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The Development of ISafe Mobile Application Using Messaging and GPS System

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Abstract: Women's safety is a crucial issue in Malaysia as well as other countries. We are all aware of the importance of women's security, but we must acknowledge that they need to be adequately secured as women always have difficulty to request for help whenever they confronting a critical situation such as rape, robbery, and domestic violence. Since individuals using mobile phones have increased rapidly, a smartphone can therefore be used effectively for personal protection or various other security purposes. Thus, the iSafe Mobile Application Using Messaging and GPS System Application are developed to prevent the threats that might occur to women. This application includes an emergency trigger and GPS combination of messages. It can help to identify the victim's position through a GPS and quickly send a message to help them in unexpected circumstances including the location URL to their registered contacts. The system will be developed by using Android Studio and SQLite as database software. The Rapid Application Development (RAD) methodology is used as a system development methodology. The development of this security system will provide women a reliable way to deal with the problem of security issues using messaging and a GPS-based system.

Keywords: Women Safety, GPS, Messaging, Android, Object-Oriented

1. Introduction

In today's society, women are not free from many security risks. They are becoming a soft target for molesters, eve-teasers, and rapists [1]. The Malay Mail in 2017 reported that according to police statistics, from 2010 to March 2017, 57,519 cases of violence against women have been reported. Subjects such as domestic violence and criminal cases under the Penal Code, involving women as victims, as well as cases such as incest, molestation, unnatural crimes, and rape, said Datuk Chew Mei Fun, Deputy Women, Minister for Family and Community Development [2].

Nowadays, Women in this society will face the problem where it is hard for them to request help when confronting a potentially life-threatening situation that comes from any direction such as women walking on the road alone after work, sexual harassment, and robbery. Most of the current application also uses shake or vibrate to detect emergency alert, but once the phone accidentally falls or get knocked, vibration is detected and it will trigger an emergency alert and sent SMS to emergency list.

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However, most of them are required to purchase the application to enjoy more features such as location tracking or GPS.

The main objectives of this research are to design a security system apps using an object-oriented approach based on messaging and GPS systems, to develop a security system application, and to test the developed application. Scope of the projects are authentication, add emergency contacts, add personal information, change personal information, and sending a message.

The expected result of this research is to pride security for every woman where they can contact their emergency contacts to the right persons or family members or friends or helplines whenever they are in an unwanted situation by automatically sending a text message that includes the current position of the victim using SOS service. The importance of the project is users will experience a more practical and faster way of requesting help by using this mobile application because it implements the foremost minimum procedure for help requesting by using mobile devices, only take short time to send an alert message to avoid any misfortunes and take less time to achieve the contacts.

2. Related Work

2.1. Study on Safety of Women

Safety is very important to every creature in this world which also included women. According to the World Health Organization, women's safety is affected in different ways, including endemic or class, ethnicity, age, religious and national boundary, in societies and countries around the world [3]. The term safety is described as a situation in which natural forces or human mistakes are randomly removed by danger [4].

As we observe, global studies and surveys indicate that ladies feel less safe and guarded publicly places, yet as in developed countries, and fear abuse and aggression. This issue occurs in most developing nations, and the facts associated with violence against women are appalling. Therefore, this study on the safety of women is needed to develop a useful application that is functioning well for women to ensure that they will be able to request help whenever they are in a potentially life-threatening situation.

2.2. Android Mobile Application

Android is one of the versatile market pioneers, has a billion applications on the Google Play Store [5]. Android is a stack of mobile phone programming that incorporates a working framework, the fundamental application, and the middleware [6]. In fact, Android was developed by the Free Handset Alliance, headed by Google, together with other companies using a mobile operating system with open source and Linux.

Android uses touch gestures that fit realistic gestures like swipe, scroll and slide closely. Android user interface is mainly used for manipulation on-screen objects and a virtual input keyboard. Android is developed specifically for smartphones, tablets, Android Auto for vehicles, and wristwatches Android Wear, each with a customized user interface [7]. Thus, since Android is a mobile device software stack programming, it provides touch gestures that are very similar to real-world motions and the operating system architecture. This system is built to develop a mobile-based application using Android as a platform.

2.3. Global Positioning System (GPS)

The United States Defense Department initially developed GPS technology (Global Positioning System) [8]. GPS provides information about location, speed and time that enables many of the applications we use in our everyday lives [9]. In calculating the distance, the GPS receptor receives signal from a minimum of three satellites and uses a triangulation process to calculate the latitude and

longitude positions of its two dimensions and the four satellites to compute its three dimensions, which include latitude, length and altitude positions [10].

Hence, global positioning system (GPS) technology is one of the features that have been proposed to be developed in the system where it could help to sends location-based information whenever a trigger button is being clicked.

2.4. Comparing with the Existing System

The features included to be compared are sign up and log in system, add emergency contacts, modify information, GPS, SOS trigger mode and instant messaging, and fake call. Table 1 shows the detailed comparison between three existing systems and the proposed system. From Table 1, we can conclude that each existing system have their uniqueness and it can be applied and implemented in the proposed system to make it more effective for the user.

The special feature of Family Locator application is that it had a global positioning system (GPS) function whereby it gives a lot of benefit for their user for them to track their family's member current locations. Sister safety for Women application also comes with special features to increase women's safety, such as a GPS and an SOS mode to contact the emergency services with just one click and bSafe Never Walk Alone application have the advantage where it had a fake call function.

Table 1: System's Comparison

Features/System	Personal Safety | Family Locator	Sister - Safety for Women	bSafe - Never Walk Alone	iSafe Mobile Application using Messaging and GPS System
Sign up & login System	✓	✓	✓	✓
Manage Emergency Contacts	✓	✓	✓	✓
Modify Information	✗	✗	✓	✓
GPS	✓	✓	✓	✓
SOS Trigger Mode & Instant Messaging	✗	✓	✓	✓
View How to Use	✗	✗	✗	✓
View Self Defense	✗	✗	✗	✓
Fake Call	✗	✗	✓	✓
Fake Siren	✗	✗	✗	✓

3. Methodology

This study implements the Rapid Application Development Model (RAD). RAD consists of 4 phases which are requirements planning, user design, rapid construction and cutover phase. The tasks and outputs of every stage have to be generated during the production of the whole project according to Table 2. Besides, the production was completed within the given days.

From Table 2, a Gantt chart, project proposal and analysis of collected data are produced from requirements planning. Output from user design phase are UML Diagram, architecture diagram, user interface and database system. Program code is developed in rapid construction and the system is tested to end users in cutover phase.

Table 2: Software development activities and their task

Phase		Task		Output
Requirements Planning	i.	Proposed the project	i.	Produce Gantt chart
	ii.	Determine activities and output	ii.	Project proposal
	iii.	Requirement and information gathering	iii.	Analysis of collected data
			iv.	UML/DFD
			v.	Class Diagram/ERD
User Design	i.	Determine Work Plan	i.	Architecture design
	ii.	Design user interface	ii.	User interface
	iii.	Determine implementation strategy	iii.	Database
Rapid Construction	i.	Application Development and deployment	i.	Program code
Cutover	i.	Deliver the system to end users to test	i.	Test cases
	ii.	Collect feedback from end-users		
	iii.	Prototype improvement		

3.1 Requirement Planning

In this phase, the problem statement, objective, and scope of the system application has been identified. Besides that, a Gantt chart has been made to estimate the time needed for each task and phase of the application development to ensure that the entire project development is completed on time.

3.2. User Design

Analysis and design of iSafe Mobile Application using Messaging and GPS System for women safety was conducted before developing a proper system. The analysis emphasizes the analysis of the problem and specifies what the system should do rather than a solution. Analysis in this project is performed based on an object-oriented approach. In the field of object-oriented software engineering, unified modelling language (UML) is a standardized general-purpose modelling language. Hence, Activity Diagram, Sequence Diagram, Class Diagram, and Use Case Diagram, are produced in this section. This section also includes the design of the interface and database for the proposed application.

3.2.1. Use Case Diagram

A vision of the user interactions with the system that shows the user-system relation is show in use case diagram. Figure 1 illustrates the application use case model, shown the user-to-application interactions.

3.2.2. Sequence Diagram

A sequence diagram shall be used to ensure that the diagrams display the sequence of events that the actor conducts and the proper order for each occurrence. It also explains how things communicate. The system sequence diagram is presented in Figure 2.
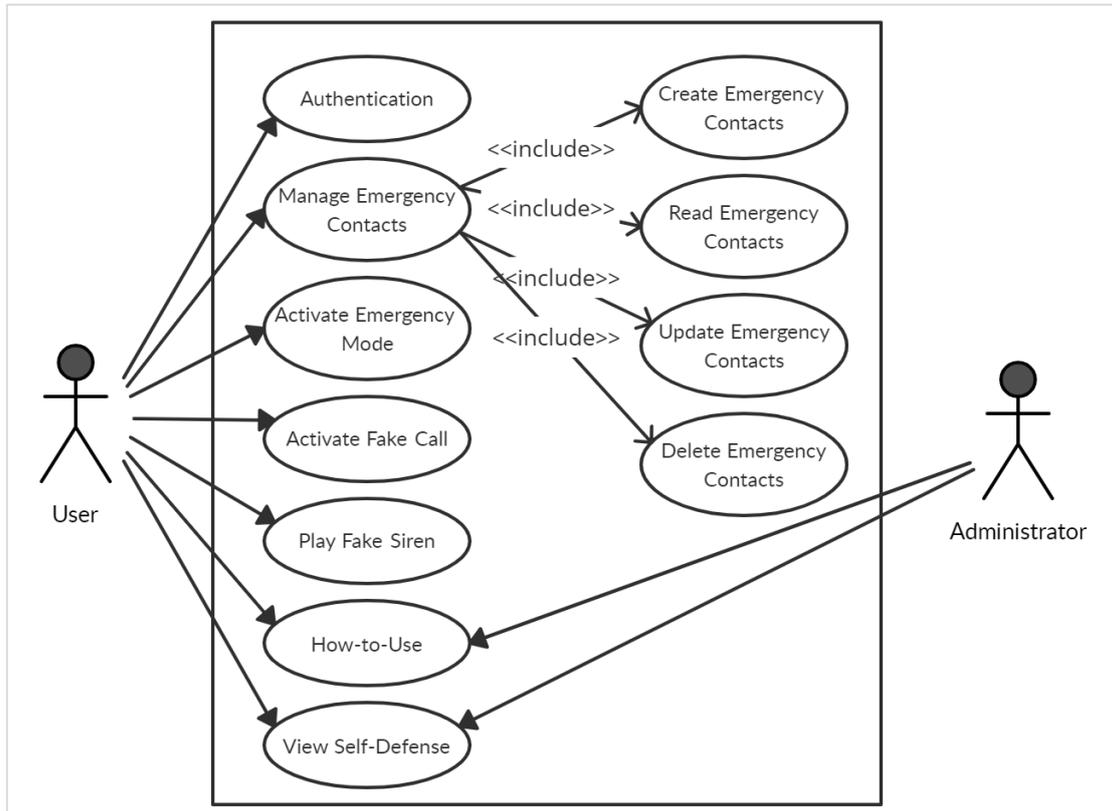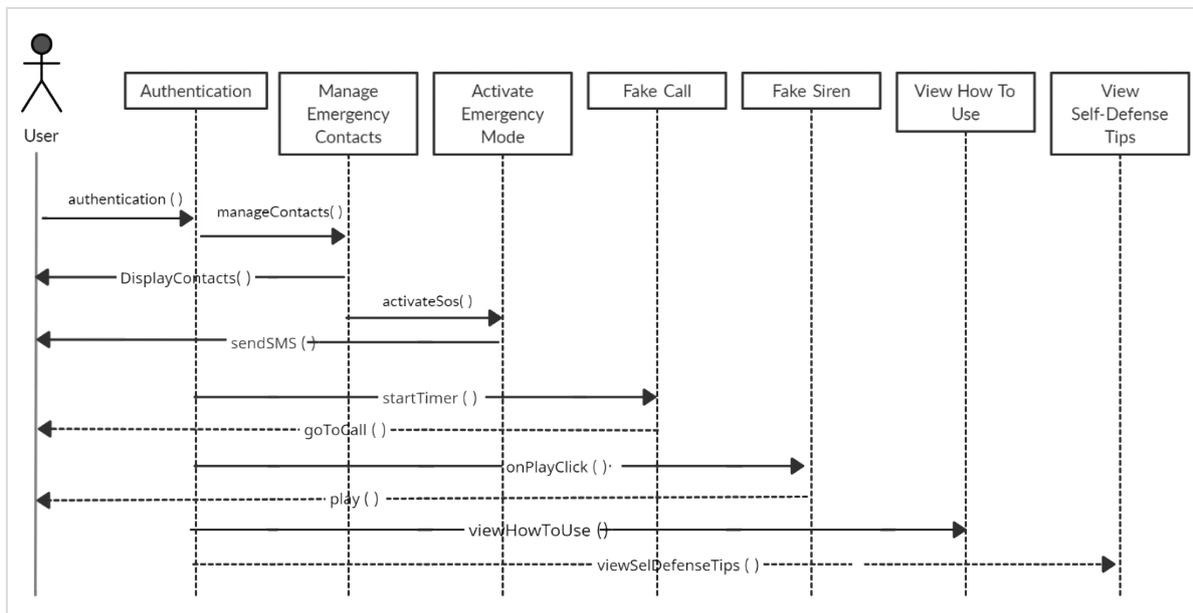
Figure 1: Use Case Diagram

Figure 2: Sequence Diagram

3.2.3. Activity Diagram

The operating diagram is also an essential UML diagram to explain the complex aspects of the system. The activity diagram is basically a flow diagram representing the step-by-step flow between activities. In a map of operation, the input, output, processes, and data flow contain several symbols

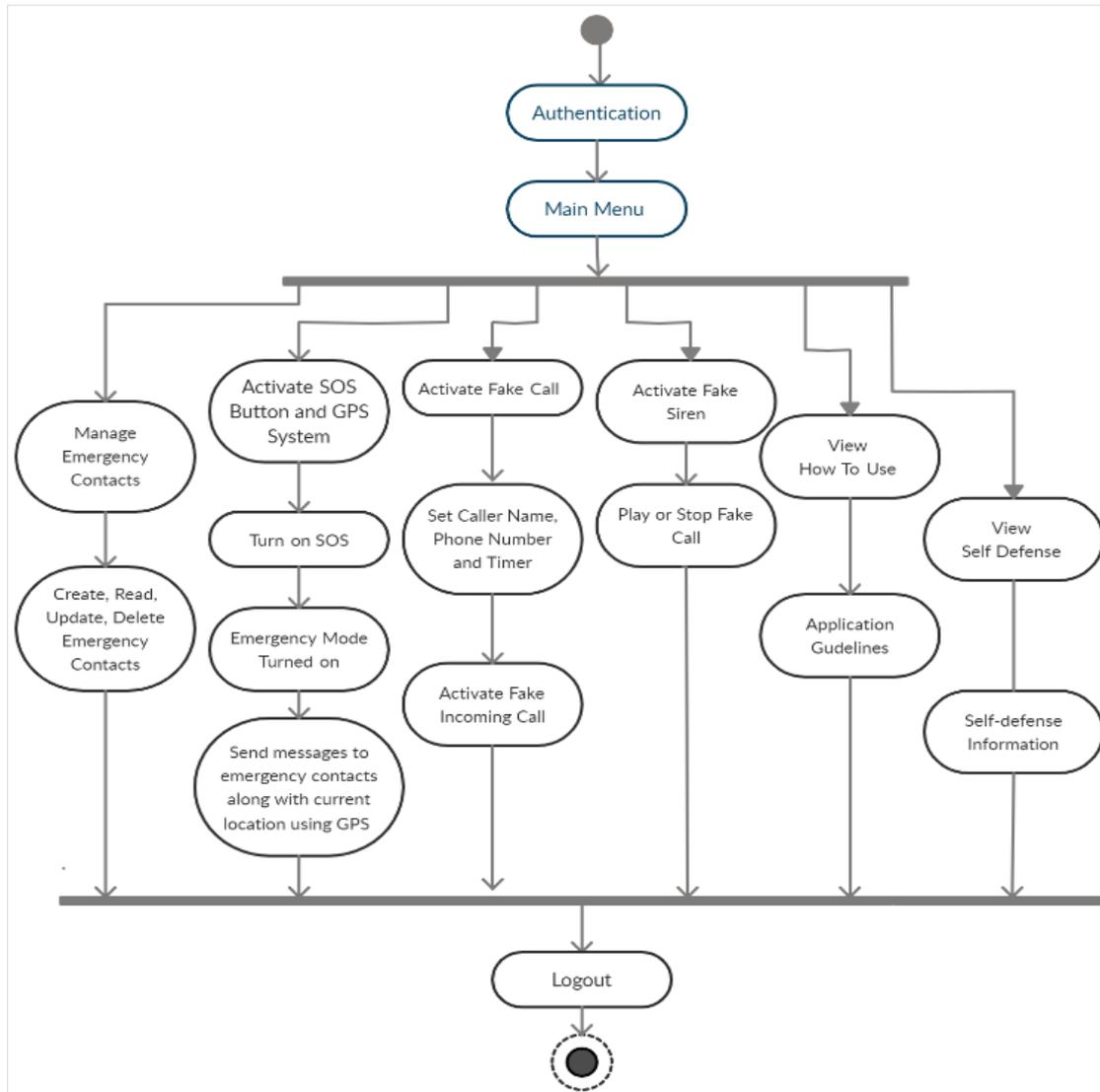used in the flow chart. Figure 3 shows the activity diagram of the iSafe Mobile Application using Messaging and GPS System.

Figure 3: Activity Diagram

3.2.4. Class Diagram

For general modelling of an application structure and detailed modelling translating the models into programming code, the class diagram is implemented. Figure 4 shows the iSafe Mobile Application class diagram using GPS and Messaging system.

3.2.5. Database Design

Each class has its internal structure and links with other classes in the design of databases. The relationships between tables enable a relation database to store a great number of data efficiently and to retrieve selected data effectively. In this section, database schema is needed to reflect the abstract structure of all or part of a relational database. The database schema is listed in the following:

    i.   User (userID, phoneNo, email)
    ii.   EmergencyContact (contactID, contactName, contactPhone)
   iii.   EmergencyHandler (empID)

iv.   GPS (gpsID, Date, Time, Latitude, Longitude, description)
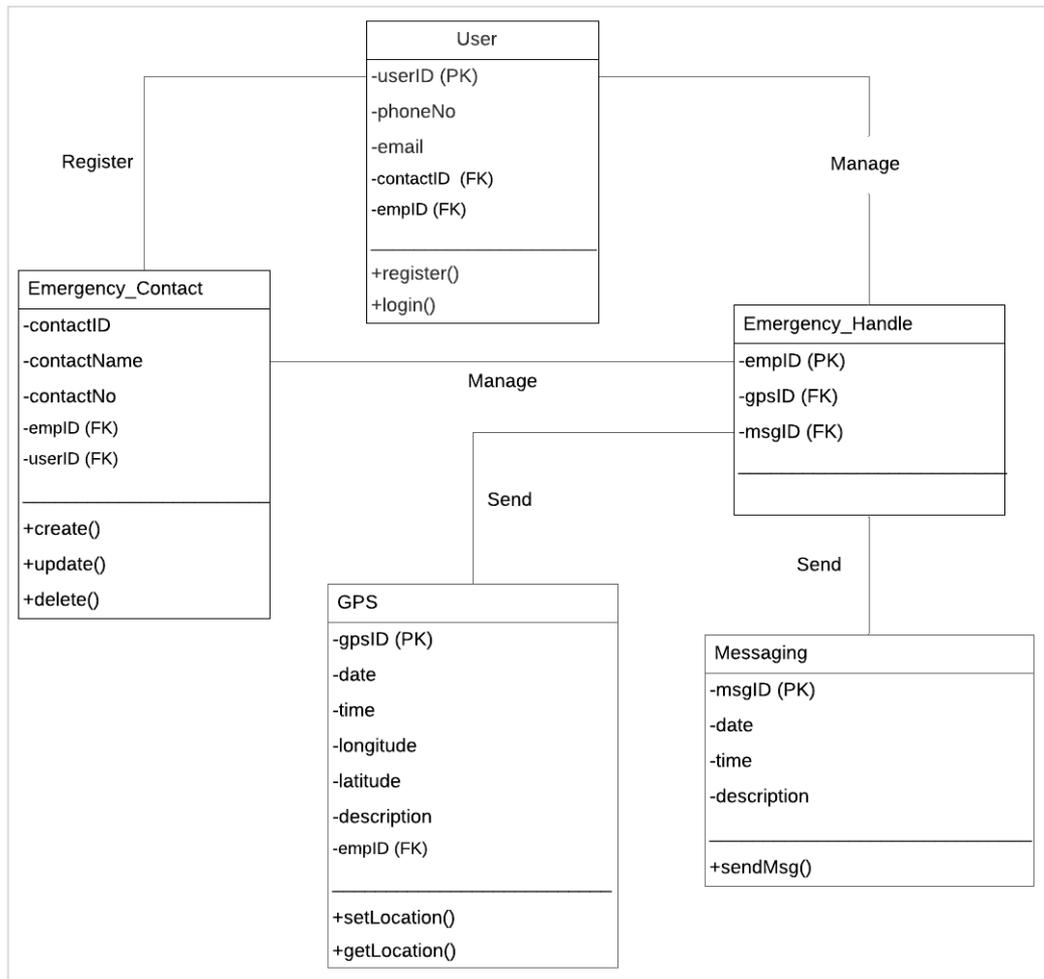v.   Message (msgID, Date, Time, description)

Figure 4: Class Diagram

3.2.7. Interface Design

   Interface design is crucial for users' use to emphasize appearances or design. Interface design is essential. The goal is to make this page easy to use and enjoyable. Users are successfully directed to using the application without frustrating it by a good navigation design, input design and output design. Figure 5 illustrates the user interface design for the application.
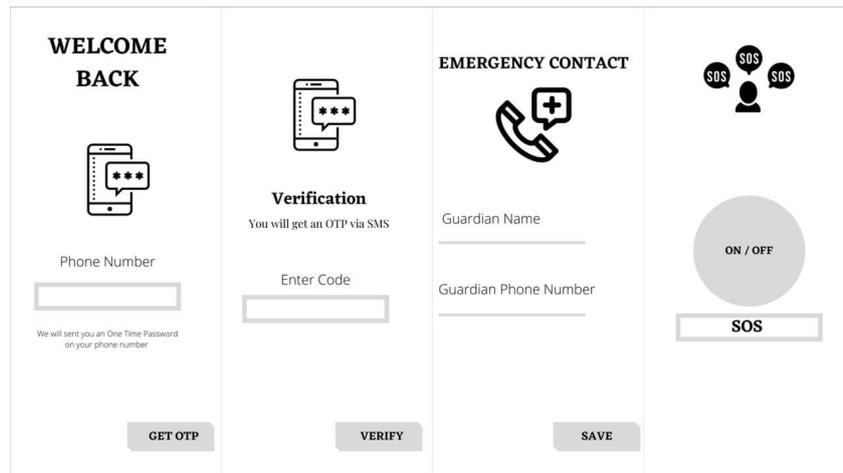
Figure 5: User Interfaces Design

3.3. Rapid Construction

In order to develop the proposed application and XML for each module it was mainly used in Java Languages through integrated development environment (IDE) which is Android Studio. The Firebase tool and SQLite are chosen for the database and can be used to connect to the proposed application. Figure 6 shows the partial coding for Firebase database connection and Figure 7 shows the partial coding for SQLite database connection.

```
implementation platform('com.google.firebase:firebase-bom:28.0.1')
implementation 'com.google.firebase:firebase-analytics'
implementation 'com.google.firebase:firebase-auth'
```

Figure 6: Source Code for Firebase Database Connection

```
public class DatabaseHandler extends SQLiteOpenHelper {
    public static final String DATABASE_NAME = "ISAFEAPP.db";
    public static final String TABLE_NAME = "Contacts";
    public static final String COL_1 = "ID";
    public static final String COL_2 = "NAME";
    public static final String COL_3 = "CONTACT_NO";

    public DatabaseHandler(@Nullable Context context) {...}

    @Override
    public void onCreate(SQLiteDatabase db) {...}

    @Override
    public void onUpgrade(SQLiteDatabase db, int oldVersion, int newVersion) {...}
```

Figure 7: Source Code for SQLite Database Connection

Authentication module of this application is done by using firebase authentication. Figure 8 shows the code segment of authentication module. Figure 9 shows the interface of iSafe Mobile Application Using Messaging and GPS System Application.

```java
@Override
public void onCodeSent(@NonNull String verificationID, @NonNull PhoneAuthProvider.ForceResendingToken forceResendingToken){
    progressBar.setVisibility(View.GONE);
    buttonGetOTP.setVisibility(View.VISIBLE);
    Intent intent = new Intent(getApplicationContext(), VerifyOTP.class);
    intent.putExtra( name: "mobile", inputMobile.getText().toString());
    intent.putExtra( name: "verificationId", verificationID);
    startActivity(intent);
}
```

```java
@Override
public void onCodeSent(@NonNull String verificationID, @NonNull PhoneAuthProvider.ForceResendingToken forceResendingToken){
    progressBar.setVisibility(View.GONE);
    buttonGetOTP.setVisibility(View.VISIBLE);
    Intent intent = new Intent(getApplicationContext(), VerifyOTP.class);
    intent.putExtra( name: "mobile", inputMobile.getText().toString());
    intent.putExtra( name: "verificationId", verificationID);
    startActivity(intent);
}
```

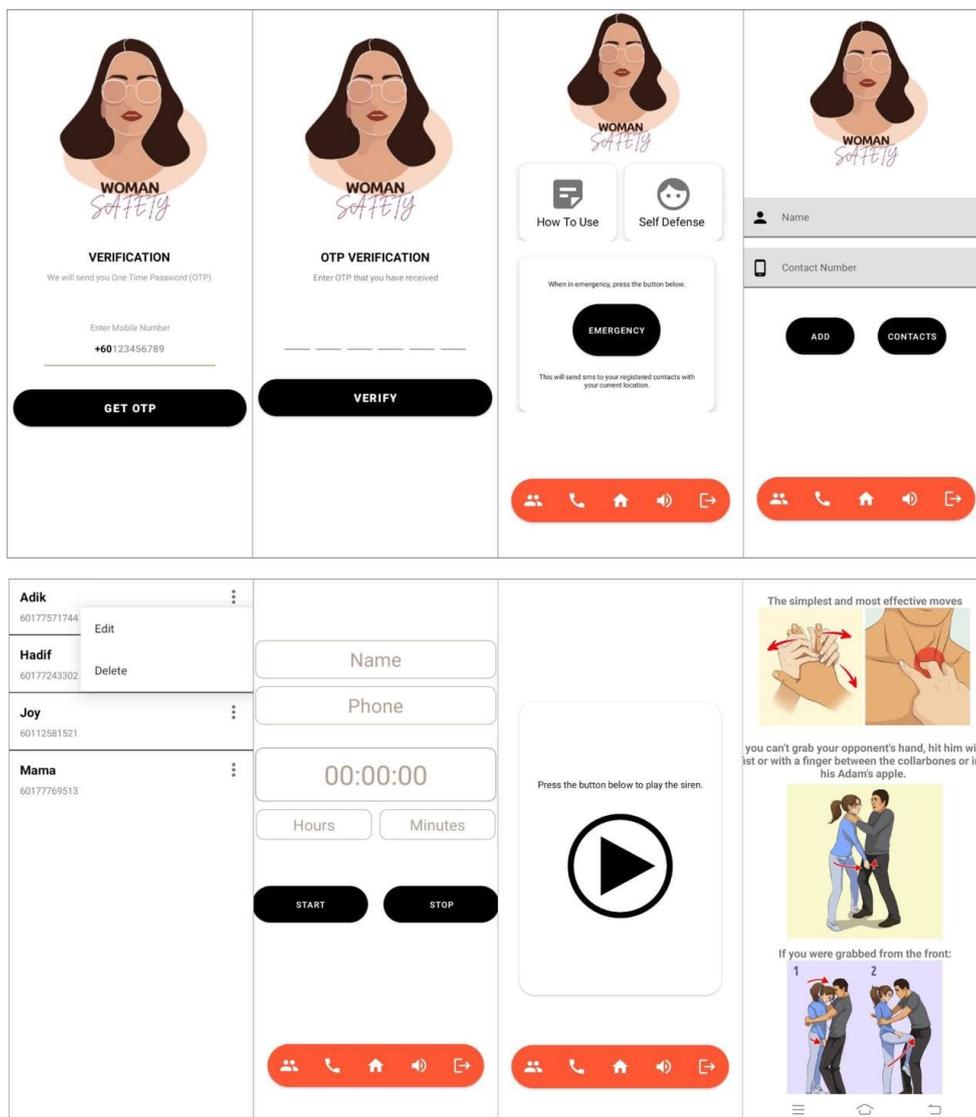**Figure 8: Code segment for authentication Module**

Figure 9: Interfaces of the application

4. Result and Discussion

4.1. Alpha Testing

The alpha testing describes the testing on functionals and features of application to ensure that the system functions properly and according to expectations. A test plan is implemented once the proposed request has been implemented. The iSafe Mobile Application using Messaging and GPS application can be used to check whether the project needs have been met. The test plan for all iSafe Mobile Application features is given using the message and GPS application in Table 3.

Table 3: Test Cases of Application Modules and Results

Module	Test Case	Expected Output	Actual Output
Authentication	User able to login to the system using mobile number and verify by using one-time password via SMS.	Authentication successful and the homepage is displayed.	Pass
How to Use	Step-by-step guidance on how to use the application	The guidance is to display one step for each page using a slide adapter.	Pass
Self Defense	Step-by-step self-defense	The guidance is a display step to encounter attack from any harm.	Pass
Manage Emergency Contacts	User able to create, display, update and delete emergency contact	A message is displayed based on user action.	Pass
SOS Emergency	Click the Emergency button.	The system responded by actively sending SMS including the user's current location with google maps to link to the registered emergency contacts.	Pass
Fake Siren	User able to play or pause fake police siren.	A fake police siren via media player is play or stop according to user.	Pass
Fake Call	User is able to set fake caller, phone number and timer to receive incoming call.	Incoming fake calls will be displayed based on the input of the name and phone number by the user.	Pass

4.2. Beta Testing

In beta testing, beta version of iSafe Mobile Application using Messaging and GPS application for women safety is tested and evaluated by 10 respondents via google form. For this evaluation, women with android phone users are interviewed. Figure 10 shows results result for evaluation of application features and figure 11 shows the for evaluation of user interface.
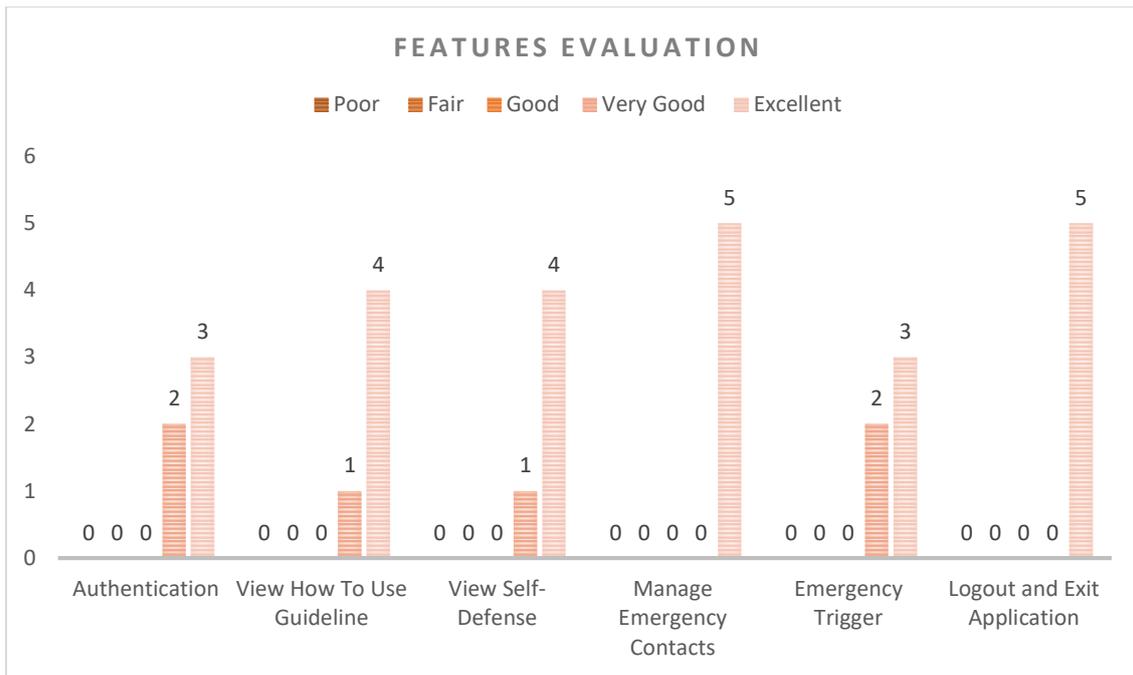
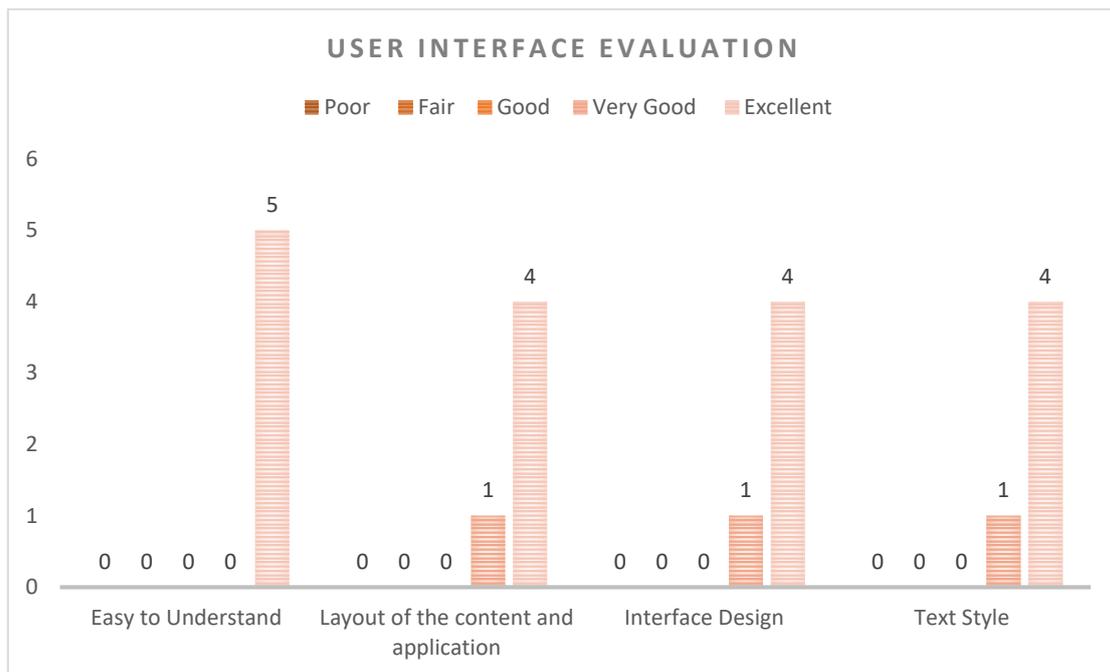**Figure 10: Result for Application Features Evaluation**

Figure 11: Result for User Interface Evaluation

The results from the evaluations via google forms are presented using bar chart as shown in Figure 11 and 12. From the bar chart in Figure 12, most of the people taking part in beta testing and questionnaire are satisfied with terms such as easy to understand, content layout, text style and interface design. In terms the application features. From the above results in Figure 12, the SOS Emergency Trigger feature was excellent by 3 of 5 users, who are 60%. The global diagram shows that the users are satisfied with the design of the application and its features.

5. Conclusion

In brief, iSafe Mobile Application using Messaging and GPS System for Women's Safety has successfully developed. Some advantages, limitations and future improvements of the application have been identified.

The advantages of the application are Firebase authentication is used to increase security as every single phone number makes logging easier for the user, because no password has to be remembered. Next, When the emergency mode is activated, SMS together with the google maps link from the user's current location are sent to emergency contacts. Furthermore, user is able to use the fake incoming call and fake siren features freely without having to do any purchases. The user also is able to view and learnt how to protect the user and prevent crime against women when no one can help them. The limitations of the application are included Internet connection is required for the user to activate emergency mode and for the emergency contacts to open the google maps link and Emergency mode can only be trigger inside the application.

A few suggestions to improve the application in future works are the application should be able to send the user live via WhatsApp so that the guardian can always track the user's exact location. It will help if the user is abducted. Besides that, the application should be able to operate and enable the emergency mode offline, or without the internet connection. Lastly, the application should be able to activate emergency mode either when the mobile phone is locked or outside the application.

Acknowledgement

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