

Original Article

Development of Mobile Based Flood Victims Medical Management System

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Abstract - Flood is the most devastating natural disaster Malaysia has ever seen. In Malaysia, including Sabah and Sarawak, there are 189 river basins (89 in Peninsula Malaysia, 78 in Sabah, and 22 in Sarawak), with the main rivers flowing directly into the South China Sea and 85 of them are prone to repeated floods. The projected area vulnerable to flood catastrophe is around 29,800 km² or 9% of Malaysia's total territory, affecting nearly 4.82 million people or about 22% of the country's entire population. Humans are affected by floods in a variety of ways. Floods have the worst effect on human health because infectious illnesses spread readily during and after the flood. Furthermore, healthcare services are hampered during the flood season. It is owing to transportation and staffing difficulties, as well as the procedure of documenting flood victims' health reports. The primary goal of this initiative is to assist flood victims in terms of health. It will be easier to seek treatment, record the patient's health concerns online, and notify the hospital immediately if there are patients who need to be sent to the hospital with the information supplied. This system was created with the Android Studio platform as the user interface medium and Google Firebase as the data storage medium.

Keywords - Android studio, Flood victim, Google firebase, Medical management, Mobile apps.

1. Introduction

Floods are a common natural occurrence in Malaysia. Floods happen practically every year, especially when the monsoon season changes. However, floods happen at various times in other areas with the same rainfall intensity. In a nutshell, floods can occur in areas with varying rainfall patterns (i.e., depth, duration, intensity). Furthermore, floods may occur at the same site with the same amount of rainfall. Floods have many consequences for people, including the danger of injury or death, power outages, and forced company closures.

Furthermore, services such as hospitals and schools may be shut down, and transportation networks, such as bridges, trains, and roads destroyed by floods, may be interrupted. The major consequence of the flood on the population is that it may drown houses and properties, causing citizens to relocate until the flood damage is rectified.

During the Malaysian Floods in the Shah Alam area, the main communication between the medical and emergency team and the victims was simple chat

applications and social media such as WhatsApp, Telegram, and Facebook, as well as filling out forms manually. The application is unreliable in content authenticity; for paper documentation, it is easy to lose important information. It will result in aid delays and food delivery to the victims. So, with the development of this system, it can collect data more easily, and communication between the medical and the victim will be easier. Includes communication of information between the medical team at the temporary placement centre and the hospital itself.

Mobile applications generally offer the same functions as those on PCs. Users, on the other hand, prefer mobile applications to mobile websites, according to studies. This is a strong case for creating a mobile app to connect new (and existing) users. As a result, the mobile era has begun. Users of mobile devices now outnumber those using desktop computers. Users can benefit from a more appealing UI in mobile applications. Notifications may also be sent more conveniently using mobile applications. Push notifications and in-app notifications are the two forms of notifications. Both options are intriguing for engaging with app users less obtrusive manner. A well-designed mobile application may do tasks more quickly than a website.



This system will focus on obtaining health information from patients, making appointments with doctors at a temporary placement centre, receiving treatment, and recording information such as the care provided and if the patient needs to be sent to the hospital. Mobile applications, generally called applications, are software that runs on mobile devices such as smartphones or tablets.

Many organizations rely on paperwork for every job transaction, such as invoicing and collecting various data information. A manual paper data management requires a lot of transparency in managing a growing number of documents. There are some disadvantages to why manual documentation must be changed into digital management documentation. Firstly, paper documentation may take up a lot of space that should be usable for other needs, as well as documents, which are increasing daily. In addition, paper documents should be nearby to make it easier to retrieve them.

Besides, security issues are critical for organizations in safeguarding information and assets. Paper is a common problem in an organization. It is because the paper is more easily lost, mistreated, and even destroyed, but digital data be protected and safely stored in the database. Lost, destroyed, misplaced, or even stolen manual documents often occur in the workplace. Fires or natural disasters can also cause the loss of important data of an organization. Without a support plan, all data and information will not be recoverable. It will affect many organizations, especially victims when they must provide the same information again while in trouble themselves.

The next problem is the transportation problem. Data transportation will be more difficult, slow, and inefficient in data management through manual paper. Using an application or web-based system will make all files or information you want to convey easier while using app notification. During the floods, all the victims in the temporary accommodation centre will have difficulty receiving medical assistance from the hospital. And information about their health is difficult to record, and doctors find it difficult to record what has been done to patients due to a lack of facilities such as writing tools and documentation. Finally, the limitation of collaboration is one of the reasons for this project. Collaboration is exceedingly tough when dealing with papers. Suppose multiple users or organization heads need to generate shared information. In that case, the users must print many copies, or when a change of information is needed, they must print it again. Users can deal with various parties more easily and quickly if using a digital management system, and the user may also keep track of all the adjustments that have been done.

2. Literature Review

Early response to flood emergencies is very important to minimize flood risk and its impact. However, it is not easy to develop the best flood emergency plan. Next, it is important to understand the existing research and discussions related to a particular topic or research field that facilitate developing a suitable system for the project.

The role of the Malaysian government's delivery system for flood victims before, during, and after the storm has been described in [1]. The flood management service delivery system is based primarily on an official plan that emphasizes deploying innovative technologies in flood control, forecasting, early warning, and evacuation systems. The official strategy uses modern technologies in flood management, forecasting, early warning, and evacuation systems based on a technology-centric approach. Due to the negative effects of the flood, it needs close attention and adopts alternative methods to reduce these disaster effects [2]. In Malaysia, flood disaster management consists of four stages: prevention/mitigation, preparations, response, and recovery.

Many disaster management applications exist in different countries and Malaysia [3]. The Thai government has used flood management processes and flood victims' experiences in Central Thailand's Chai Nut province to develop knowledge about the future handling of these disasters [4]. The government has supported electricity services, food and water, toilet and health services, and water drainage. Victims must invest funds, job opportunities, children's books, extra time to repay loans, reconnect electricity, loss investigations, and pensions in recovery.

Besides that, [14] had established the current situation regarding citizen science, crowdsourcing, and flooding and reflects future directions in this area. This article aims to develop an automatic flood detection, online reporting mobile app, and damage assessment. Additional development of flood reporting applications and automated flood detection systems will generate useful data for model validation. In Turkey, e-government" tries to identify risk areas through geographic analysis before natural disasters [5]. The other purpose of this project is to manage emergency and effective support services during and after a disaster. [6] expected the real potential of GIS technology for spatial data management, including real-time (moving object) data for ER units, can impact the quality of service of the system.

The early warning system aims to alert people to imminent natural disasters so that vulnerable people are aware of the potential impact of natural processes to respond appropriately and minimize damage [7]. So, the victim can prepare in advance, such as moving the goods to a safe

place if there is an early notification through the system. Next, [8] developed the Flood Information and Notification module aims to provide early warning to the public about possible flooding.

Data obtained from the Department of Irrigation and Drainage Board (DID) can also be used to provide flood-related information, such as rainfall and river levels. Relevant information, such as nearby shelters or routes, is displayed on the map to help victims get to a safe place. The second module is designed so that the rescue team can determine the victim's whereabouts after receiving an emergency message sent from the victim. Mobile phones are the devices we have with us all the time, so Mo-FA can be the perfect tool for providing a variety of flood-related information and a quick way to communicate information to the public and rescue teams.

The role of the flood-affected community is no less important. Awareness and response to flood disasters are essential to minimize the negative effects of disasters [2]. Therefore, communities need to be aware of flood management, especially how and what to prepare for floods and respond in the event of a flood.

2.1. Database

A system called "Android Application for Collaborative Mapping in Emergency Situation" was developed by [11], which creates the map cooperatively, and communicates the situation in the field when loading multimedia files based on cloud platforms function as a tool for fire departments and other emergency workers to make it possible. Real-time data synchronization support. Instead of flood systems, the emergency allocation flow must be in the current project. Mobile Flood Assistant (MO-FA): Assisting Flood Victims with Mobile Technology has presented the features and architecture of mobile technology to support flood victims and rescue teams [8]. The purpose is generally to provide early warnings for information modules and flood notifications. The system also uses data from irrigation and drainage units to provide information related to the flood, such as rainfall and water level (HID).

Mo-Fa was developed to have the following two (2) modules and sub-modules:

1) Flood Information and Notification Module

a) Flood Information

- Provide flood-related information from relevant authorities such as the DID and MetMalaysia.
- Provide instruction and advice to flood victims.

b) Early Warning

- Send a warning message as an early warning to the public on possible flood occurrence via SMS notification.

c) Evacuation Center

- Display evacuation centres within the vicinity.
- Show route to the nearest evacuation centre.

2) eSOS Module

- a) Enable flood victims to send SOS messages to authorities.
- b) Enable search and rescue team to locate victims.

In addition, [6] created a system to delete incorrect information, incomplete data, and overload information from database management systems (DBMS) sent to users. The researcher describes the use of emergency comprehensive routing application responses. Context-Aware built-in unit.

Besides that, the overall framework of this study is the effectiveness of early warning in reducing flood risk in vulnerable communities [7]. Within this framework, it was focused on four areas that were part of the concept of a total flood warning system, namely:

- Knowledge of the risks faced.
- Technical monitoring and warning service.
- The dissemination of warnings to those at risk.
- Public awareness and preparedness to act.

Alert writers need to learn more about how the community views risks and the reasons behind their actions when floods threaten them. It must also empower communities to play an important role in disseminating information before flooding. In addition, regarding the victim early warning system, [12] stated that strengthening early warning systems and disaster response capabilities are essential to minimize the loss of people, property, livelihoods, and critical infrastructure in communities. The basic requirements of a prepared community are:

- Warn members of an informed and active community.
- An effective community organization is identified and plays a constructive role in local emergency management readiness.
- Local governments that have fully established broadly understood and practised systems to recognize their role and fulfil their responsibility for community safety from community safety issues; and
- Organizations and communities Can work together to respond to emergencies, seek life and property, and help communities to recover.

All the data gathered shows how critical this system is in assisting flood victims. Floods, for example, can be dealt with provided the management system is well-organized and satisfies the requisite standards. Furthermore, the most important component of this system is two-way communication and data collection. To verify the system's efficacy, every data collected will be analyzed. The order is ready for data collecting and better-coordinated handling of flood victims.

3. Methodology

A software development methodology is a method or set of methods used in software development. Again, it is very broad but includes the design and development phases. It's a different way of looking at waterfall-like phenomena as a non-repetitive process. It usually takes the form of well-defined steps. Its purpose is to define the methods of the software lifecycle.

SDLC (Software Development Lifecycle) is a framework used by development teams to build high-quality software in a structured and cost-effective style. Software companies large and small are all implementing SDLC technology. The team uses Agile Methodology as the main development lifecycle.

3.1. Methodology Used

A well-designed process will reduce error, remove redundancies, and increase efficiency. With speed, scale, and flexibility, smart workflow management software may assist you in doing this.

Given that there are six stages of the software development life cycle, as shown in (Figure 1), it is important to understand what each step constitutes and why this is important for the overall development of the product.

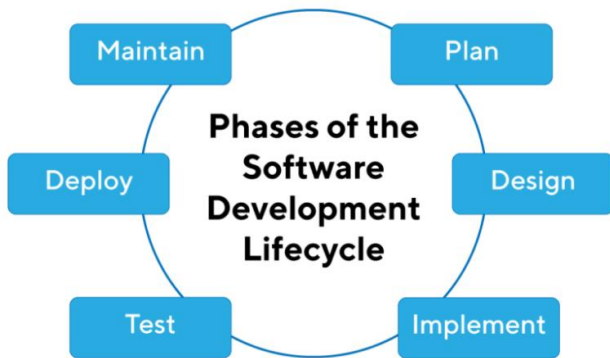


Fig. 1 SDLC Phase

Agile methodology is the most suitable for this project, as shown in (Fig. 2). Agile is a way to do some really important work. Agile teams spend hours or days creating a full project plan, where the match and inconsistencies match the implementation of the project, and instead start with a

fraction of the work, assess progress, and clear the road after receiving enough input to move along. This cycle suggestion makes they are on the right track.

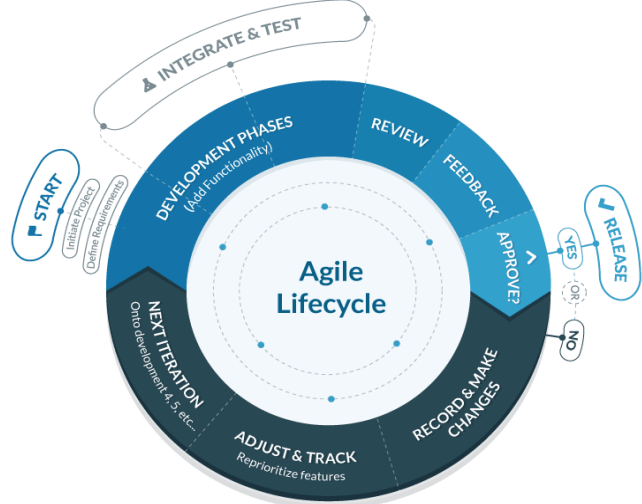


Fig. 2 Agile Lifecycle

Table 1. Software Application and Operating System

Software	Description	Version
Windows 11 Home Single Language	Operating System	Version 21H2
Android Studio	Android Studio is the official integrated development environment for Google's Android operating system, built on JetBrains' IntelliJ IDEA software and designed specifically for Android development.	4.2.1 for Windows 64-bit
Firebase	Cloud Storage for Firebase is a powerful, simple, cost-effective object storage service built for the Google scale. The Firebase SDKs for Cloud Storage add Google security to file uploads and downloads for your Firebase apps, regardless of network quality.	Firebase Android BoM (Bill of Materials) version 28.1.0
Microsoft Office	Report Writing	Office 365 2019
ondershare EdrawMax	Drawing Tool	10.5.5
Adobe Reader	Documentation	Version 2021.005.2 0048

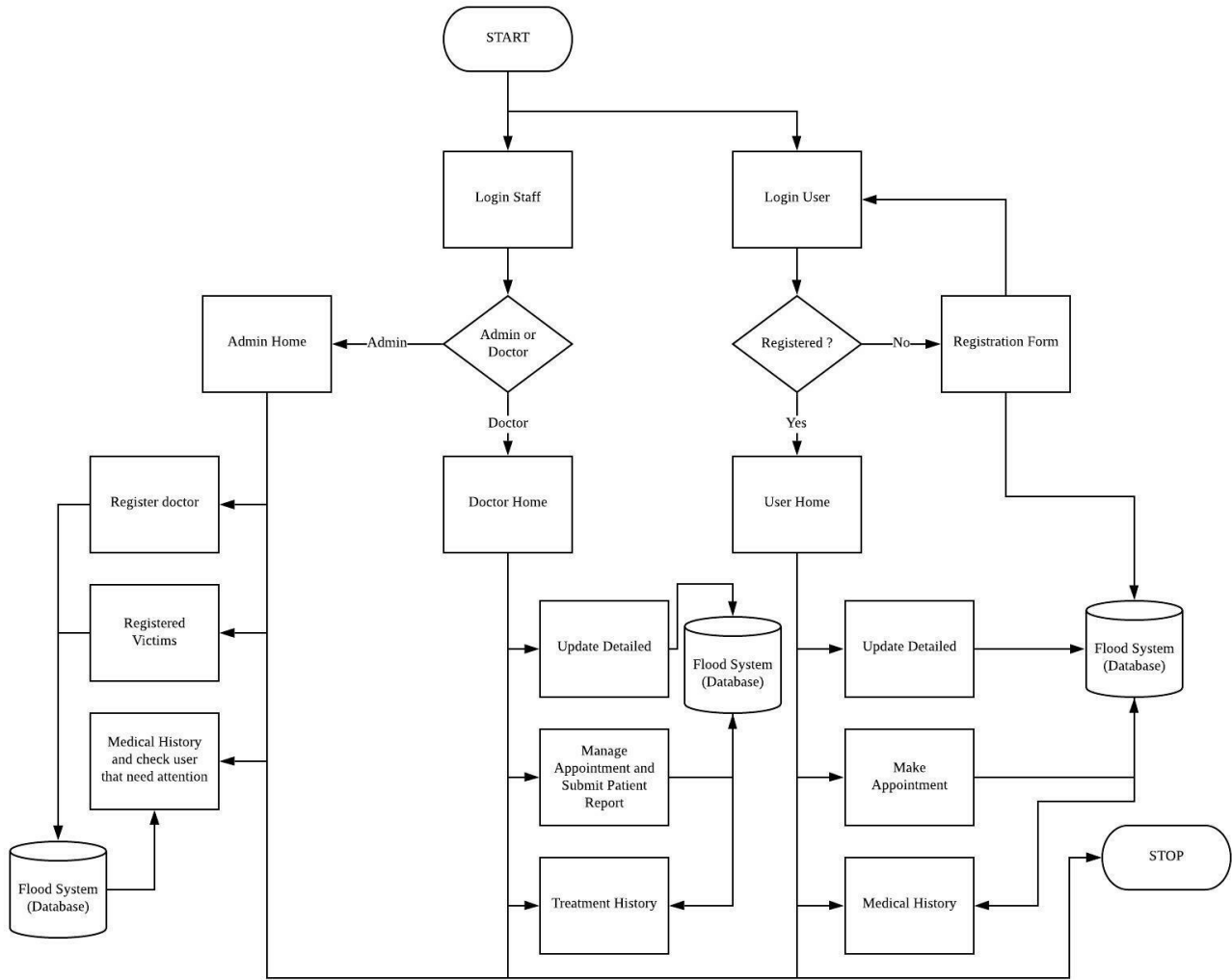


Fig. 3 Flowchart of System

From (Fig. 3), the system modules were described based on the user category, such as Staff and User.

- 1) User access level: Staff (Admin and Doctor)
 - System Module to handle:
 - Manage User – Register Doctor.
 - Manage User – Problem Solving / Health.
 - Check All Medical History.
- 2) User access level: User (Victim and Non-Victims)
 - System Module to handle:
 - Registration.
 - Update Detail.
 - Make Appointment.
 - Check Medical History.

4. Results

This system will be built from one stage to another using work planning procedure and methodology. Design and analysis will be conducted in more detail in the design phase. Each system design will be developed according to the module, such as login, insert, update and delete, as stated in the system analysis part. Each interface design will explain the input and output of the system. Database design is also included in this phase as it will ensure that every single data is inserted correctly.

4.1. Database Management

A data flow diagram in (Fig. 4) illustrates the flow of information through a specific process. It contains data inputs and outputs, database systems, and the numerous subprocesses through which the data flows.

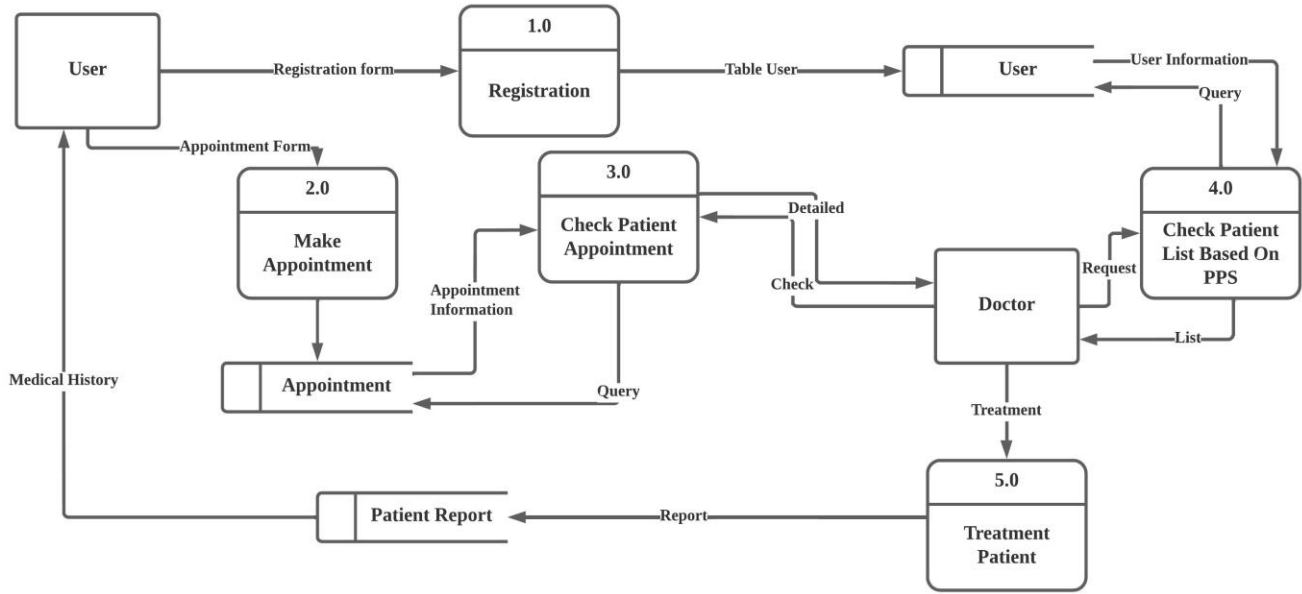


Fig. 4 Data Flow Diagram

The explanation is as below:

a) Admin Flow

- Register new PPS.
- Register doctor information to the system.
- See the current situation of every PPS in the state.

b) User

- Fill in the registration form and insert it into USERS Table.
- Users make an appointment by filling in the form and inserted to the APPOINTMENT Table.
- Users can see history by retrieving data from the PATIENT REPORT Table.

c) Doctor Flow

- Check all patient appointments detailed for the current date and select Temporary Evacuation Centers (PPS).
- If a patient doesn't have or has already missed an appointment, the doctor can retrieve it directly from the USER table based on selected Temporary Evacuation Centers (PPS).
- The doctor fills in the form of the report when assessing the patient and stores it on the PATIENT REPORT Table.
- The doctor can see history of the medical history of the patient with whom they have been treated.

(Fig. 5) An entity relationship diagram (ERD) depicts a database's relationships between entity sets. In this application, an entity is an object, a data component. An entity set is a group of entities that are comparable in a certain way. Attributes can be assigned to these entities to specify their properties.

a) Users-Appointment (one-to-one)

- Users can only make one appointment.
- An appointment is only can have by one user.

b) Users – Temporary Evacuation Centers (PPS) (one-to-many)

- Users can only be in one PPS.
- One PPS can have many users.

c) Appointment – Temporary Evacuation Centers (PPS) (one-to-many)

- An appointment can be requested on one PPS only.
- PPS can have many appointments.

d) PatientReport – Appointment (one-to-many)

- One patient can have many reports.
- One report is based on one appointment.

e) Staff – Patient Report (one-to-many)

- One staff can assess many reports.
- One report was assessed only by one staff.

Database ER Diagram (Victims Medical System)

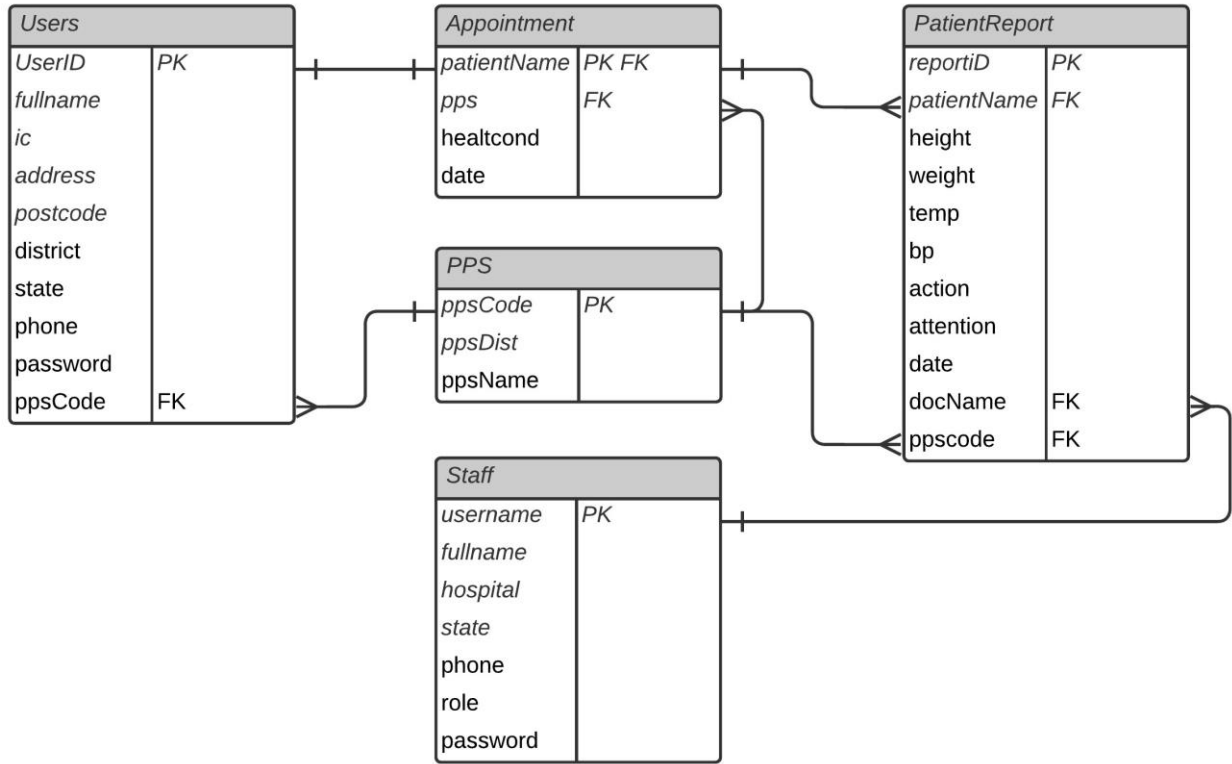


Fig. 5 Entity Relationship Diagram

4.2. User Interface

Function modules are sub-programs that contain a set of reusable statements with importing and exporting parameters. At the same time, A user interface specification (UI specification) is a document that captures the details of the software user interface into a written document. The specification covers all possible actions an end user may perform and all visual, auditory, and other interactive elements.

This part contains full implementation for this system, including database, interface, and data handling. Throughout the project, the analysis, development, implementation, and testing phases will be conducted using the requirement standard, agile development life cycle. This specifies that changes can be made if required and appropriate. This system analysis report is intended for all the project's major stakeholders: the user (patients/victims), doctors, and the hospital.

4.2.1. User

In this registration interface, users will fill in the form (Fig. 6). The registration detail will be inserted into the database. Once the users complete the registration, they can log in to the system and make it easy to make an

appointment without inserting any detail again. The user login form will request the user to insert their email and password before authenticating the data and direct the user to the main page if the data inserted matches to database data.

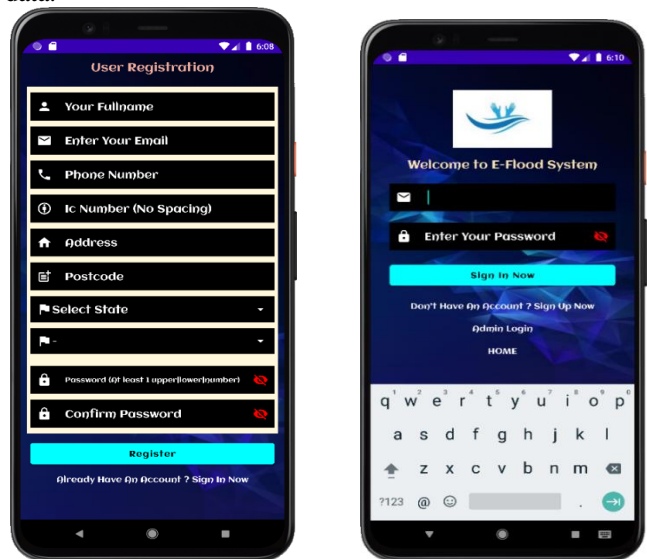


Fig. 6 User - Registration and Login Form

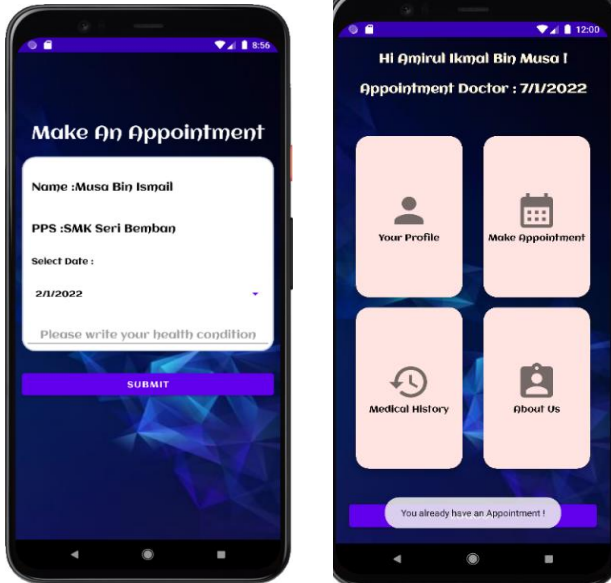


Fig. 7 User - Appointment Form

The appointment form will ask the user to select a date for the appointment, as shown in (Fig.7). After submitting data, the appointment date will be displayed on the user's homepage and restricted from making another appointment until the user meets the doctor.

(Fig. 8) shows all current user medical treatment history by retrieving it from the database and be shown to the user as information detail for that appointment. The report will appear in the list and be sorted by the newest report first.

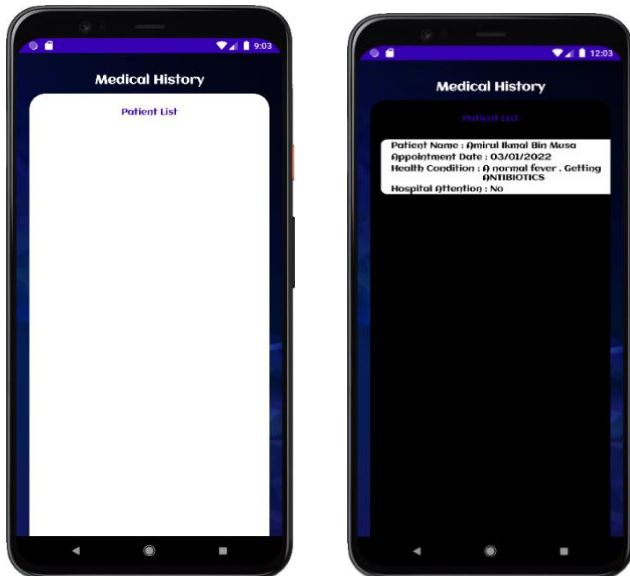


Fig. 8 User - Medical History View

4.2.2. Doctor

The list of users (patients/victims) registered in selected PPS will be displayed on the doctor's homepage, as shown in (Fig. 9) and (Fig. 10). It is a tabular view of the user (patients/victims) with details of name, ic number, phone number, and upcoming or missed appointments.

The doctors must fill the selected patient in the patient list module, as shown in (Fig. 11). The data will be inserted into database storage and updated the previous appointment. The patient can make an appointment again if needed.

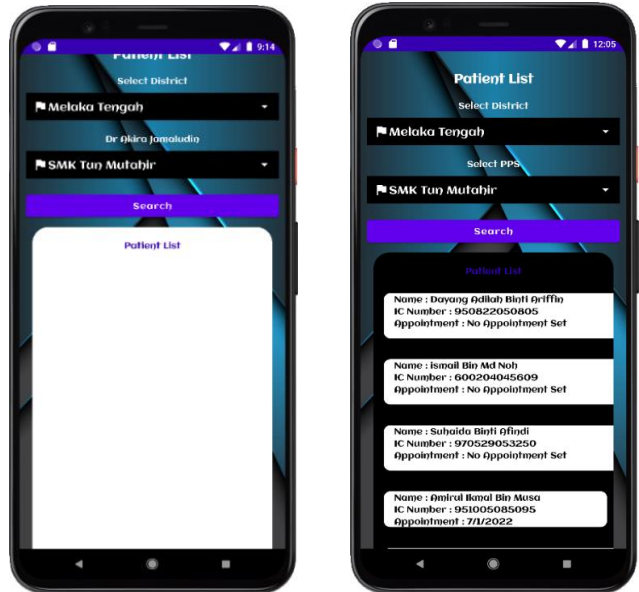


Fig. 9 Doctor - Patient List View

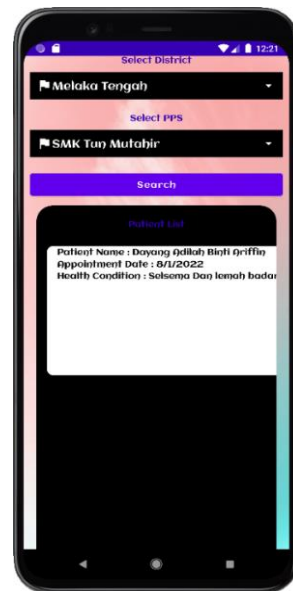


Fig. 10 Doctor – Current Patient Appointment



Fig. 11 Doctor – Report Form and Treatment History

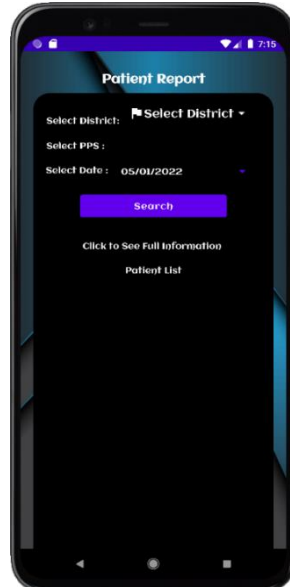
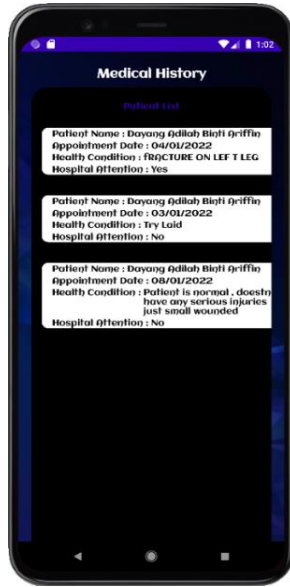
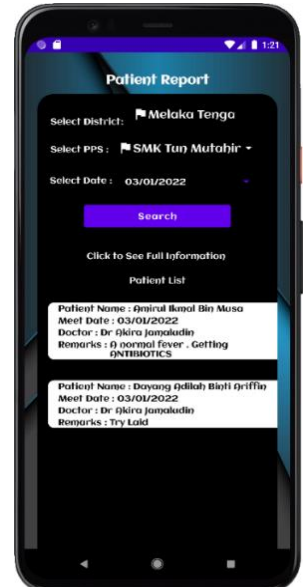


Fig. 13 Admin – Patient Report List



4.2.3. Admin Hospital

The patients that need immediate attention will be informed to the admin (hospital) immediately, as shown in (Fig. 12). It is a tabular view for the user (patients/victims) with details of patient name, meeting date, doctor-in-charge, and remarks for hospital information.

(Fig. 13) shows a list of all patients/victims that the current doctor has treated at the selected PPS and the selected date. It is a tabular view for the patient with details of name, ic number, and doctor's management for the patient. A full report will be displayed when the admin clicks on the specific patient name from the list and can be saved as a pdf file, as shown in (Fig. 14).

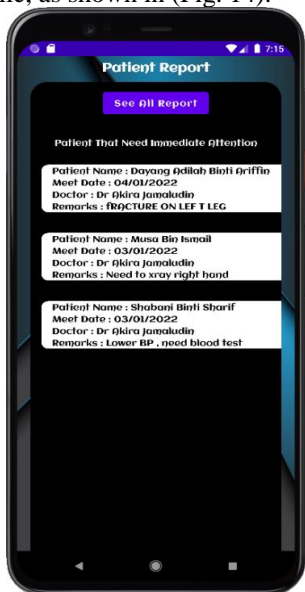


Fig. 12 Admin – Patient that Needs Attention

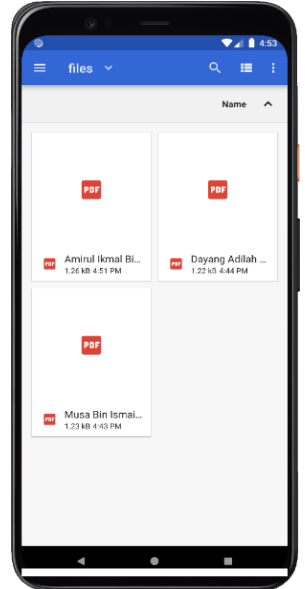


Fig. 14 Admin – Patient Full Report

The admin registered the doctors' information that had joined the flood medical support team, which will be stored in the database as shown in (Fig. 15).

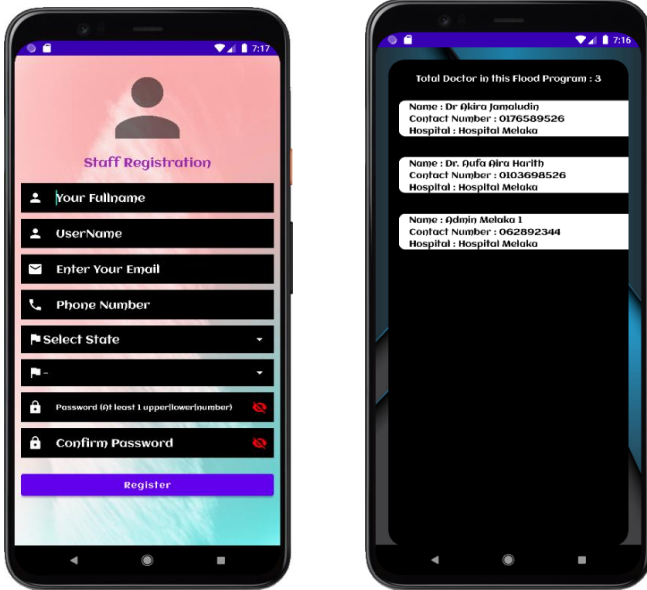


Fig. 15 Admin – Doctor Registration and List

Temporary Evacuation Centers (PPS)

PPS admin registered all the victims on that PPS into the system so the doctors can treat and submit the report for any patient (Fig. 16). The registration details will be stored in the database. Once the admin completes the registration, victims can also log in to the system and make an appointment without inserting any details.

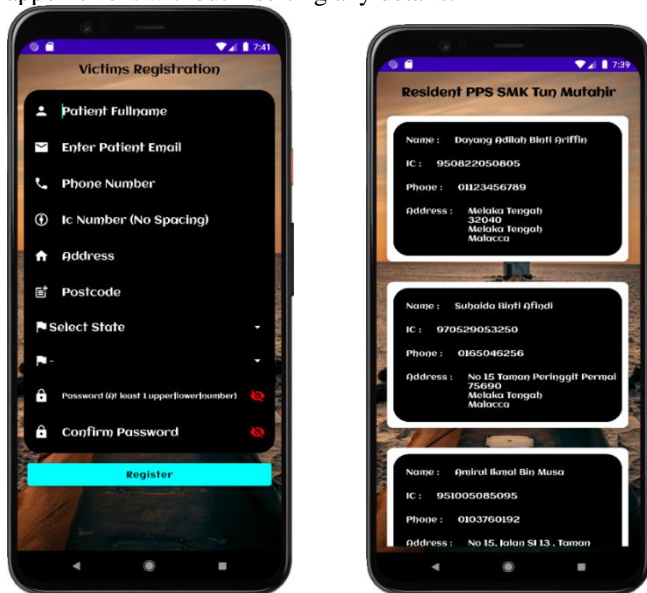


Fig. 16 Admin PPS – Victims Registration

Overall, this system runs without a problem and successfully follows the module needed.

5. Conclusion

In this project, a mobile phone-based system was developed from the beginning covering the planning phase, design, implementation, testing, and report analysis. To conclude, this project's objective is to collect victims' medical report data and communicate multiway information between data in PPS and report to the hospital. Based on all results implementation and testing, the user can submit an appointment and see a medical treatment history. While the data is submitted, PPS can be accessed by the hospital to see which patients need immediate attention to the hospital so that the information given is accurate and shortens the duration taken to inform the hospital. Admin can see who needs immediate attention as their initial observation and decide what should be done next. All the objectives were accomplished. As for future work, this system can be improved to be a bigger mobile-based system by becoming flood disaster management which includes information about the meteorological report, flood information, stock, asset, volunteer, and transaction fund management.

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