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Smart Safety Hikers Application

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Abstract: The number of people who go missing due to mountain climbing is increasing every year. A mobile-based Emergency Distress Signal application was developed to help hikers can seek help when they lost their direction or do not reach their destination in the stipulated time. The application can send distress signals including the user's longitude and latitude and the user's alert message to team volunteers when they miss the direction. Other than that, users can also view the emergency note that will lead them to solve the problem accordingly such as injured and lost direction. The Prototype Model technique was utilized to create this application. The actions carried out for the creation of this application include identifying the issue statement, objectives, and application requirements, designing the application interface, and creating the database. The Java programming language and Android Studio were used to create this application. The database is built using the Firebase platform. It is hoped that this application would be created effectively and be able to assist those missing hikers getting rescued by volunteer teams.

Keywords: Hiking, SOS, Emergency, Longitude, Latitude, Mobile-based, SMS, Coordinates

1. Introduction

Earlier this year, the Volunteer Fire Brigade Jalan Alor Mengkudu had received missing reports from Mountain Keriang. Even though they still have a way to contact the missing person, because of the complicated geographical location, it took them a long time to locate the missing person. A system that can send distress signals in time should allow these personnel to seek help from the outside world in the time. The main purpose of this system is to allow user to send a distress signal to seek for help during an emergency or when the user no arrived the destination in the stipulated time. The system will automatically send a distress signal with the longitude and latitude coordinates to the outside world when the user no arrived the destination in the stipulated time. This is important so that volunteer team around the area can start the secure job as soon as possible.

This project involves building an application for users who like to hike. The target users for this app are the hikers in Gunung Keriang. The expected time taken to complete the project is about 40 weeks. The goal of this project is to provide platform for hikers to seek for help when they meet emergency or miss their direction during hiking. The tool will be created using Android Studio software

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and the programming language used is Java. The Firebase database is used to store the data. There are 5 modules in this application which are Login, Register, Emergency alert message, Emergency contact, Timer, and Emergency manual.

Based on the several problem statements, several objectives are identified. The objectives of the project include:

1. To design a Distress Signal system using mobile-based approach.
2. To develop Distress Signal system which automatically send a distress signal and map coordinates when the user does not arrived destination in a specific time.
3. To test the developed system to identify whether the system can help user to send the distress signal and map coordinates automatically successfully.

According to this proceeding paper, Section 2.0 will discuss the literature review and study of existing application. Next, methodology that selected to develop the proposed application will be explained in Section 3.0. Section 4.0 is about the explanation of analysis, design, implementation and testing of the proposed application. Section 5.0 concludes the summary of the chapter.

2. Related Work

2.1 Short Message Service (SMS)

SMS is an abbreviation for Short Message Service. It is the most established and commonly used text messaging service today. SMS can communicate over cellular networks, requiring a wireless plan and a wireless provider [1]. In order to realize the sending of distress signals without Internet, the choice of using SMS technology is to ensure that the distress signals can be sent and received.

2.2 Global Positioning System (GPS)

The global positioning system (GPS) is a network of satellites and receiving devices that may be used to detect the location of something on Earth. GPS receivers offer latitude, longitude, and altitude information. GPS is used to track the location of the user or hiker so that the volunteer team can track the user's whereabouts in an SMS alert issued by the user. By presenting GPS position data on a map, GPS tracking solutions make it simple for end users to comprehend GPS location data [2].

2.3 Study on Existing Application

Comparison between existing applications with the proposed application is done to identify the features found in the existing application for used as an improvement on the proposed application. Table 2.1 shows the results a study of existing applications and some features that can be identified in those applications.

The first application is Community Alerts App. This is the application where the community can do their part in helping to combat crime in Malaysia and to report SOS emergency cases [3]. The mobile SOS alert will be transmitted to the police command center by pressed SOS button on the application, and the operator will check the GPS longitude/latitude coordinates on the map will then send Police Vehicle officers to the victim's locationto start helping them right away. The GPS technology that performed in this application will be implemented in the proposed application.

Second application is Panic Button. This application mentioned that users can add a panic button widget and unlimited emergency contacts to the application [4]. Users can also edit emergency SOS messages. User can activate the alarm from the background with the different modes such as Shake phone, press power button, Charge phone, set a countdowntimer and Tap panic button. Users can also turn off power saver mode to keep the app runningin the background without disruption. The features of add emergency contact, countdown timer, and power saver mode will also conclude in the proposed application.

Third application that choose to compare is SOS Mobile App. It is connected to an online SOS account, which organizations use to process incoming alarmsto legal requirements. In an emergency, employees can use it to automatically and quickly sendout a call for help [5]. Simple and intuitive user interface for lone workers, with interesting cloud abilities. The proposed application tries to have a simple user interface and user-friendly from this application.

Comparison between existing applications with the proposed application is done to identify the features found in the existing application for used as an improvement on the proposed application. Table 1 shows the results a study of existing applications and some features that can be identified in those applications.

Table 1: Comparison between existing application and proposed application

Features	Community Alert SOS Application	Panic Button | Emergency SOS	SOS Mobile App	Proposed Application
Send SMS alert	✓	✓	✓	✓
Unlimited emergency contact	×	✓	×	✓
Registration	✓	×	✓	✓
Continuous location update	✓	×	✓	×
Send SOS alert without network	×	✓	×	✓
Sent location with Coordinates	×	×	×	✓
Alarm sound	×	✓	✓	×
Activate alarm by motion detection	×	✓	×	×
Emergency SOS button	✓	✓	✓	✓
Emergency Manual	×	×	×	✓

3. Methodology

This section will go through the project methodology that was utilized to construct this project. Prototype Model was chosen as the model for this project. Method prototyping offers consumers with a system to assess fast and reassures users that work is being made. When users have difficulties describing system needs, this method comes in handy [6]. Figure 1 shows that there are five main phases inside the prototype model which is: planning, analysis, design, implementation, and testing [7].

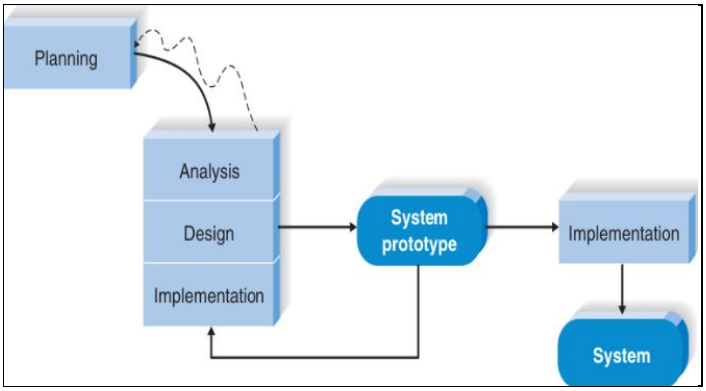


Figure 1: Prototype Model [6]

3.1 Planning Phases

The project design, task list, schedule plan, and development framework should all be created during the planning phases [8]. It ensures that the entire project is more systematic and the project progress on the right track. In order to gather more information useful for the proposed application, extensive reading was made of journals and online resources on the relevant topic. In addition, the existing systems and their functions are investigated and understood, and three existing systems are selected for functional comparison with the proposed application. The author then set a plan by scheduling a Gantt chart to list down all the activities with the duration that will be carried out throughout the project development. Gantt chart helps guide the author in completing the tasks on time. Figure 2 shows Gantt chart diagram.

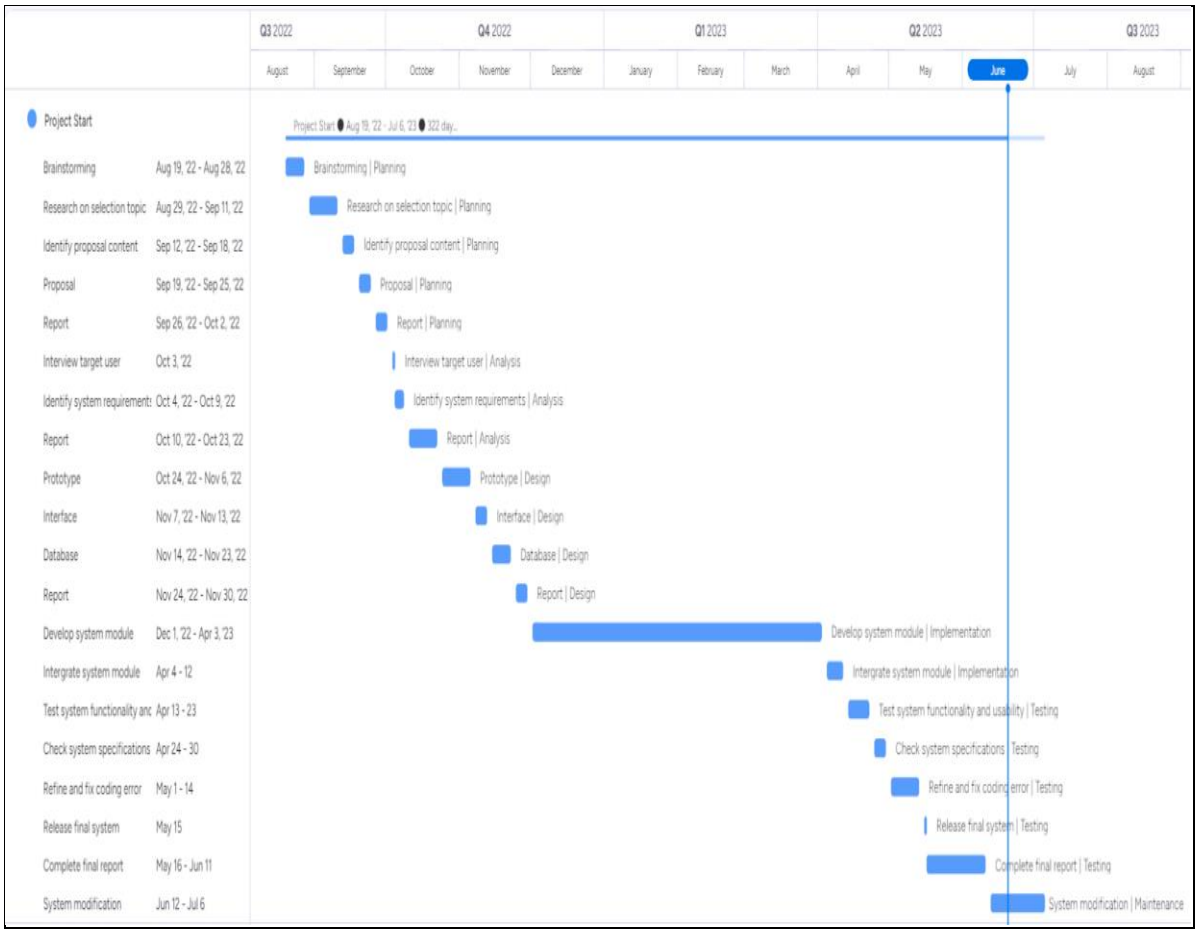


Figure 2: Gantt chart diagram

3.2 Analysis Phases

The system's requirements are defined in depth at this phase. During the process, system users are interviewed to determine what they anticipate from the system [9]. To begin, a Google Form questionnaire was disseminated on social media sites such as the Kedah Hikers group to collect data on the functionality required by the general population. The technological way of assessing and creating the proposed application is Object-Oriented Analysis and Design (OOAD).

3.2.1 Questionnaires

The information was gathered from 25 respondents. From the data collection in questionnaire, it shows that most of the respondents want to have GPS tracker feature in the proposed application. All of the respondents agree that it is appropriate to use a SOS alert system to send distress signal with GPS tracker if the hikers lost connection for long time with their own reason.

3.3 Design Phases

Basically, the initial characteristics and operational functions of the entire system are determined during the design phase. Because basically all ideas will be transformed into reality constructions in the statistical stage. User interface and database design are included in this stage. During design phase, the proposed application is designed using Wire frame.

3.4 Implementation Phases

The implementation phase begins once the proposed system has received user acceptance. The Android Studio IDE were used to construct the Smart Safety Hiker mobile application, which employed Java programming language for the back-end user side. The front-end system, on the other hand, is designed using Android Programming. Firebase is used to configure the proposed system, which includes fully specified security and recovery methods. In addition, a rudimentary system prototype will be created at first to allow the user to test and provide comprehensive feedback.

3.5 Testing Phases

One of the most important procedures in the Software Development Life cycle is testing (SDLC). The application development life cycle testing steps aid in identifying any flaws and defects in the program. User acceptability testing was also carried out to provide users the opportunity to review and engage with the planned application. Tester will leave review on the system bugs and errors to check the system reliability [10].

4. Results and Discussion

This section discusses the results and discussion of the project, which are the system analysis and design, implementation, and system testing results.

4.1 System Analysis and Design

A system's architecture represents how it is thought about in terms of its structure, functions, and linkages. It specifies the interconnections of all system components as well as the data link that connects them [11]. This section will show the system architecture diagram, use case diagram, activity diagram, class diagram, and user interface design.

4.1.1 System Architecture Diagram

Figure 3 depicts the system architecture diagram, which abstracts the interactions, restrictions, and boundaries between software system components. It gives a comprehensive picture of the software system's physical deployment and development road map.

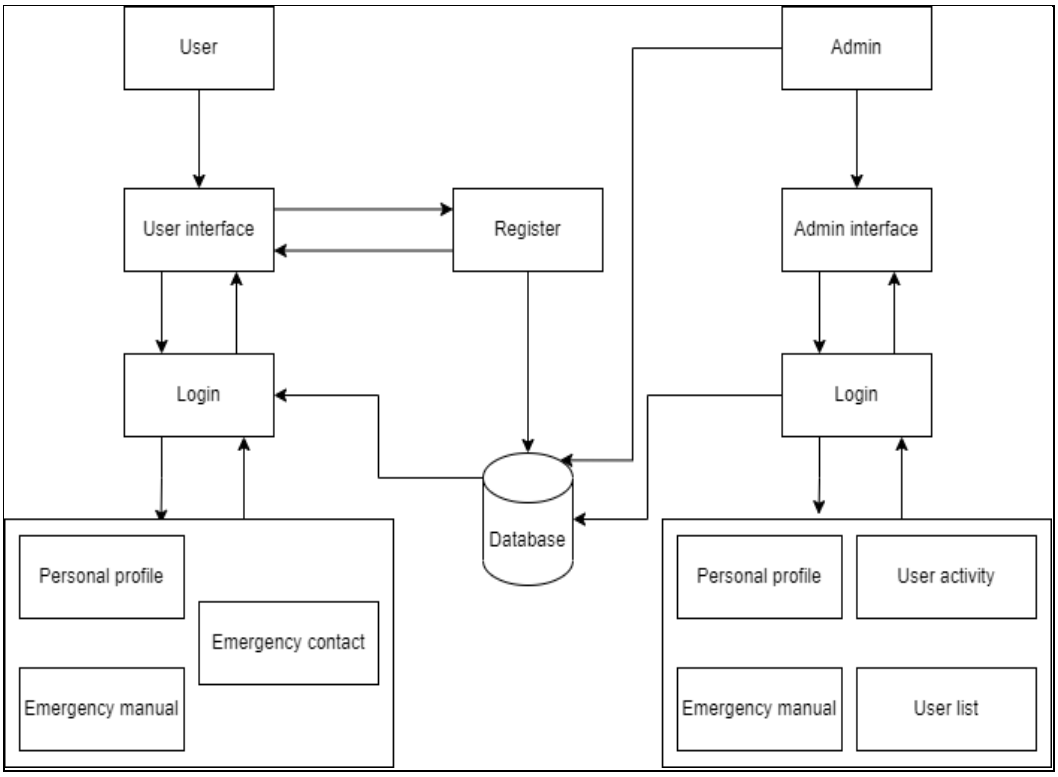


Figure 3: System architecture diagram

4.1.2 System Requirement Analysis

Requirements analysis refers to the process of analyzing, documenting, validating, and managing software or system requirements. Table 2 shows the functional requirement of the proposed application.

Table 2: Functional requirements

Function	Requirements
Register	User can register as a new user to the application with a valid email address, username, and password.
Login	Both user and admin can login to the application with a valid username, and password.
Profile update	Both user and admin types can edit and save their personal information.
Emergency contact	User can add, delete and edit multiple emergency contact.
Emergency notification	User can send emergency notification with current location to admin.
Timer	User can set and delete timer for sent the emergency notification.
Emergency manual	User can view emergency manual that can guide user to handle emergency. Admin can add and update the emergency manual.
User list	Admin can view user list that register on the application.
User activity	Admin can view user activity log on the application.

4.1.3 Use Case Diagram

The use case diagram depicts the user's interaction with the system. A use case diagram is useful for modelling, specifying, and reporting an element's behavior. Figure 4 shows the interaction between the user and the administrator with the program. It demonstrates the functions that the user and

administrator can conduct. The user can register, login, update account, set emergency contact, send emergency notification, create timer, view emergency manual, and logout, whereas the administrator can login, update account, view user list and user activity log, and logout.

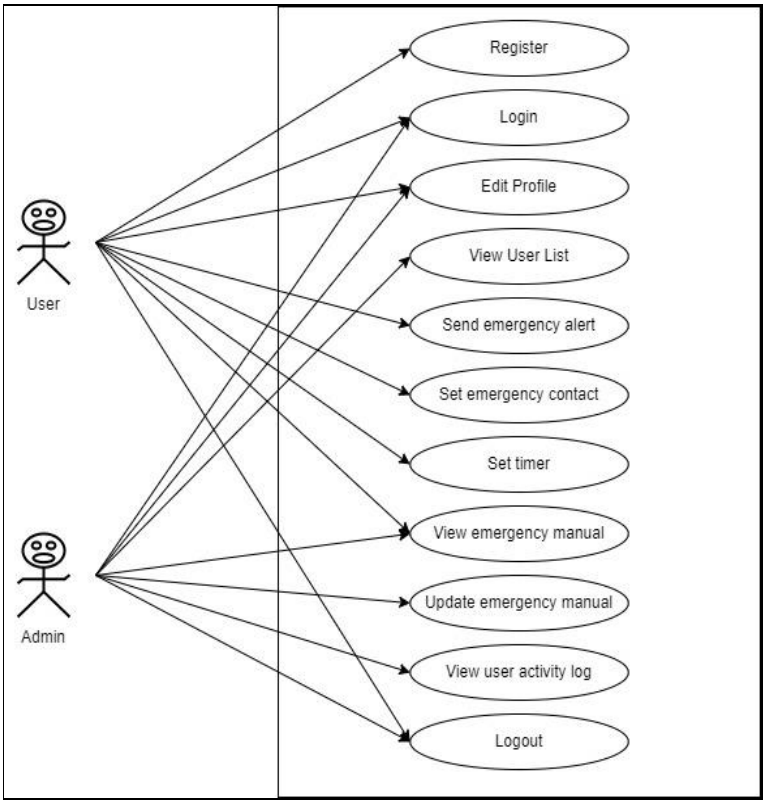


Figure 4: Use case diagram for proposed application

4.1.4 Activity Diagram

Flow charts are used in activity diagrams to show the steps of one operation to another operation. Activity diagram is to describe the dynamic behavior of the system. There two activity diagrams for this application since there are two user type: user and admin. Figure 5 shows activity diagram for user and Figure 6 shows activity diagram for admin.

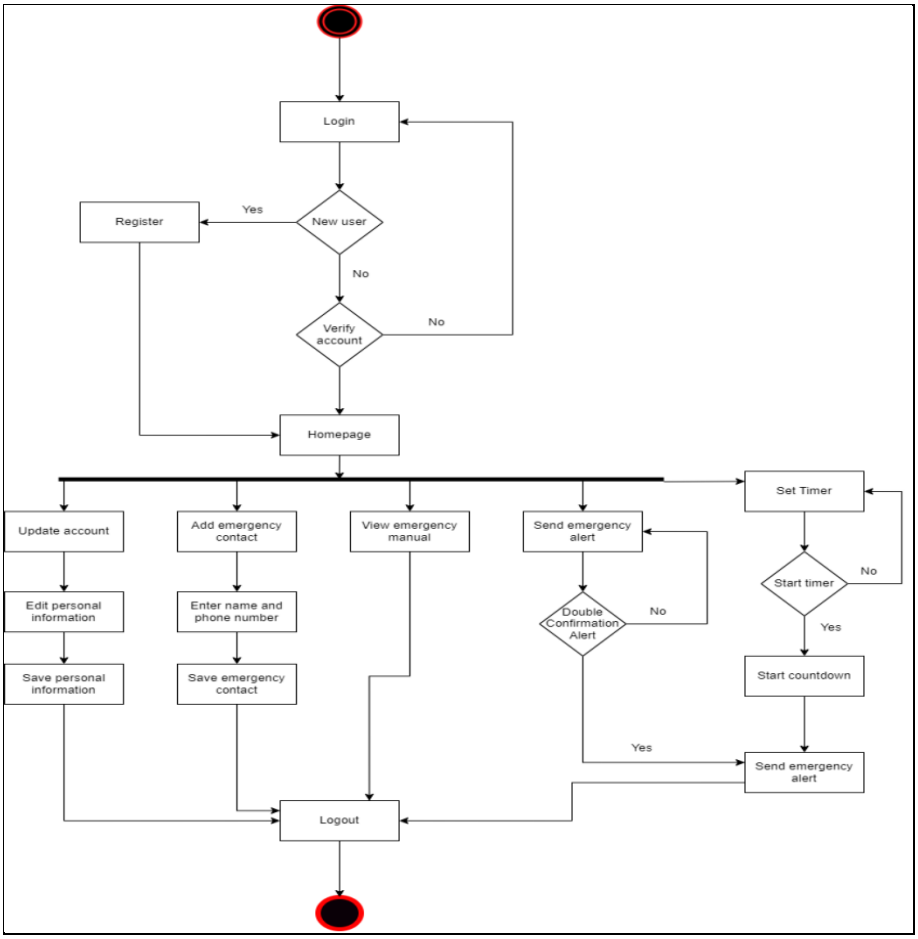


Figure 5: Activity diagram for user

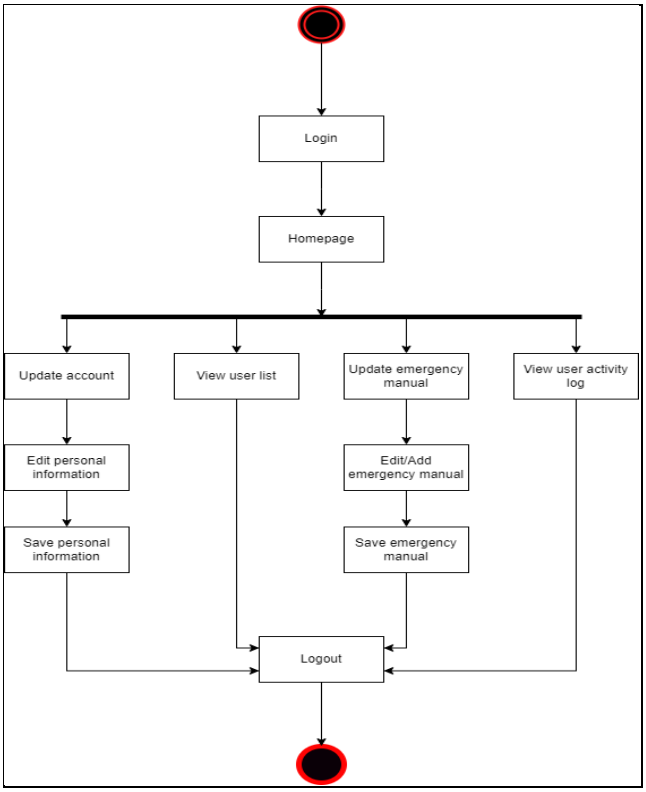


Figure 6: Activity diagram for admin

4.1.5 Class Diagram

Class diagrams are schematics of a proposed system or subsystem. The class diagram's role is to represent the objects that comprise the system, to depict the relationships between the items, and to describe what those objects perform and the services they offer. There are five classes involve in this diagram and from the user's class will separate in to two access levels: hikers and administrator. Figure 7 shows the class diagram for proposed application.

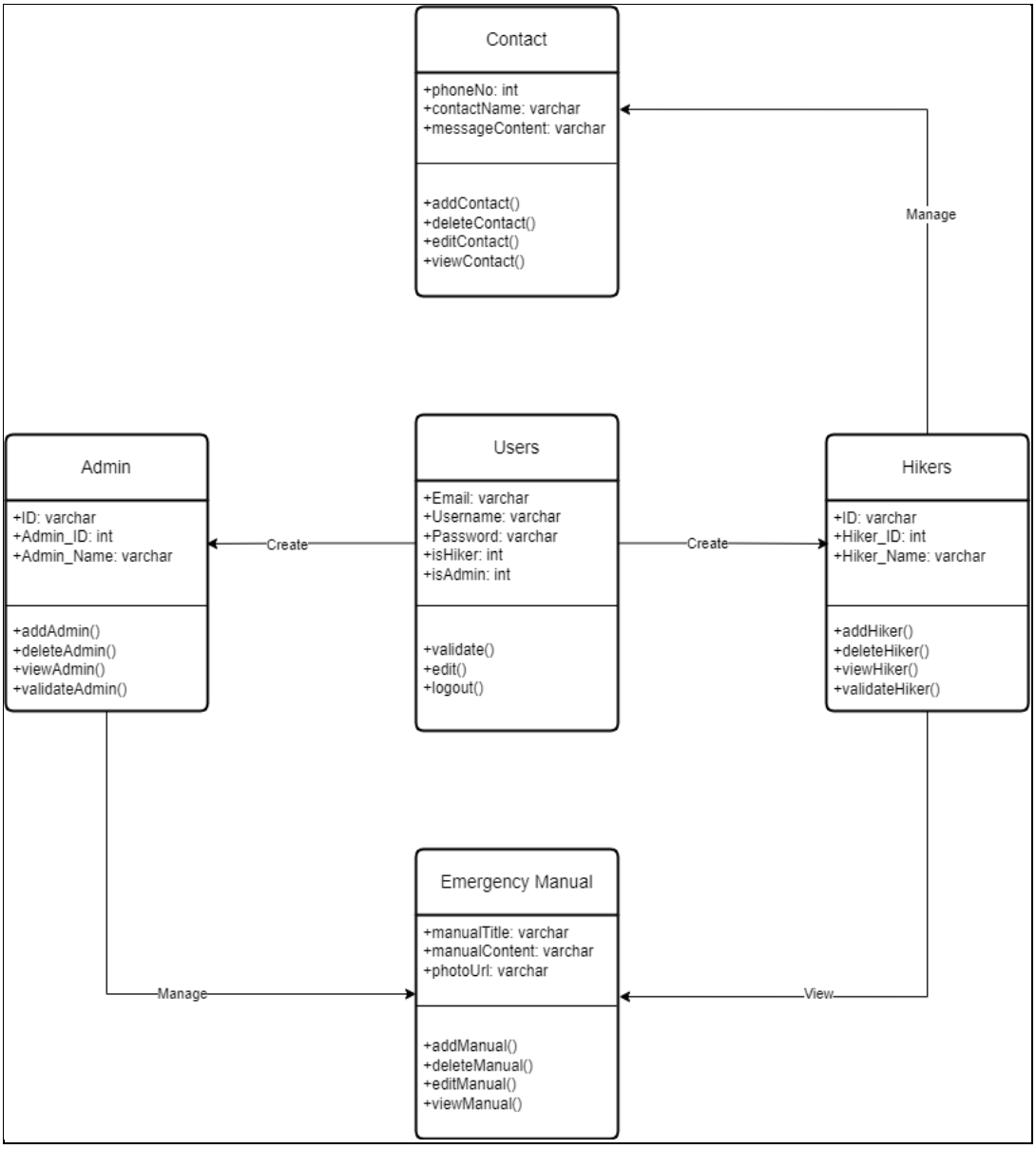


Figure 7: Class diagram of proposed application

4.1.6 User interface design

Interface design is concerned with how a design presents content to the user so that the user can get the material required to perform a function. It is critical to follow this approach attentively in order to create a decent application that runs smoothly. A wire frame is a low-resolution design layout that shows the features of the page that will be shown. Figure 8 shows the user interface for user side. Figure 10 shows the user interface for admin.

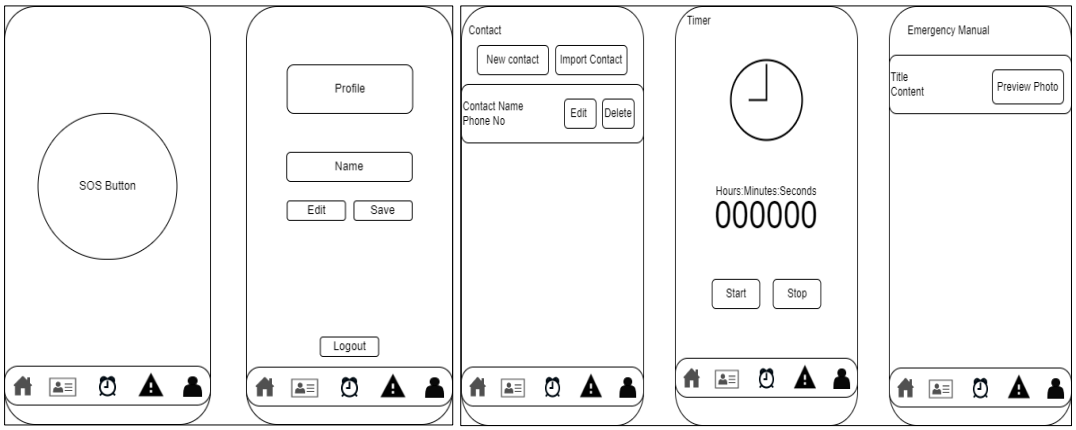


Figure 8: User interface

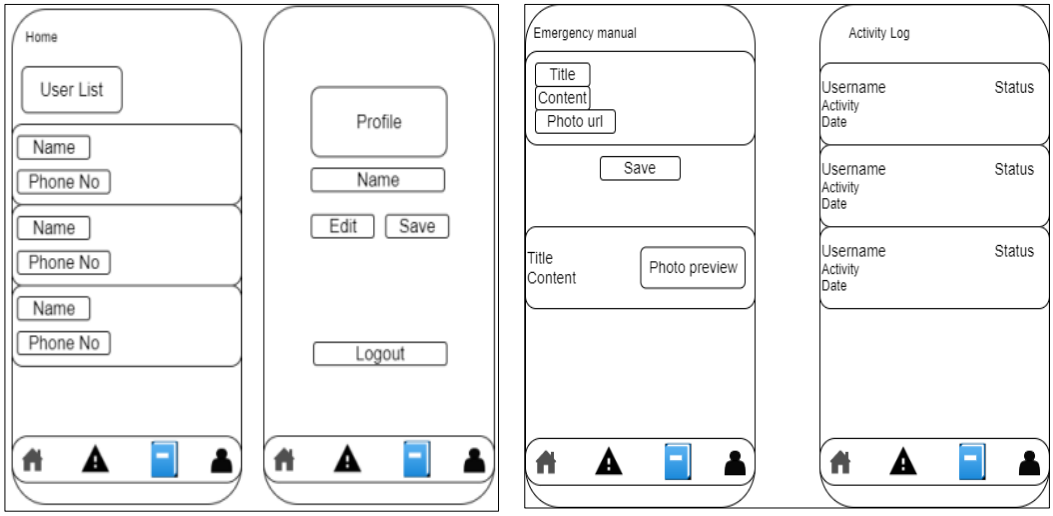


Figure 9: Admin interface

4.2 Implementation of user management module

The design's logical extension is the implementation phase. For the back-end user side of the Smart Safety Hikers application, Java programming is utilized, while XML and Android programming are used to construct the front-end system. Firebase SDKs are installed to link the system to Firebase Firestore and login authentication. Firebase Cloud Firestore is selected as the database for this proposed application. Firebase also provides authentication services in the mobile application to authenticate the user by creating the users' account using a email address and password. The dependencies need to be declared as shown in Figure 10. Users may generally manage their information using the user management module, which includes registration, login, logout, update user profile, update emergency contact, set timer, sent emergency alert message and emergency manual.

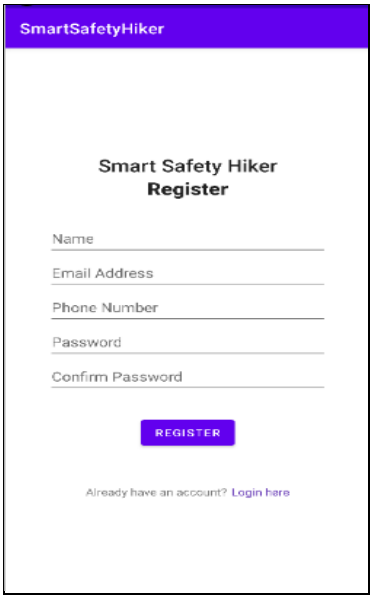
```
dependencies {

    implementation 'com.google.firebase:firebase-auth:21.1.0'
    implementation 'com.google.firebase:firebase-firestore:24.4.1'
```

Figure 10: Dependency declared for Firebase Cloud Firestore Android and Authentication

4.2.1 Register & Login module

Figure 11 shows the register page of the application. To establish an account, users must provide their username, email, phone number, and password as indicated in the picture. The user may also access the login page by clicking the "Login here" button. The user or admin can login to the application by input their email and password. User can click the button “Create a new account” button to register page and register for a new account. Figure 12 shows login page of application.



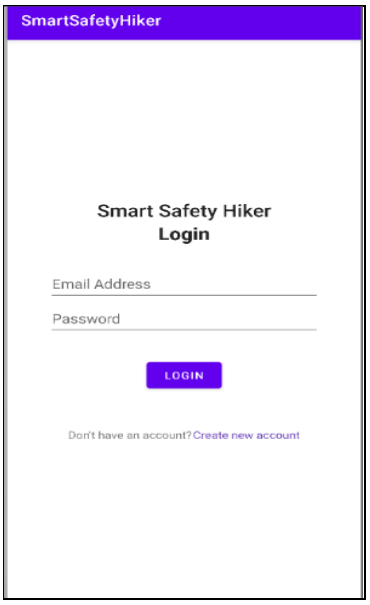


Figure 11: Register page of application

Figure 12: Login page of application

4.2.2 Profile module

Figure 13 shows the profile page of the user and admin. The username will be auto filled up by the application. Both admin and user can edit and update their username in the application.

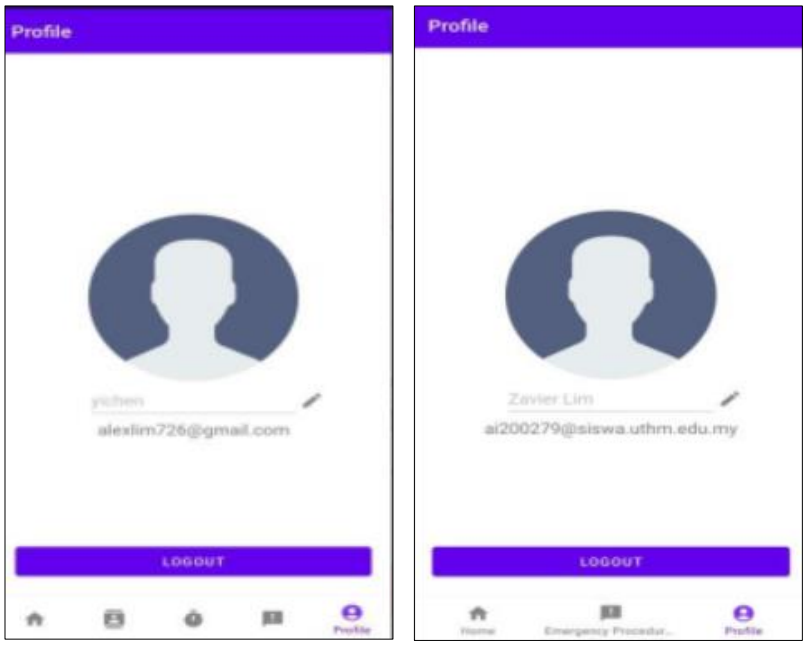


Figure 13: Profile page for user and admin

4.2.3 Emergency alert module

Figures 14 depict the application's emergency button page. When the user presses the emergency button, an alert message appears, it will shows a 5 seconds count down for user withdraw to send a emergency distress message. The withdraw alert message function is avoid the user accidentally press the emergency button. If the user selects the "Cancel" button, the emergency notification will not sent out else the emergency alert message is sent to all contact in the emergency contact list. Figure 15 shows the page when emergency message sent out.

Figure 14: Emergency button page

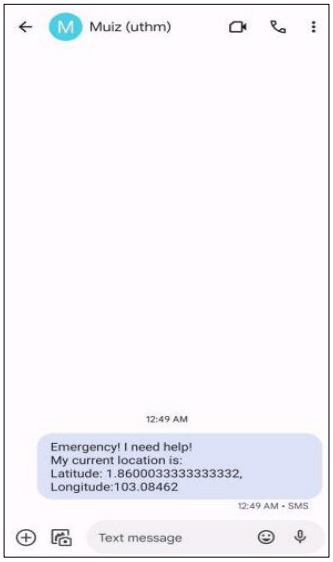


Figure 15: Emergency message sent out.

4.2.4 Emergency contact module

Figure 16 shows the application's emergency contact page. By clicking on the new contact button, the user may add an emergency contact. After added the contact, user can click the pen icon to edit the person's name, phone number and emergency alert message in the saved contact. Figure 17 shows edits contact page.

Figure 16: Add contact page

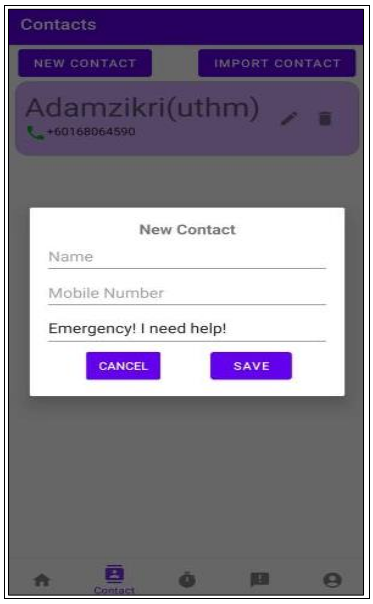


Figure 17: Edit contact page.

User can also import the contact from the phone device by clicking the “Import Contact” button. Figure 18 shows the application ask for permission to import contact from device. The application required the user permission from phone to import the contact.

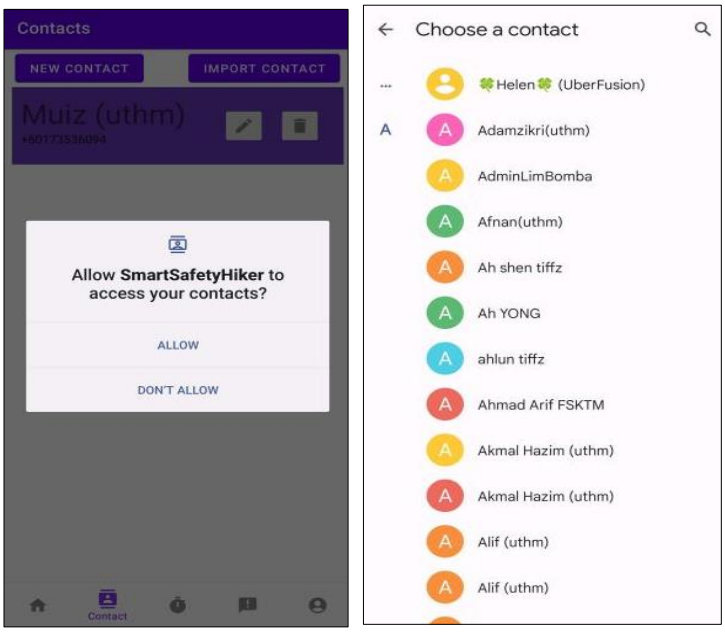


Figure 18: Import contact from mobile device

4.2.5 Timer module

Figure 18 shows the timer page. Users need to input a specific time for them to reach the destination. If the timer will start countdown after user click on the “start” button. When the countdown timer started, user can click the “stop” button to stop the timer. After the countdown timer finish and user does not reach the destination, the application will automatically send the emergency alert message to user’s contact.

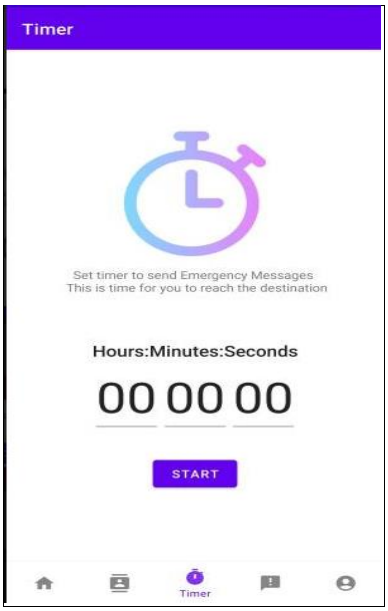


Figure 18: Timer page for user

4.2.6 Emergency manual module

Figure 19 shows the emergency manual page. User can click and view the emergency manual added by admin. It will display photo and description that guide user to handle emergency like injured. Admin can add, edit and delete the user emergency manual. Admins need to input title, description and photo URL to create a new emergency manual. Admin can edit the emergency manual by click the pen icon and delete the emergency manual by click the trash-bin icon. Figure 20 shows admin emergency manual page.

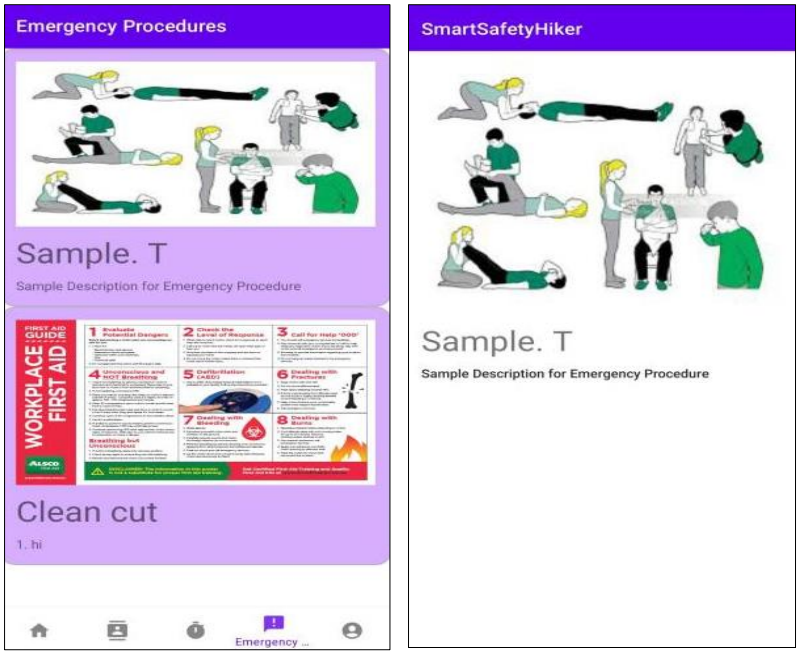


Figure 19: Emergency manual page at user side

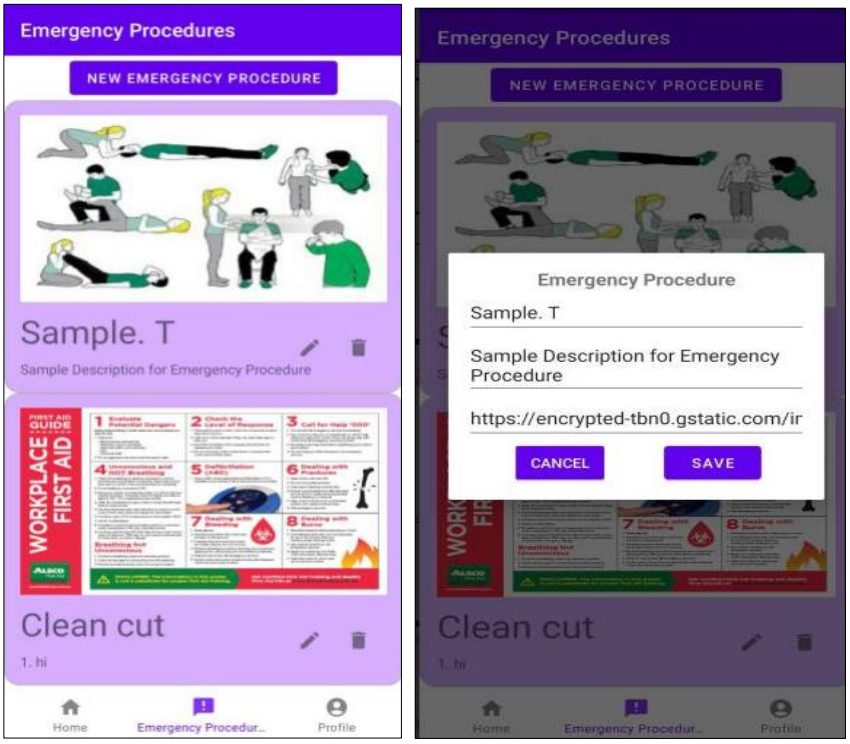


Figure 20: Emergency manual page at admin side

4.3 System testing

System testing is a sort of software testing that is conducted on an entire integrated system to ensure compliance with the applicable criteria. The suggested application's features and functionality will be evaluated using functional testing in this project.

4.3.1 Functional testing

Functional testing is an application testing technique that focuses on verifying the functional requirements of an application. It involves testing the system's behavior and functionality by evaluating its features, inputs, and outputs. The purpose of functional testing is to ensure that the application functions as intended and meets the specified requirements. Table 3 shows the result for functional test.

Table 3: Functional Testing

Function	Test Case	Expected Output	Result
Login/Logout	Inputs correct email and password.	User able to login based on the correct email and password	Pass
	Inputs incorrect email and password.	An alert message display, user is required to input the login credentials again.	Pass
	Logout	Redirect to login page.	Pass
Registration	Inputs username, email, phone number, and password to register	The account is created successfully.	Pass
	Inputs invalid data or leave a blank on text field	An error message show and require user to input again their data.	Pass
Update Profile	Update username at profile	User latest username will display	Pass
Emergency button	Click on emergency button to send alert message.	A confirmation counts down message is prompt out. Alert message sent.	Pass
	Click cancel button before the emergency alert message sent out.	The emergency message does not send	Pass
Emergency contact	Add contact	An emergency contact is added successfully	Pass
	Import contact	Access to contact is enabled and user can import contact from mobile device.	Pass
	Update contact	User can edit and delete the contact	Pass
Countdown timer	Input a specific time and start timer.	Timer started countdown and an emergency alert message sent after the countdown timer finish countdown	Pass
	Press stop button when countdown timer is running	Timer stops when user press the stop button and reset to the specific time	Pass
Emergency Manual	Create an emergency manual.	An emergency manual is created, and user can view the emergency manual.	Pass
	Update emergency manual.	User can view the latest updated manual.	Pass

4.3.2 User acceptance testing

User Acceptance Testing (UAT) is a type of testing in which the end-user or customer checks and accepts the software system before it is transferred to production. UAT is the ultimate level of testing after functional, integration, and system testing. Due to scheduling constraints, only 15 participants participated in this testing. Following the collection of data from the user, the output is assessed and presented on a graph. Figure 21 and Figure 22 shows the results charts.

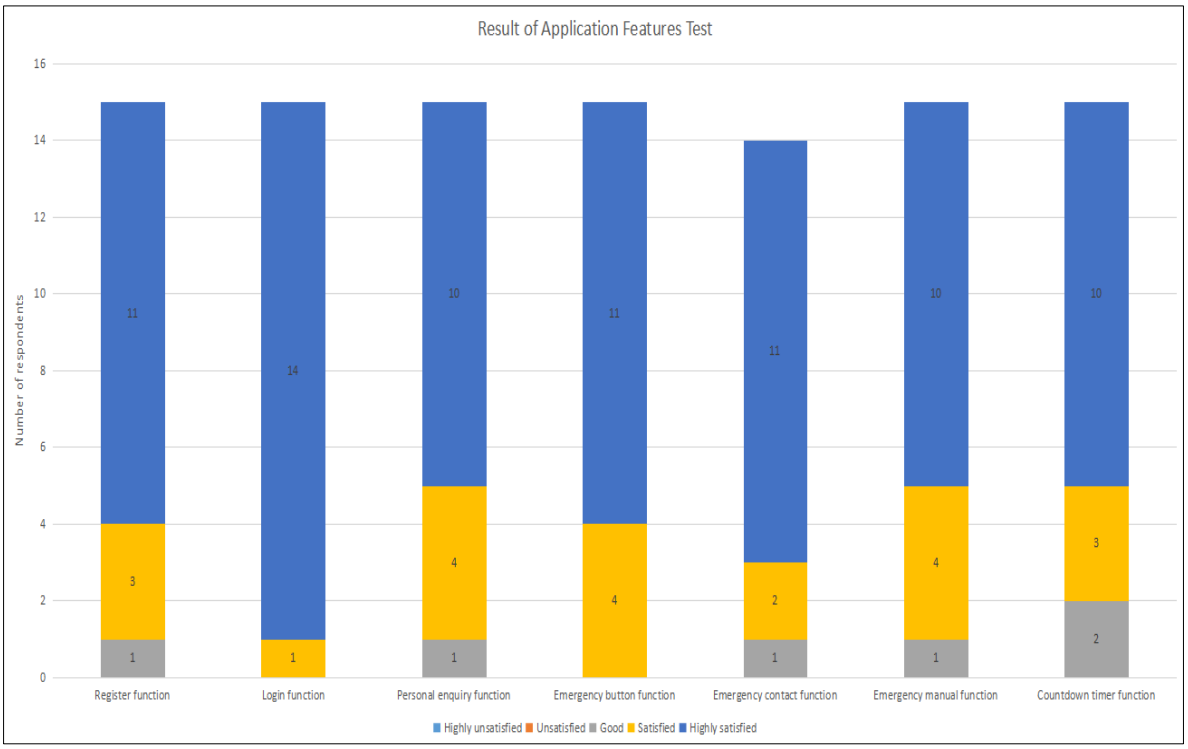


Figure 21: Result of application features test

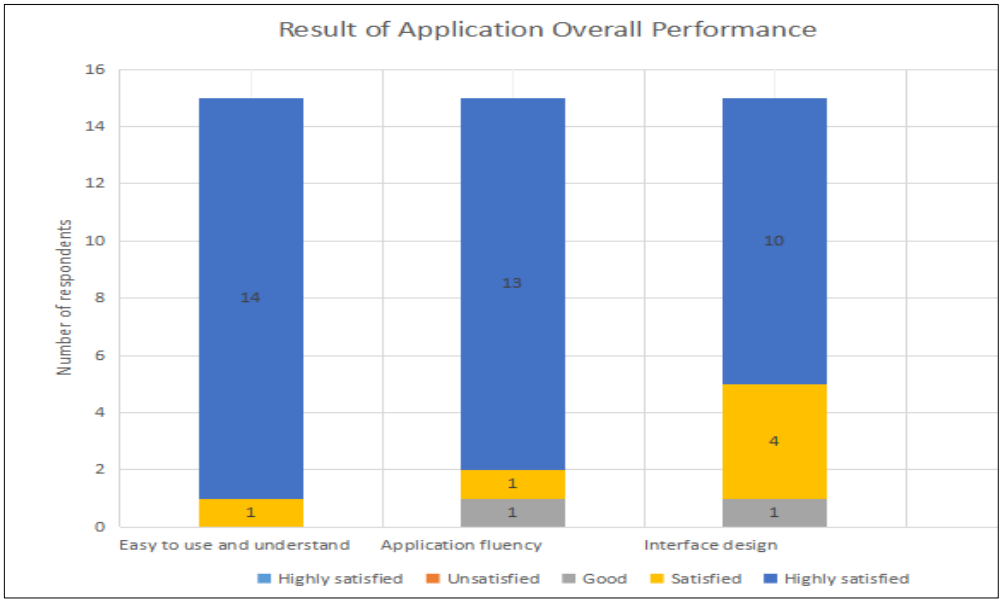


Figure 22: Result of application overall performance test

5. Conclusion

In a conclusion, the Smart Safety Hiker application will be one of the useful applications that may send an emergency alert message with the current position to one or more recipients during an emergency circumstance by just pressing a button in the application. The alert message with the location coordinate will be delivered to the receiver. This program also has a countdown timer function. It has two user types, and most modules may communicate with both the user and admin sides. This mobile

application's concept is simple and dependable. Furthermore, this application is intended for hikers who are exploring Gunung Keriang.

Improvement may be accomplished by examining the application's benefits and drawbacks utilizing the system's advantages and investigating additional options to remedy the weaknesses. To begin, a more accessible location method should be created in the alert message to allow recipient to quickly find the location of the user. A smarter setup for countdown timer should then be included in the future. The push notifications and reminders are also considered a function for users as it would be beneficial in reminding them about their countdown timer made. Although the application has certain limitations, more significant efforts should be made to overcome those constraints and expand it with more functionalities to best help the public in the future.

Acknowledgment

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