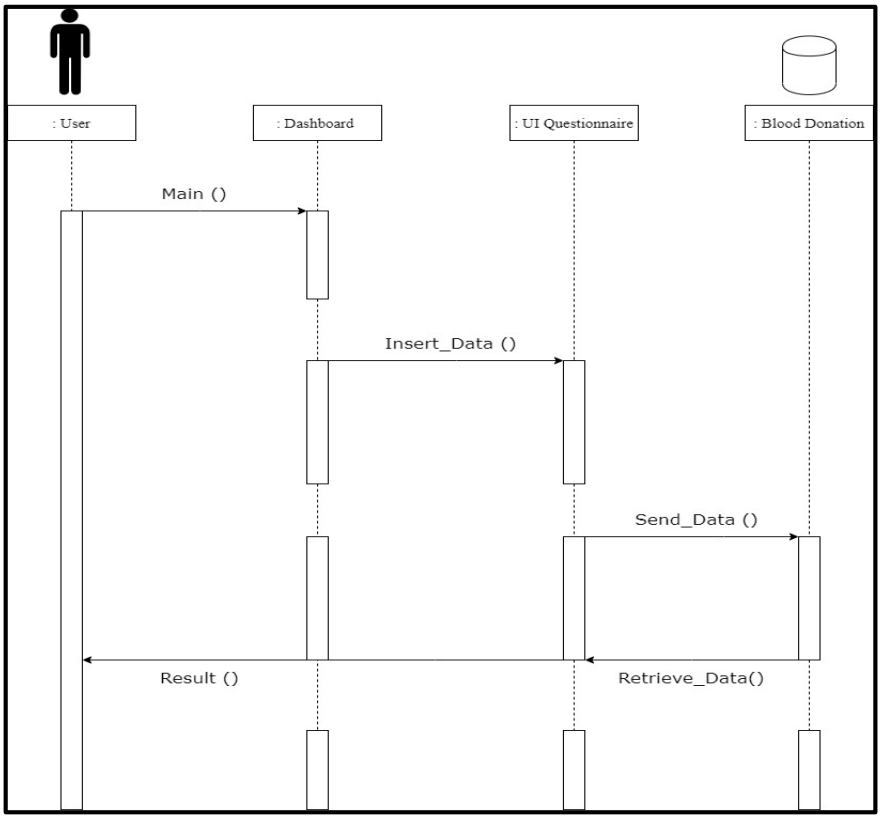
Appendix A4: Sequence Diagram for Create New Blood Donor



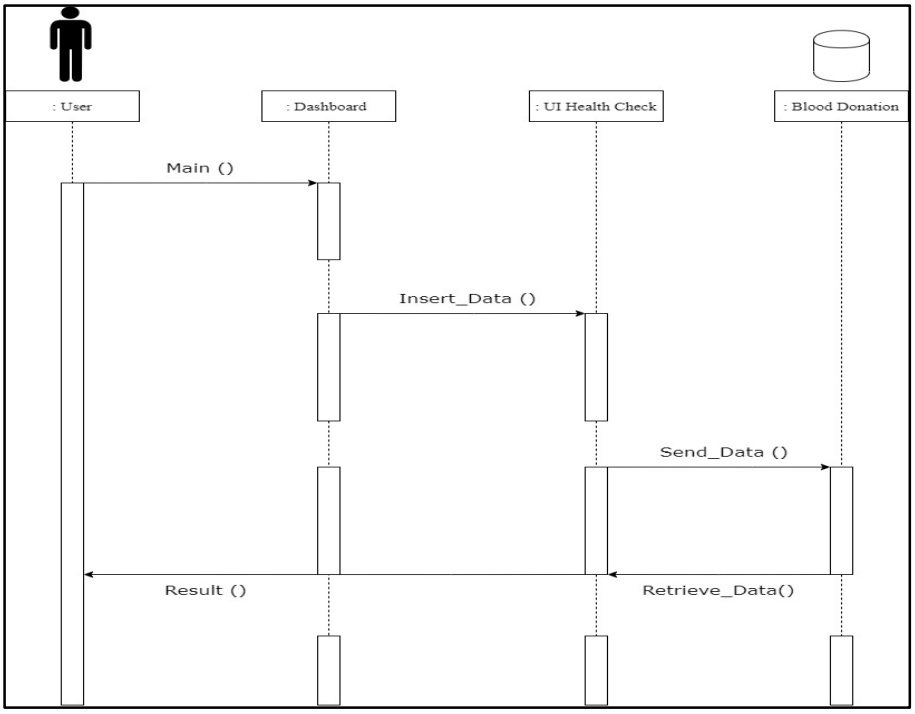
Appendix A5: Sequence Diagram for Donation History



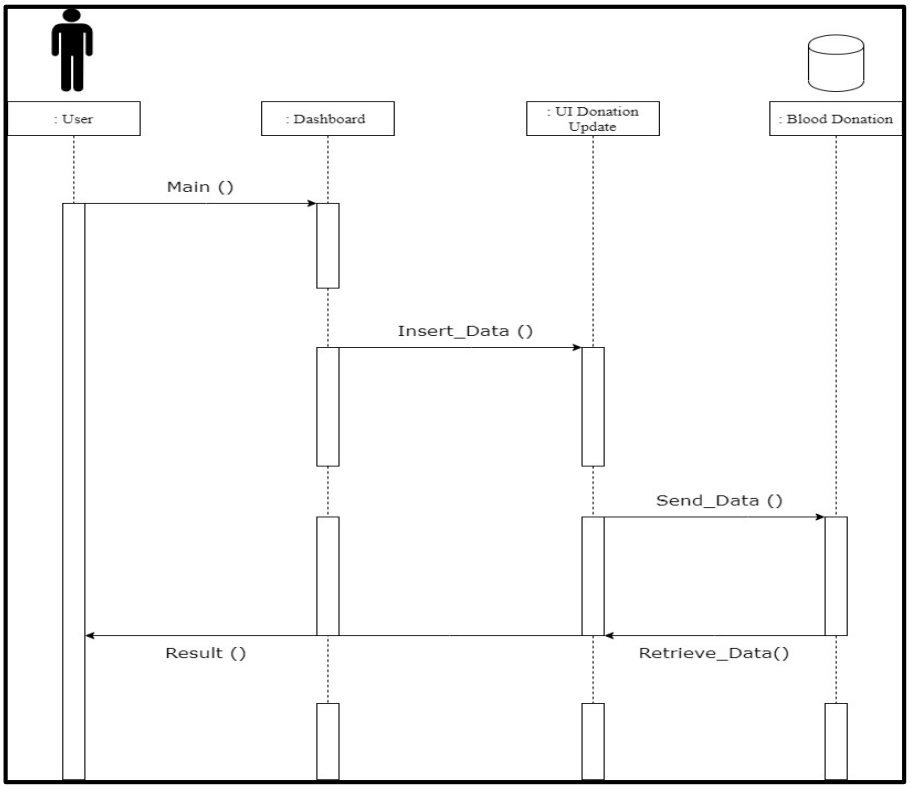
Appendix A6: Sequence Diagram for Questionnaire



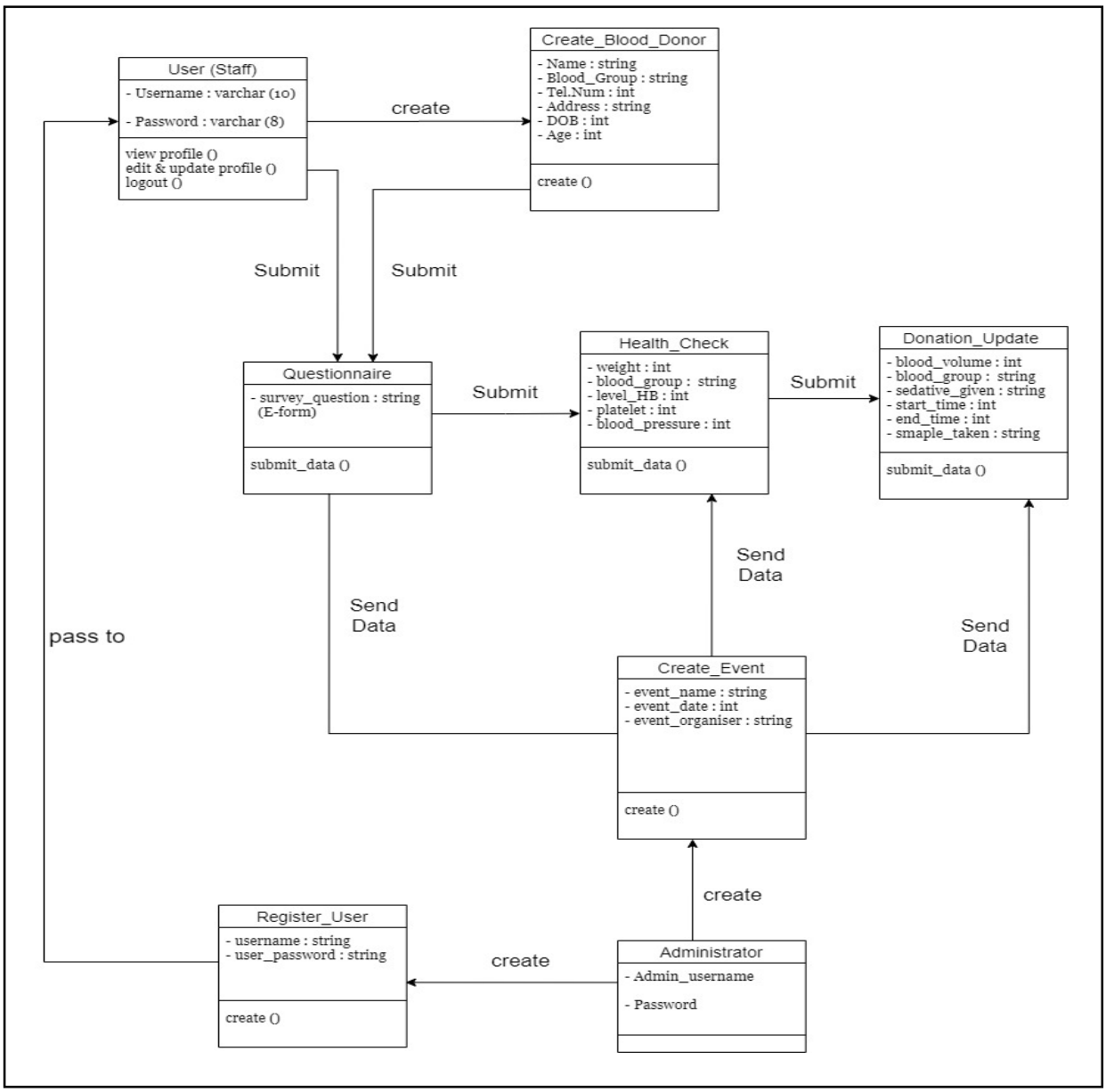
Appendix A7: Sequence Diagram for Health Check



Appendix A8: Sequence Diagram for Donation Update



Appendix B Appendix B: Class Diagram for Red Donor Application

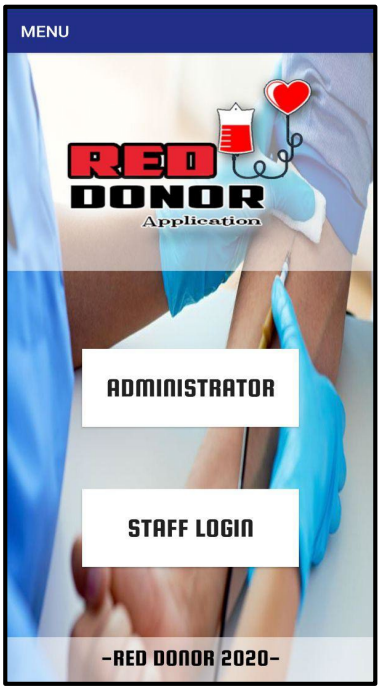


Appendix C

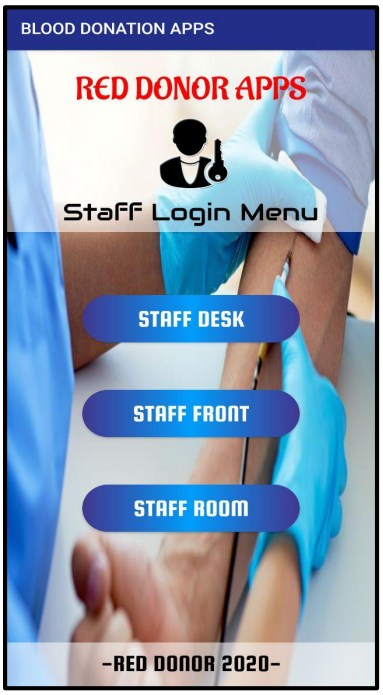
Appendix C: Interface Design for Red Donor Application

Appendix C1: Splash Screen Interface

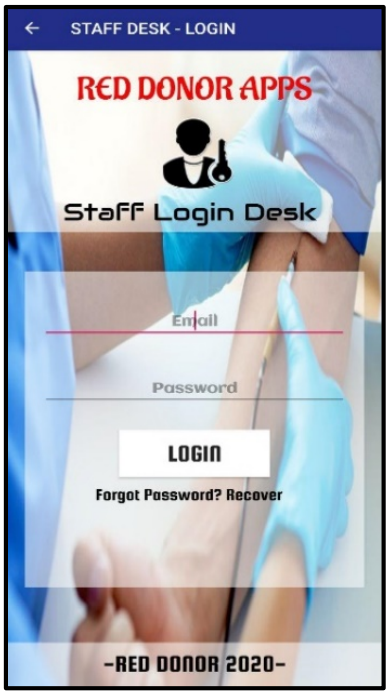
Appendix C2: Menu Interface



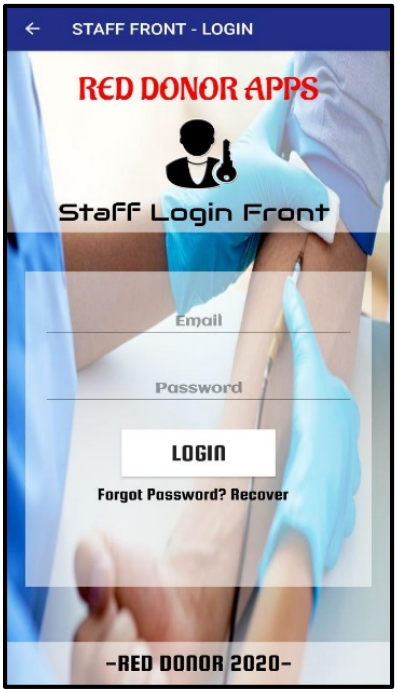
Appendix C3: Staff Login Menu Interface



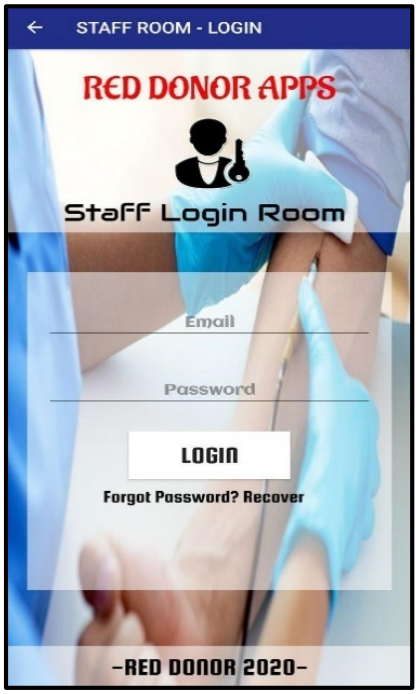
Appendix C4: Staff Desk Login Interface



Appendix C5: Staff Front Login Interface

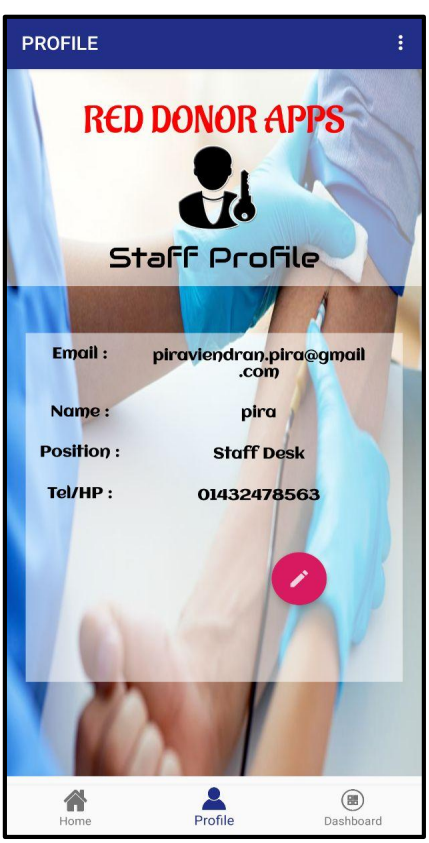


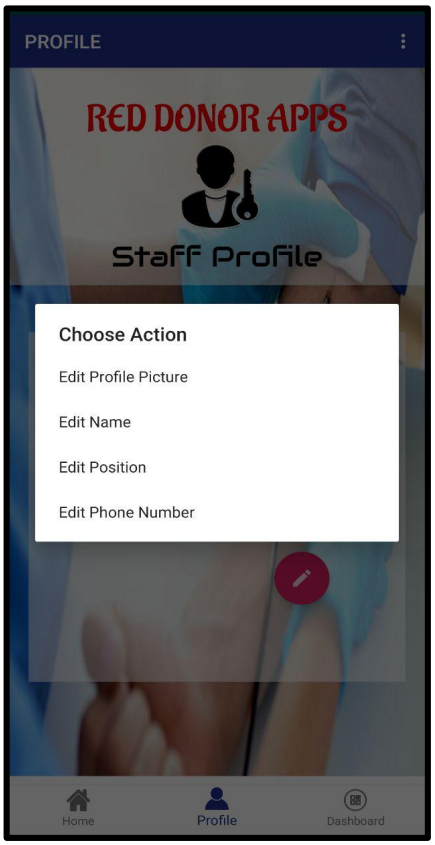
Appendix C6: Staff Room Login Interface



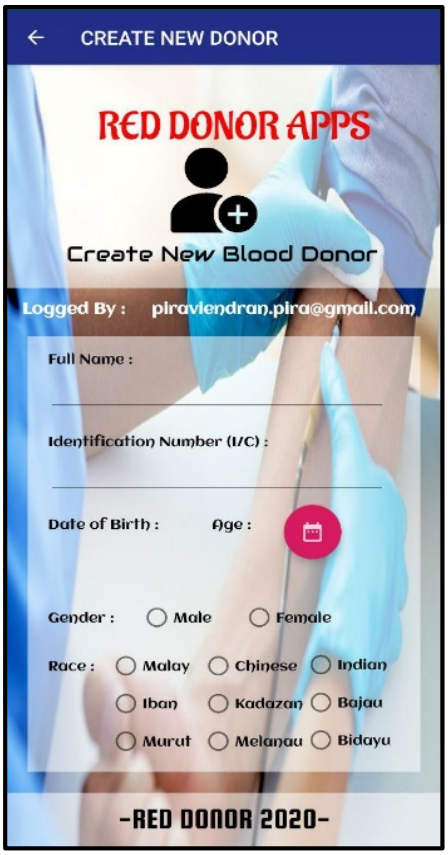
Appendix C7: Home Interface

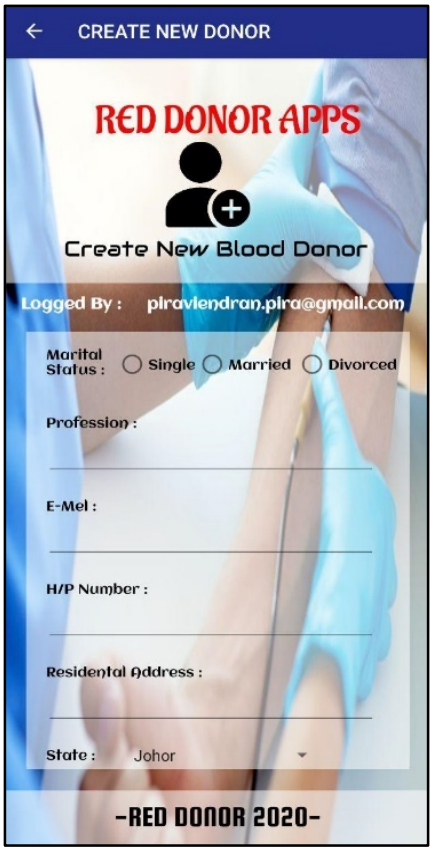
Appendix C8: Staff Profile Interface

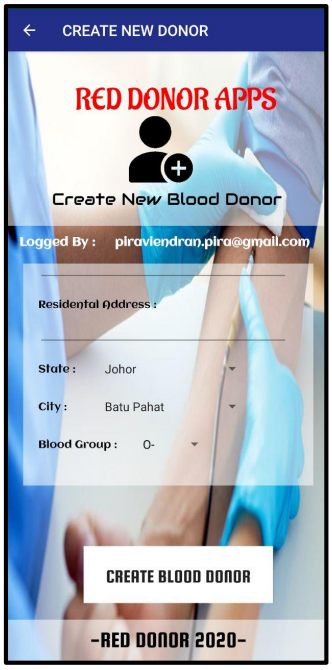




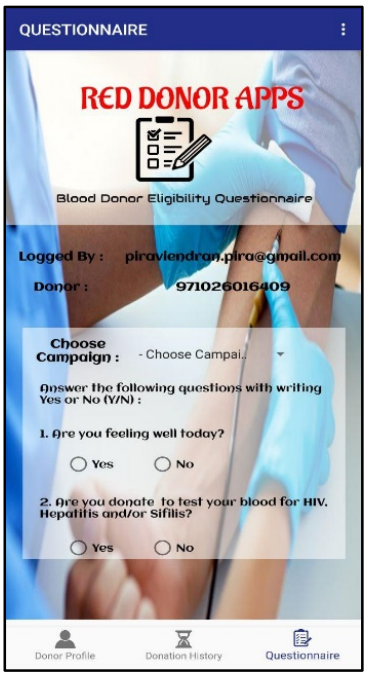
Appendix C9: Create New Donor Interface





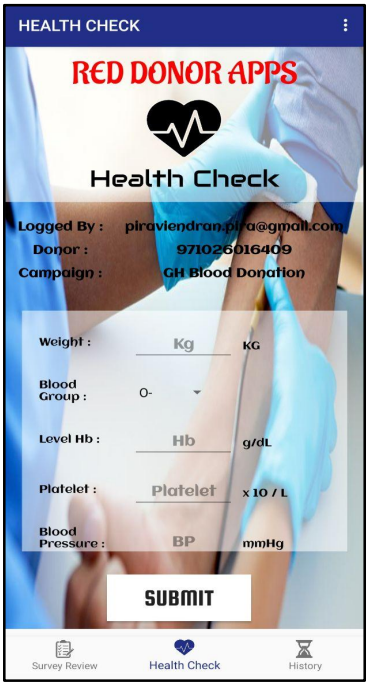


Appendix C10: Questionnaire Interface

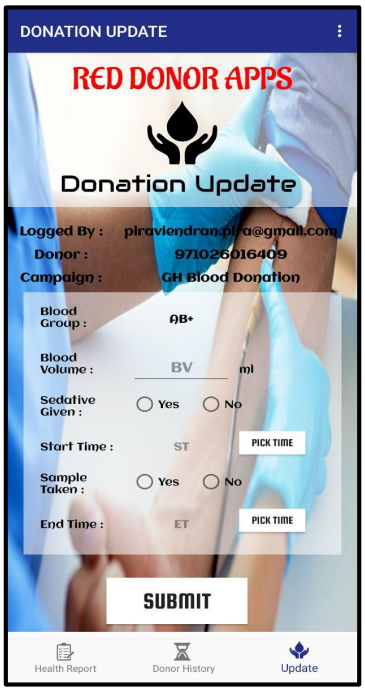


Appendix C11: Donation History Interface

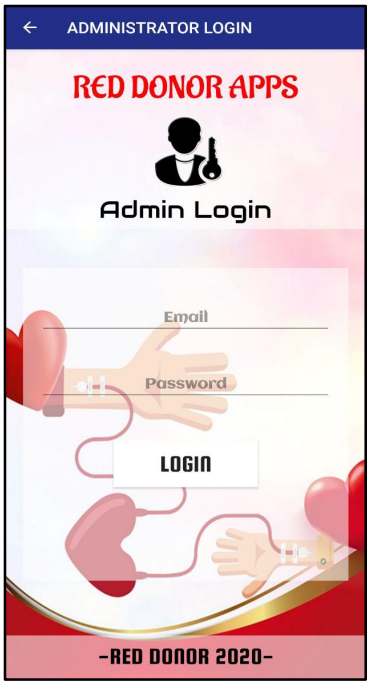
Appendix C12: Health Check Interface



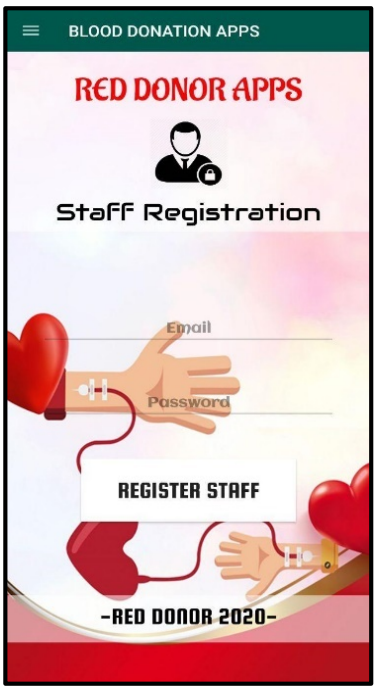
Appendix C13: Donation Update Interface



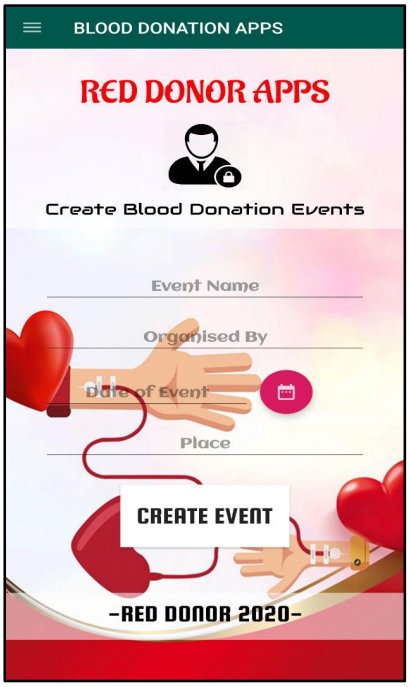
Appendix C14: Administrator Login Interface



Appendix C15: Staff Registration Interface



Appendix C16: Create Blood Donation Event Interface



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