Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF MOBILE BASED FLOOD DISASTER MANAGEMENT SYSTEM

MOHD ARIFUDDIN BIN MOHD ROFI

Bachelor of Computer Engineering Technology (Computer Systems) with Honours

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DEVELOPMENT OF MOBILE BASED FLOOD DISASTER MANAGEMENT SYSTEM

MOHD ARIFUDDIN BIN MOHD ROFI

A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Computer Engineering Technology (Computer Systems) with Honours

Faculty of Electrical and Electronic Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2021

DECLARATION

I declare that this project report entitled Development of Mobile Based Flood Disaster Management System is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : 

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Date : 19/1/2022

APPROVAL

I hereby declare that I have checked this project report and, in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Computer Engineering Technology (Computer Systems) with Honours.

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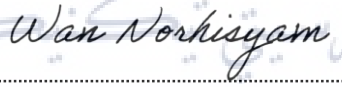
Signature	:	
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DEDICATION

I dedicate this project to my beloved parents for providing all the support and assistance that have made possible the fruition of our efforts. They have never given up and will always be remembered in this heart.

Next, I dedicate this project to my supervisor lecturer for all support and cooperation during the Final Year Project. Your patience, knowledge, and words of encouragement gave me immense strength throughout the project.

Then, to all my friend's thanks for their cooperation, advice, motivation, and support while conducting the Final Year Project. To all lecturers, thank you for all their moral guidance and support during this semester in University Technical Malaysia Melaka.

ABSTRACT

Flooding has become one of the world's most growing natural catastrophes. It is one of the worst natural catastrophes in many nations and affects low-lying or flood-prone regions. For both flood management and emergency response activities, a complete and thorough decision-making tool is needed to reduce loss of life and economic damages. In this project, we propose our research design to create a mobile disaster management system for floods. We have identified three research objectives. The initial stage will be to define key flood risk assessment criteria, followed by the creation using Geographic Information System (GIS) and Multi-Attribute Decision Making (MADM) and data mining methods of a relative flood risk measuring model. In the third goal, the integrity of communication technology and other ICT-related needs is a holistic architectural design for mobile decision assistance. The third objective is to verify the efficiency of mobile based flood disaster management system by getting survey form from 50 respondents. The case study approach is used to understand the flood event and to verify the model of support for the decision. Flood maps based on data gathered through questionnaire answers by experts, a field survey, the satellite pictures and papers from flood control organizations have been produced using well-defined methods. They aim to offer important comprehensive information for flood risk management, evacuation and communication by combining a mathematical model, GIS and a mobile application in the flute risk assessment. The decision-making support design for this project may enhance the warning system and help to reduce casualties.

ABSTRAK

Banjir telah menjadi salah satu bencana alam paling berkembang di dunia. Ia adalah salah satu bencana alam terburuk di banyak negara dan khususnya di kawasan rendah atau rawan banjir. Untuk kedua-dua aktiviti pengurusan banjir dan tindakan kecemasan, alat membuat keputusan yang lengkap dan menyeluruh diperlukan untuk mengurangkan kehilangan nyawa dan kerosakan ekonomi. Dalam projek ini, kami mencadangkan reka bentuk penyelidikan kami untuk membuat sistem pengurusan bencana bergerak untuk banjir. Kami telah mengenal pasti tiga objektif penyelidikan. Tahap awal adalah menentukan kriteria penilaian risiko banjir utama, diikuti dengan penciptaan menggunakan Sistem Informasi Geografi (GIS) dan Multi-Attribute Making Making (MADM) dan kaedah perlombongan data model pengukuran risiko banjir relatif. Dalam tujuan ketiga, integriti teknologi komunikasi dan keperluan lain yang berkaitan dengan ICT adalah reka bentuk seni bina holistik untuk bantuan keputusan mudah alih. Objektif ketiga adalah untuk mengesahkan kecekapan dan keberkesanan sistem pengurusan bencana banjir berasaskan mudah alih dengan mendapatkan jawaban soal selidik daripada 50 orang responden. Pendekatan kajian kes digunakan untuk memahami peristiwa banjir dan untuk mengesahkan model sokongan untuk keputusan. Peta banjir berdasarkan data yang dikumpulkan melalui jawaban soal selidik oleh pakar, tinjauan lapangan, gambar satelit dan kertas dari organisasi kawalan banjir telah dihasilkan dengan menggunakan kaedah yang ditentukan dengan baik. Mereka bertujuan untuk menawarkan maklumat komprehensif penting untuk pengurusan risiko banjir, evakuasi dan komunikasi dengan menggabungkan model matematik, GIS dan aplikasi mudah alih dalam penilaian risiko seruling. Reka bentuk sokongan membuat keputusan untuk projek ini dapat meningkatkan sistem amaran dan membantu mengurangkan korban.

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The final year project was a long and challenging journey. Community support from family, colleagues and lecturers gave me endless strength to move further, and this project will be done successfully. First of all, I would like to thank my supporting supervisor, Mr. Izzat Zakwan bin Mohd Zabidi and my co-supervisor Ts. Wan Norhisyam bin Abdul Rashid and my co-supervisor industry for your constant encouragement, infinite advice, and advice on this initiative. First, I would always like to share my thoughts and acknowledge the support and assistance provided by my colleague and classmates. And the last but not least, just most especially, thanks to my mom, who have been loving me all the way spiritually and the financial support for this endeavour is the strongest.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

A flood is a natural event that may have far-reaching implications for both humans and the environment. Flooding is defined as reasonably high streamflow overturning the natural or manmade banks in any section of the river, lake, lake or dam before joining a stream and/or coastal flood produced by super-high levels of the sea and/or waves which overload shoreline defenses. The language used must be consistent and comprehensible given the various ideas being discussed. A flood is an overflowing body of water that normally is not inundated. In Malaysia all kinds of floods occur: Monsoon floods, urbanflash, debris flow, mudflow, landslides, tidal floods, dam releases and bund breach. In general, floods are divided into two types: river floods and coastal floods, each having its own specification, which is:

1.1.1 River Floods

Due to flows surpassing the capacity of stream systems and spilling natural or manmade barriers, floods occur mainly on floodplains or wash land. Normally dry land flooding is produced by water overflowing a stream, river, estuary, lake, or dam's naturalor manmade bank. In rainy circumstances, floodplain or other flat regions may flood when an already shallow water table rises above ground level. This kind of water table flooding is often an early warning indication of stream flooding. Under dry circumstances, huge flat regions may flood when the ground surface is baked hard or crusted. Rainwater flooding is anticipated in dry and semi-arid areas, although it

also occurs elsewhere. Overflow or surface ponding, as mentioned above, often causes flooding in urban settings, but it may also occur when urban stormwater drains become overloaded and overflowing. Stormwater is caused by storm runoff. During a rainstorm,some water stays on the surface or is retained as groundwater in the soil or undergroundaquifer, some water is utilized immediately by plants, and the remainder runs over the surface. This overland flow is called stormwater. Local Overland Flooding occurs whenlocal runoff inundates a stream, river, estuary, lake, or dam rather than overbank discharge from a stream, river, lake, or dam. Coastal Flood.

Floods in low-lying coastal areas, including estuaries and deltas, involve brackishor saline water inundating the land. Brackish-water floods occur when river water overflows embankments in coastal reaches due to high tide conditions impeding flow into the sea. Overspill is exacerbated when high tide levels rise above average due to storm surges or when large freshwater flood flows move down an estuary. When huge wind-produced waves are driven into semi-enclosed bays under severe storm or storm- surge conditions, or when so-called 'tidal waves' created by tectonic activity-travel into shallow coastal waters, direct inundation by saline water floods can occur.

1.1.2 Coastal Flood

Floods in low-lying coastal areas like estuary and deltas include the inundation ofbrackish or saline waters. Brackish-water floods occur when river water overflows into the sea beds of the coast due to high conditions of tide that impede sea flow. The excessis increased by high tide rises above average by storm surges or when substantial fluxesof freshwater travel down an estuary. In extreme stormy or tempest conditions when big waves of the wind are carried into semi-closed bays, or when the so-called

'tidal waves'arise by tectonic activity in the shallow coastal waters direct floods may occur.

1.2 Problem Statement

A flood is usually produced by a combination of heavy rain and river or coastal overflow from their banks, and it may occur at any time of year. Most river floods are triggered by climatological events such as heavy and unusually prolonged rainfall. Significant flooding happens often during the time of snowmelt and ice melt in spring and early summer in cold-winter regions where snowfall accumulates, particularly whenmelt rates are high. River floods may also occur when landslides fall directly into upstream lakes or reservoirs, causing a rapid increase in water level that exceeds the outlet or dam. Coastal areas are also susceptible to sea flooding, which is usually causedby a combination of high tides, increased sea levels, and massive waves associated withstorm surges caused by severe cyclonic weather systems and low air pressure. The problem with disaster management systems is not a lack of technology or the availabilityof critical information. It is often related to a lack of information accessibility. Having the correct information on the right person at the right time may be crucial in reacting toa flood. The ability to use data more quickly to manage, discover, and critically evaluatethe situation is essential to resolving the flooding problem. These issues include an imbalance in disaster risk management planning approaches between top-down and bottom-up approaches, a lack of coordination in executing the disaster risk managementcycle, and a lack of long-term planning (particularly for recovery / post-disaster), whichhas resulted in low community and stakeholder resilience to disasters.

1.3 Project Objective

The main aim of this project is to design a project that control and develop measurement model for relative flood risk using Geographic Information System (GIS), Multi-Attribute Decision Making (MADM) and data mining technique. Specifically, the objectives are as follows:

a) To develop a Geographic Information System (GIS) to approach flood disaster management system in Melaka effectively.

b) To develop a firebase in the mobile-based flood disaster management system application that is user-friendly.

c) To verify the efficiency of river water level push notification to the problem statement by conducting a survey that consists of 10 survey questions and 50 respondents of Melaka residents.

1.4 Scope of Project

The scopes will be helpful to keep the projects in line to achieve their goals. The development of the mobile application by the project is also limited by a specific requirement. The criteria include the acquisition of the ecosystem in a disaster management system, a functional MDMS system and the enhanced responsiveness of the company in natural catastrophes. The present technique of disaster recovery focuses on telephone conversations. This, however, is not a totally dependable or feasible futurestrategy. More research should be carried out on the existing system, including interviews with key individuals and observations of the present usage of the system.

This will enable the project's requirements to be more precise. There are difficulties with scalability, and there are almost no continuity or redundancy preparations. Suppose a natural catastrophe, like an earthquake, is destroying telephoneconnections. In this situation, unless Internet services providers and telecommunicationsfirms fix the problem, there is no way to restore telephone networks.

The mobile application needs to enhance the reaction capabilities and ability of the disaster management system to communicate with the public. A mobile application mayoffer individuals in the impacted region with vital information such as updates from thecountry's disaster warning system, local information for people to assist, and effective disaster recovery. A cloud-based approach also increases system stability considerably and makes it stronger than the traditional, earthquake-prone telephone system. Enablingpush notifications on mobile devices will enhance the efficiency of the system by givingfast and efficient notice of those in danger. A cloud-based solution is also less expensivesince the business does not pay for resources not utilized.

1.5 Thesis Structure

Chapter 1:

The first chapter gives a brief overview of the idea. This chapter is about the background of the project. The focus was on the project overview, goals, problem statement and project scope.

Chapter 2:

The second chapter covers the concept, theory and some of the hardware components employed in this project. This chapter further explains the word used for this research project.

Chapter 3:

The methodology is explained in this section. The methodology chapter is a timetable or steps to complete and structured reports of studies to be carried out to achieve this goal. This chapter explains the procedure for completing the project and detailed information on the development of this project.

Chapter 4:

This chapter discusses the results and the feedback we get based on the methods.Both models, data collection and analysis, have been thoroughly discussed. The results were compared with the objectives outlined to present those theories and conclusions.

Chapter 5:

The conclusion and future work are discussed in this chapter. This section ends with guidelines for improved system performance based on desired outcomes.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In the last three decades floods have been a major danger globally and are presently becoming more frequent in Malaysia It led to the death and destruction of persons and property. It is one of the natural disasters which hinders the growth of a nation. Flood was the most common disaster in Malaysia since the 1920s and affected abroad variety of areas, especially lowlands. Previous studies show that the developmentof the area is responsible for almost 9% of all disasters, while the flood affects around 22% of the whole population directly. Indeed, due to increased migration from rural to town areas, unregulated land structure changes, poverty and another flood risk factors the flood disaster is expected to worsen. The frequency of rainfall increases and the sea level in some parts of the nation grows and flooding in Malaysia increases.

The two most frequent types of flooding in Malaysia are the monsoon and flash floods. Monsoon floods are the most prevalent between May and August (Southwest Monsoon) and November and February (Northwest Monsoon). In crowded cities, on theother hand, flash floods are more frequent. This is the consequence of uncontrolled human activities, such as the construction of infrastructure near river areas and large waste, leading to clogged drains and waterways.

2.2 Result and Statistical Information

As suggested flow disasters may be classified into three main phases: pre- catastrophe, post-catastrophe, and post-disaster, which need and address all processes inany Flood Early Warning and Response System (FEWRS) plan. FEWRS may also include early warning and preplanning, since flood damage may be significantly minimized. The implementation of the FEWRS provides additional information to prepare people for natural disasters such as tsunamis or floods. FEWRS will also react swiftly to mitigate damage prior to the occurrence of a disaster. Early warning systems may also be used to predict floods and allow local governments time to evacuate residents.

This is because the pre-disaster stage is a realistic first step in incorporating general flood-related situations and provides real-time access to flood mitigation and preventive knowledge. Academics in the field of information systems think that information systems may play a critical role in improving the efficiency and effectiveness of disaster management activities in emergency circumstances. The foundation for flood and early warning systems, which includes natural or man-made disasters such as floods, cyclones, tsunamis, or earthquakes.

As shown in figure 2.1. This research focuses on floods by using an Early Warningand Reaction System as a means of mitigating flood damage. This study falls under the category of information systems since it makes use of an Early Warning and Flux Response system. The FAEWRS, shown in figure 2.1, is an example of an information system of this kind. It provides data on factors influencing the efficiency of information systems used to handle natural catastrophes. Disaster techniques based on data, such as FEWRS, can forecast and provide recommendations for natural disasters based on factors that aid in disaster

management. Thus, it is critical that information-based disasterprediction systems provide adequate time for policymakers and the community to respond to evacuation. Additionally, an early warning system must have a response component to guarantee the full effectiveness of information-based disaster systems.

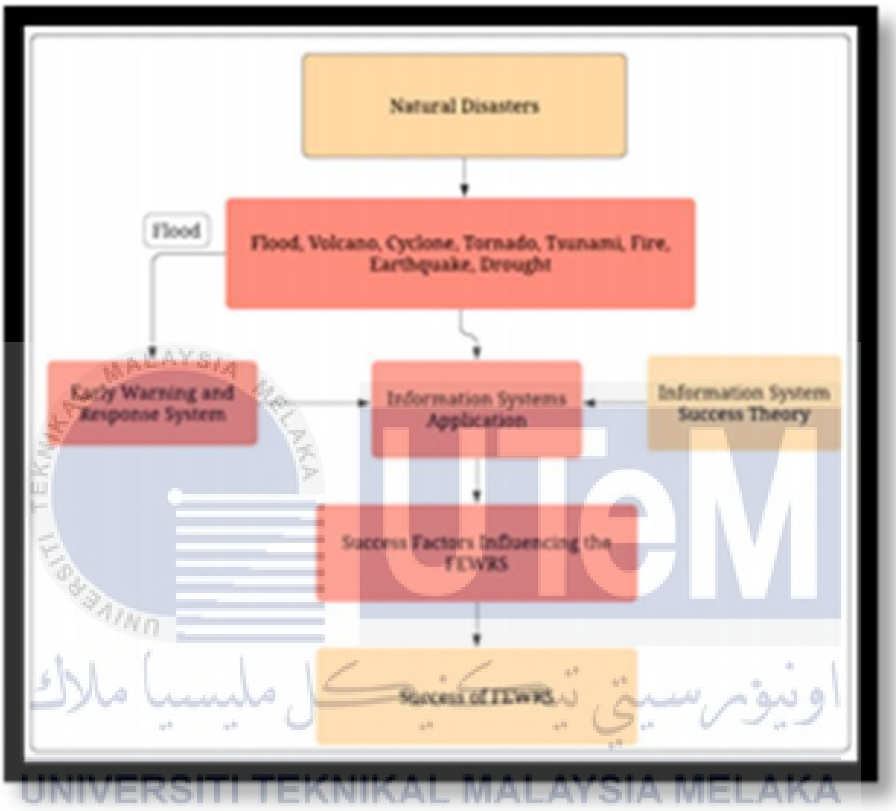


Figure 2.1: Framework of The Flood Early Warning and Response System

2.2.1 Flood Early Warning and Response System (FEWRS)

Flood disasters and flood related risks are linked to one another, and thus FEWRSDecision-makers utilize both concepts mainly for the sake of reducing flood levels tolerable at different disaster management phases.

FEWRS helps and warns individuals of choices at different stages of the disaster management cycle. Four operational components are included inside a conventional early warning system. These are risk information, communication and distribution, responsiveness and monitoring and warning systems.

Figure 2. 2: Key Elements of an Early Warning System

2.2.2 Risk Information

When dangers and vulnerabilities emerge at the same time in a certain region, risksdevelop. Risk assessments need systematic data collection and analysis, as well as consideration of the changing character of hazards and vulnerabilities resulting from processes including urbanization, rural land use change, environmental degradation, and climate change. Risk assessments and maps aid in motivating individuals, prioritizing the requirements for early warning systems, and guiding catastrophe preventive and response plans.

2.2.3 Monitoring and Warning Services

The system's warning services are at its core. For identifying and forecasting dangers, there must be a solid scientific basis as well as a dependable forecasting and warning system that operates 24 hours a day. To create accurate alerts in a timely manner, continuous monitoring of danger metrics and contributing variables is required. Warning services for different hazards should be coordinated with stakeholders and relevant agenciesto gain the benefit of shared institutional, procedural and communication networks.

2.2.4 Communication and Distribution

Those who are at risk must receive warnings. Clear messages with simple, useful information are essential for proper understanding of warnings and responses to protect lives and property. Communication systems at the regional, national, and community levels must be identified ahead of time, and appropriate authoritative mandates must be established. Multiple communication channels must be used to ensure that as many people as possible are notified, to avoid any single channel failing, and to reinforce the warning message.

Early warning communication systems are made of two main components:

I. Hardware for communication infrastructure that must be dependable and robust,especially during natural disasters; and
II. Appropriate and successful interactions among the key players in the early warningprocess, such as scientists, stakeholders, decision-makers, the public, and the media.

Short Message Service (SMS), Email, Radio, Television, and the Internet are only a few of the communication tools that are currently available for warning dissemination. Early warning relies heavily on information and communication technology (ICT). During and after a disaster, ICT plays a critical role in disaster communication and information dissemination to organizations responsible for responding to warnings as well as the public.Communication system redundancy is vital for disaster management, while emergency power supply and backup systems are critical to avoid communication system failure after adisaster.

Furthermore, frequencies and channels must be designated and devoted to disaster relief operations to ensure stable and effective functioning of communication networks during and after disasters, as well as to avoid network congestion. Warnings are frequently disseminated in a cascade process that begins at the international or national level and proceeds outwards or below in the scale, eventually reaching regional and community levels. Early warnings may trigger more early warnings at other authoritative levels, resulting in a cascade of responsibility roles, but they are all required for successful early warning.

2.2.5 Responsiveness

It is crucial that communities are aware of their hazards, that they respect and followthe warnings, and that they are aware of how to respond. Risk reduction is aided by educationand readiness initiatives. Disaster management strategies must also be in place, with resources assigned and regular processes properly performed and tested. The community should be well-informed on safe behavior options, available escape routes, and how to minimize property damage and loss.

2.3 Flood Early Warning System

Flood Early Warning System (FLEWS) is a system for minimizing and preventing flood-related hazards, as the name implies. On a national, continental, and global scale, various groups are now working on flood forecasting and early warning.

The most essential input in a flood early warning system is real-time hydro-meteorological readings from weather radar satellites and an automated hydro-meteorological station network. This real-time data can be utilized in a variety of ways to assess flood risks and flood warning issues. Aside from real-time data, probabilistic weather forecasts (Numerical Weather Prediction-NWP) are a significant source of information for hydrological models that create warning scenarios. In addition to providing forecasts for the most essential input (precipitation), a model that describes and simulates watershed reactions for flood early warning must be chosen.

The creation of a flood alert system was one of the corrective methods in which the information system is essential for the collection, processing and channeling of datafrom all riverside stations for rapid reaction by the competent authorities. Although the method is very reliable in the transmission of flood information, it has had minimal incidence on overall resolution. However, full flood control is generally recognized to be neither possible nor desirable. As a result, the Geographical Information Systems (GIS) are increasingly seen as the most effective way to manage flood catastrophes. As a result, research on a flood alert system was performed utilizing GIS. In combination with mathematical modelling, this GIS is used to collect and analyze data and to create applications that monitor and raise awareness of possible flood disasters and their effects. Changing trends and advances in GIS technology and mathematical modelling have enabled their use in a broad range of scientific

and technical resources and skill development efforts to mitigate flood disasters. These developments include their application in real time in suitable early warning systems, preparedness and disaster management in general. The design emphasizes flood plain estimation as part of the control of flood disasters that was mainly neglected in previous Malaysian management plans. The predicted flood maps are then utilized to provide anticipated warnings of future floods far in advance.

In recent years, several projects have been undertaken across the globe aimed at improving and "smartening" flood protection systems. Each of them attempts to tackle flood management problems, many of which via the creation of early warning systems (FEWS). Existing EWSs are customized, located and depend heavily on local computer resources. Modern early flood warning systems incorporate weather, water levels and (optional) remote satellite monitoring data. However, in Malaysia the concept of FEWS is still relatively new, and the government agency must enhance its system of decision support and convey its findings in real time to the affected people. This key task is necessary to minimize losses, particularly in the East Coast State of Malaysia during the monsoon season.

2.3.1 Benefits of Flood Early Warning Systems

Flood forecasting and warning systems are a critical component of regional and national flood preparedness programs, and many countries place a high priority on their development. Flood EWS are being investigated as an alternative to structural plans for dealing with flood concerns, partially because they are less expensive. Even though governments place a high importance on flood warnings in flood risk management, there is a scarcity of accurate data on the advantages and costs of these systems.

The value of an early warning system can be estimated by estimating the amount of flood damage to private and public assets that could be avoided if action is taken in responseto the warning. BEWS' flood-reduction benefit can be expressed as follows:

$$BEWS = Xwithout - Xwith$$

Where, Xwithout=without project economic flood damage; andXwith= economic damage if the project is implemented

The savings in flood damages are one of the advantages of flood early warning systems. Floods are random occurrences that produce damage, hence flood damages are likewise random or probabilistic events: the likelihood of any certain quantity of flood damage is determined by the chance of the flood event that caused those damages. Flood damages are calculated using a risk assessment to determine the likelihood of future flood episodes being avoided, as well as a vulnerability assessment to determine the damage inflicted by those floods and, thus, the economic savings to be obtained from their reduction.

2.4 The Mechanism in Flood Disaster Management

DSS research began in the 1960s, with researchers focusing on conceptual aspectsof decision-making. Later, a more comprehensive decision support framework with management activity categories and decision type definitions was developed. Strategic planning, management control, and operational control are examples of management

activities. Antony's management duties are combined with Simon's Model definition of decision types, which includes structured, unstructured, and semi-structured decision types. DSS are often intended to solve problems with Multi-Attribute Decision Making (MADM). Project selection, contractor selection, supplier selection, and consultant selection are all examples of common MADM issues. The MADM problem involves choosing the "best alternative" from a set of pre-selected alternatives specified by their criteria.

2.5 Research Methodology for Mobile Based Decision Support System

The following research phases are suggested:

Phase 1: Knowledge about the problem.

The research phase begins with the awareness of the questions. The only activityin this period is literary examination. In this phase, the FEWS and adaptive engineeringneeds are rigorously evaluated.

Phase 2: Analysis and design requirements for a mobile FEWS.

The second phase of the research focuses on the development, through mobile devices, of FEWSs. It includes a case study of the requirement analysis to perform a thorough ecological, user, technological and methodological assessment of system requirements for the monitoring of floods. Data collection techniques will include analyses of documents, detailed interviews and focus groups of specialists from the government agencies involved. The case study will support the suggested architectural design for a FEWS mobile system via Goal Requirement Analysis, Fuzzy TOPSIS risk computation and data mining as well as the risk mapping of the mobile app and its communicative components.

Phase 3: Mobile FEWS validation.

A case study is utilized to test and validate the model to demonstrate the proposed approach. A conceptual design for a mobile decision support system known as FEWS will be shown. A risk value is given to each sector or block, which will be transmitted tocustomer side maps, previously calculated using Fuzzy TOPSIS and Data Mining (mobile device).

Phase 4: Deliverables and findings.

This is the last and summary phase of the research. A new software definition for mobile decision assistance, or FEWS, is one of the deliverables of the phase. The primary research goal will thus be achieved quickly.

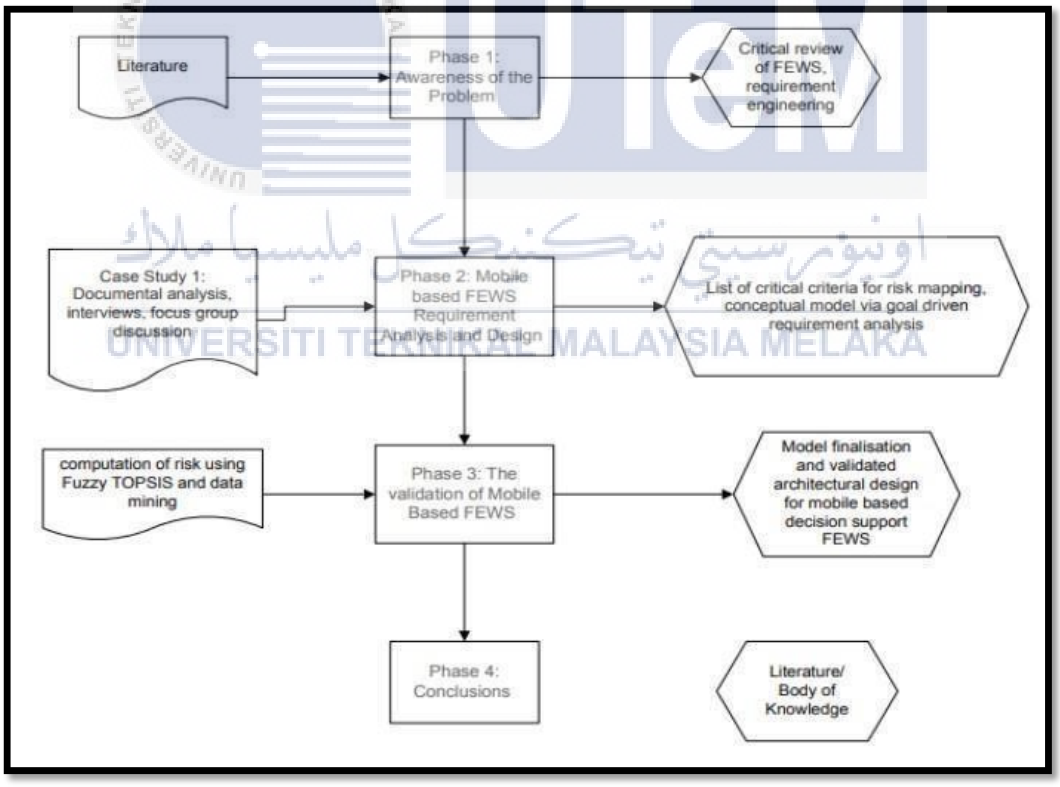


Figure 2.3: Research Phases for Mobile based FEWS

2.6 Summary of Related Work

No.	Paper Details	Author	Purpose	Finding
1	Disaster Prevention and Management	Billa et al. (2006)	• Providing and growinga comprehensive floodmanagement strategy for Malaysia, encompassing various planning stages and proponents. • Highlight spatial information technology's strategicimportance and explain important decision-making processes at various phases of the plan.	• The participation of SDSS inimproving and speeding up communication amongst the various promoters of the programme. It's good for theresearcher and the students both. It provides both fundamental concepts of disaster preparation and management and a structure.

2	Disaster Prevention and Management: An International Journal	Chan (1995)	• To study the efficiencyof permanent resettlement systems operated by the government to addressflood dangers in Malaysia. • Discussing flood risk,including sources, effects and ways of managing flood risks in Malaysia;	• Disaster management usually considers relocation/resettlement the worst choice since it conveys the feeling that nothing more can be done about the hazardsand people must be relocated..

3	Water SA	Darrien et al. (2011)	• Show a modelling results theoretical flood control paradigmdeveloped from Sarawak River.	• The river model simulates floodwater flow throughoutriver reaches. • A flood early warning systemis directed by information onflood levels and barrier overtopping.
4	Procedia-Social and Behavioral Sciences	Elias (2013)	• For the potential Malaysian legal partner, examine the2010English Flood Management and Water Management Act (Flood Risk Management Act in England and Wales).	• Data will be analysed utilisinga doctrinallegal approach in this study. • An analysis of the legal approach to floodrisk management in England and Wales isexpected to provide a model for the potential legalequivalent of Malaysia.
5	Procedia - Social and Behavioral Sciences	Hamin (2013)	• Aims to explore governance methods for aligning and integrating flood- related policies and programs, and subsequently topropose a unified flood management legislation for Malaysia. Objectives:	• Taking a library-oriented approach, thisresearch should have the expected outcome ofproposing Malaysia's single flood control legislation.

6	International Journal of Social Science and Humanity	Johari and Marzuki (2013)	• This debate aims atexaminingthe connection betweenstress, anxiety, and depression andthe quality of life and well- being of floodvictims.	• A flood disaster is one of theevents that impacts people's life in Malaysia. Destructionand loss make people unhappy and worried.

7	Disaster Prevention and Management	Katuk (2009)	• To demonstrate the usage of a web-basedflood response assistance system in Malaysia.	• The whole element of flood response is enhanced by providing electronic featuresthat simplify the flood response procedure and dataadministration.
8	Land Use Policy	Khailani and Perera (2013)	• To assess the extent towhich Malaysia's regional development plan responded to the reduction of vulnerability and improved resilience needs of civil society in order to accommodate floods caused by climate change.	• Indicate that planners were fairly aware of people's flood risks and included policies and techniques into the local development plan to minimize people's and property's susceptibility to flood hazardswhile also improving urban settlements. ' flexible
9	International Journal of Social Science and Humanity	Khalid and Shafiai (2015)	• To study the role of the Government's flood victim deliverysystem in Malaysia, before, during and after the catastrophe.	• The kind of flood delivery mechanism utilized in Malaysia, as well as comparisons with other distribution systems. Malaysian flood management plan, flood delivery systemare index terms.

10	Disaster Prevention and Management	Mah (2011)	• Presentation by integration of waterflow and marine interaction a hydrodynamic rivermodelling.	• In the worst-case scenario, themodel shows that roughly 5 - 6 km2 of metropolitan areas along the Lower Sarawak River would be flooded.

11	Disaster Prevention and Management	Mansor (2011)	• A methodology to model disaster risk forflood risk managementand forest fires in peatswamps will be developed by combining high spatialresolution remote sensor data with Geographic Information System (GIS) data and multi-criteria analysis to aid in providing decision support systems for emergency operations and disaster prevention.	• Spatial technology can evaluate and estimate landslide danger regions by generating and overlaying theme maps to create a final hazard map that classifies areas by three risk categories.
12	Procedia-Social and Behavioral Sciences	Mohit and Sellu (2013)	• To assess the flood situation in Pekan Town in terms of flood damage and flood damage caused by increasing sea levels, and to suggest policiesand strategies for long-term community-based flood mitigation.	• Hundreds of Malaysians die every year as a result of floods. The town of Pekan, which is situated on the banksof the Pahang River, is flooded, causing both economic and physical damage..

13	International Journal of Disaster Risk Reduction	Othman (2014)	• Offering COBIT, widely recognised andutilised by businesses as a technique of management of naturalcatastrophe projects via clearly defined process management, necessary information and associated IT.	• Through the use of science and technology, the Sendai Framework offers a once-in- a-lifetime opportunity to move beyond simple reactionto crises and towards a more comprehensive, prevention- based approach to mass gathering management.
14	Journal of Theoretical and Applied Information Technology	Yahya (2016)	• Identify the processesthat are frequent and essential in the execution of information transfer from many senders toone receiver using the star topology as the architecture.	• Capability of obtaining essential data from the sender • Capacity to convert a varietyof terms into ones that are universally recognised
15	A Review Of Flood Disaster And Disaster Management In Malaysia	Mohd Taib, Zaiton Jaharuddin, Nor Siah Mansor, Zuraina (2016)	• The data need is themost challenging element of flood control. • Improved flood forecasts and alerts can aid the country in catastrophe • preparedness.	• Steps should be taken tominimise damage to the flood. Every year, the disaster inflicts huge damage. This is because information and resources are few.

16	Development of inter-agency information system for catastrophic flood preparedness in Malaysia.	Leman, Rahman, Salleh, Baba, Johnson (2016)	• This prototype may bebeneficial in Malaysiain the case of a naturaldisaster, such as monsoon flooding or flash flooding. The emergency response plant system was developed in this research using an online system that is simple to use and quick to find.	• The system will need to beconnected to the National Security Council (NSC) website in order to be compatible with the NSC database..
17	International Review of Management and Marketing A Review on Mechanism of Flood Disaster Management in Asia.	Rabiul, I. et al. (2016)	• The disaster management system isguided by an enhancedresponse and handling of disaster risk and thereduction of social and economic disaster damage. • With increased significance in policy making, the availability of and evaluation of data improves and possiblycoupled with other types of information.	• Signals are detected • Preparation/prevention • Control/containment of damage (recovery)

18	Comprehensive planning and the role of SDSS in flood disaster management in Malaysia	Billa L, Shattri M, Mahmud A, Ghazali A. (2006)	• Providing the variousplanning stages and plan promoters with a comprehensive flood control strategy for Malaysia. • Explain and emphasisethe importance of spatial information technology in the strategy, as well as explain important decision-making at various plan phases.	• Analytical techniquesin a model database management system;A database management system; • A report generator and a display generator arealso available. • a user interface that isgraphical

19	Research Design of Mobile-Based Decision Support for Early Flood Warning System	Omar M, Nawi M, Jamil J, Mohamad A, KamaruddinS (2020)	• To demonstrate an early warning systemassistance research idea via mobile devices (FEWS). • Using the Geographic Information System (GIS), the Decision Making Multi-Attribute (MADM) and data mining technologies, build a rather high flood risk assessing model.	• In this way, the most efficienttechnique of flood disaster management is quickly becoming seen as geographical information systems (GISs).
20	*Push Notification Monitoring Sistem Pintu Air Berbasis Android Menggunakan Firebase Cloud Messaging.*	Fernando F, Arini A, Fahrianto F (2020)	• The apps are not just designed for BPBD, but the general public may also learn about the condition of the Watergate. • There are also flood mitigation methods and recommendations on what to do at different water levels.	• Using the Firebase cloud messaging platform, which will be utilised to build Android water doors that aredependent on push notifications. The software will provide customers with real-time notification and watergate data, making it easier for them to get data inreal time.

Table 2.1 : Summary Related Work

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter discusses in detail the Development of Mobile Based Flood Disaster Management System. This chapter will take a stroll us through each step of the research process. There have been studies conducted on previous research on the title. The basic information about the project's components was also updated for better understanding. Following that, the flow, design, and construction of the system were designed and discussed with the supervisor. Following the approval of all sides, the planned experiments were carried out to obtain their results. Finally, a proper conclusion about the study was reached, and the overall results were presented in Bachelor Degree Project 2. The explanations of the above are given as a flowchart in Figure 3.1.

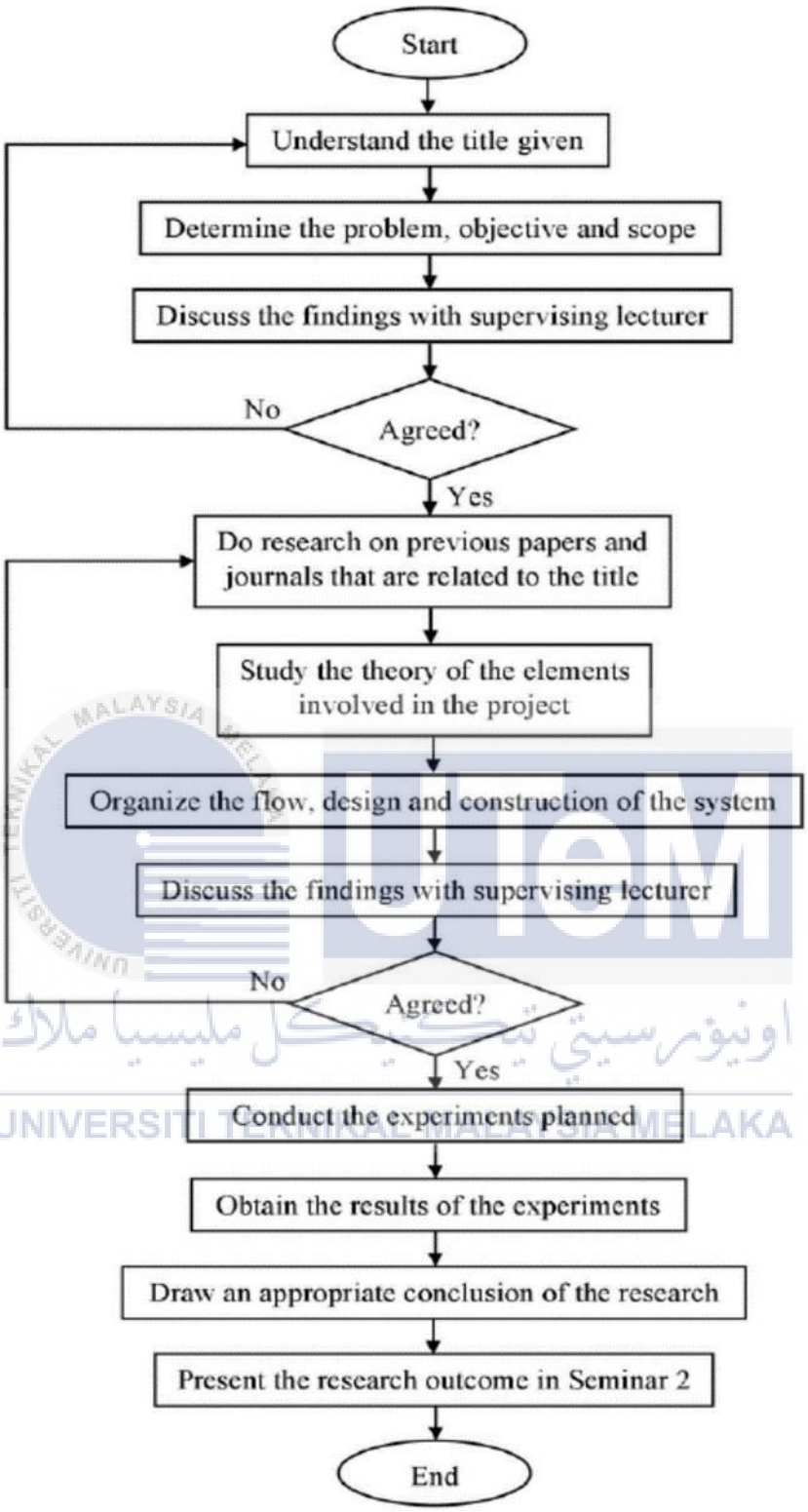


Figure 3.1: Flowchart of Final Year Project

3.2 Methodology

The project begins with a study of the literature on how technologies are used to help in reducing the damage of floods and system management. Research problems related to flood management are discussed in journals and research papers in the studies. The fundamental research related to the implementation of a flood volunteer, stock, andasset management system is covered in Chapter 2. According to the findings of the study,a mobile management system can reduce the time needed to pass on information to the people involved in flood mitigation. So far, most of the flood management systems are part of other disaster management systems. This project aims to create a framework thatis both user-friendly and efficient.

Below the software development, the flow chart and application used are defined.A comprehensive software development flowchart, as seen in figure 3.2, has been madeto ensure the project proceeds smoothly and keeps track of the project progression.

3.2.1 Project Workflow

Project planning is important to ensure everything runs accordingly and finishes on time. A good plan can reduce stress when doing a project since everything has been laid out.A proper plan will ensure the project finish on time with the minimum setback.

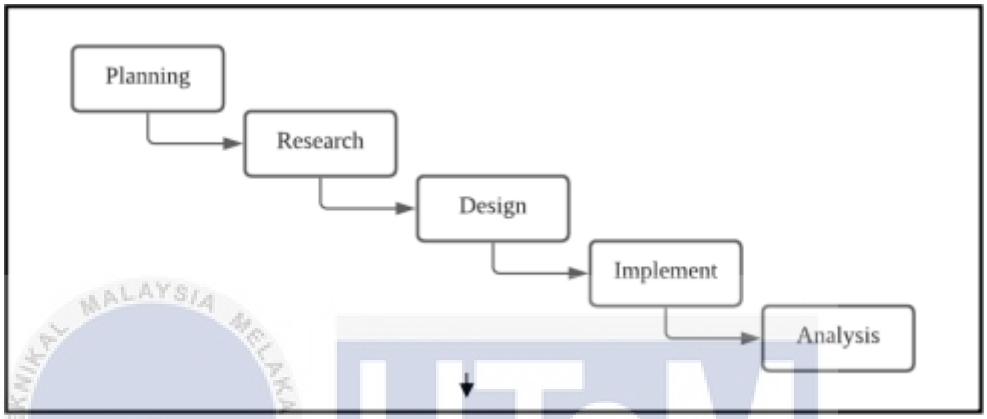


Figure 3.2: Project Workflow

3.2.2 Milestone of PSM 1 and PSM 2

No	Task Name	Start Date	End Date	Duration
1	Briefing	17th March 2021	17th March 2021	1 day
2	Title Selection	18th March 2021	18th March 2021	1 day
3	Discuss the project with SV	25th March 2021	25th March 2021	1 day
4	Learning Flutter Firebase and Visual Studio Code	20th March 2021	25th May 2021	66 days
5	Chapter 2: Literature Review	18th October 2021	17rh November 2021	29 days

6	Submission of1st Progress	18th November 2021	19th November 2021	1 day
7	Chapter 1: Introduction	21st November 2021	6th December 2021	15 days
8	Chapter 3: Methodology	7th December 2021	9th December 2021	2 days
9	Design a demo program	10th December2021	16th December 2021	6 days
10	Prepare Video Poster, Send RecheckReport	17th December 2021	20th December 2021	3 days
11	PresentationPSM 2	19st January 2022	20th January 2022	2 days

Table 3.1 Milestone of PSM I and PSM II

3.2.3 Gantt Chart

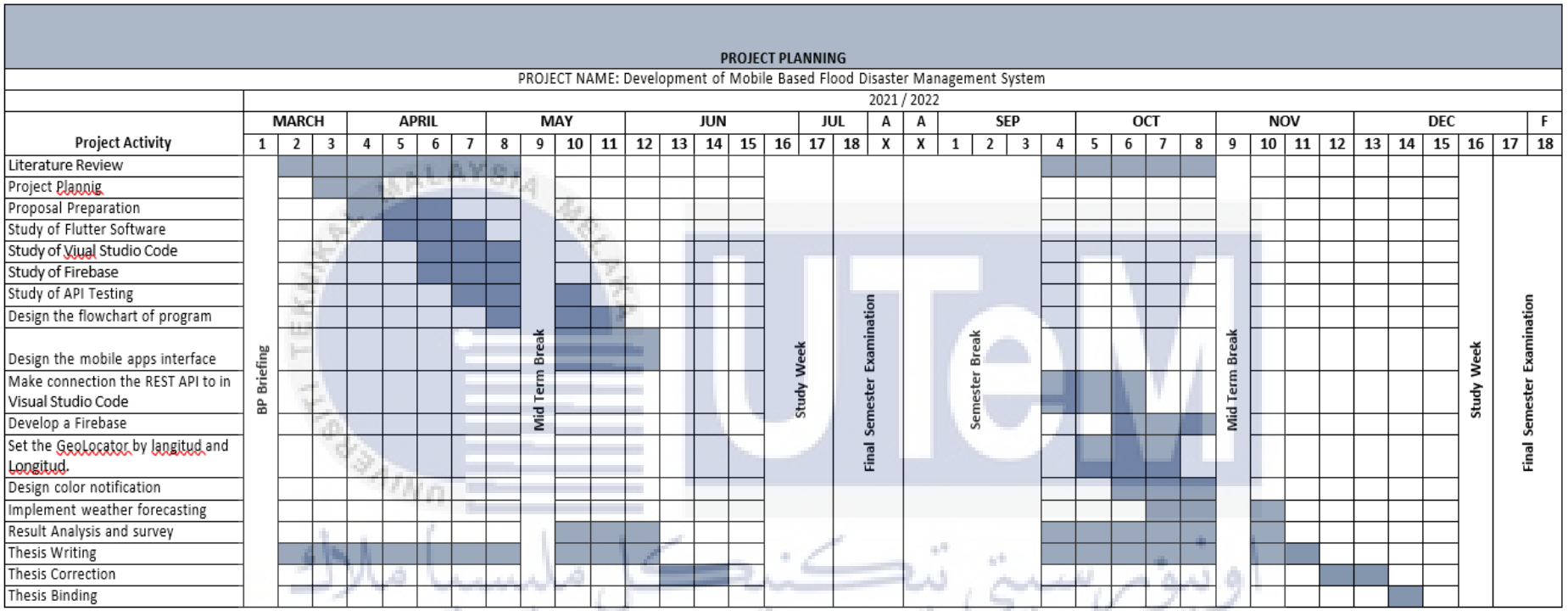


Figure 3.3: Gantt Chart

3.2.4 Equipment

Software	Function	Version
Windows 10	Operating System	Version 21H1
Flutter	Framework	Version 3.32.0 Windows 64-bit
Visual Android Studio	Application Development	Version 1.63.2 Windows 64-bit
Firebase	Firebase Authentication	-
Firebase Database	-	-
Dart Language	Programming Language	-
Postman	API Testing Tool	Version 9.0.9 Windows 64-bit
Microsoft Office	Report Writing	Office 365

Table 3.2 Equipment

3.3 System Block Diagram

In Figure 3:2, the system block diagram will describe how the connection of the entire system will running. Flutter software will be the crucial part of the system becauseit is where all the framework is designed. Data that had been collected will later then processed by the firebase to store data which action output should be sent to the server. The transmission of data from API to the server will be connected through a GeoLocatorwhich allows wireless network communication between system and server. The data includes flood water level to read the river water level before flood happening.

As data reached the server, software system will process the data is a database storage. Here, the information will be prepared for visualization in real-time. Client will be able recognize the water level of the nearest three rivers from current client's location and condition of the water level as well as preparation can be done. By allowing the system access the current user's location, the user will be notified the rivers water level data anytime.

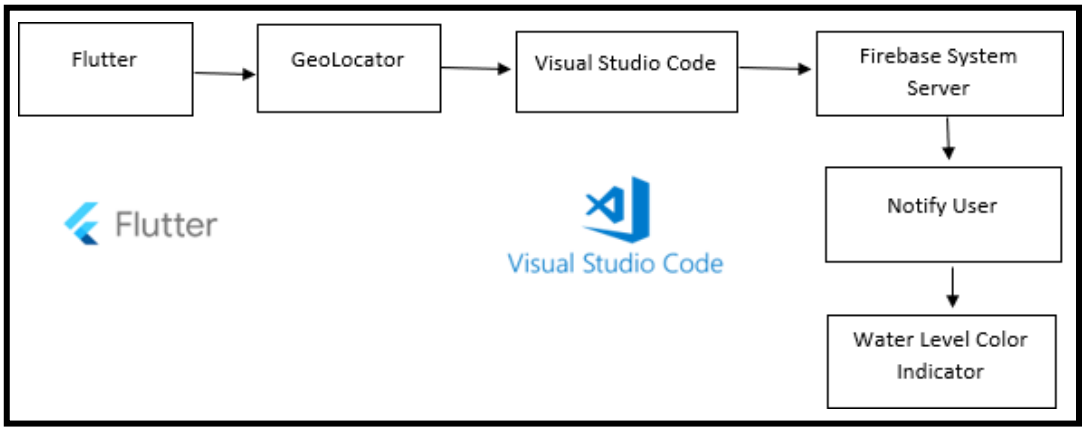


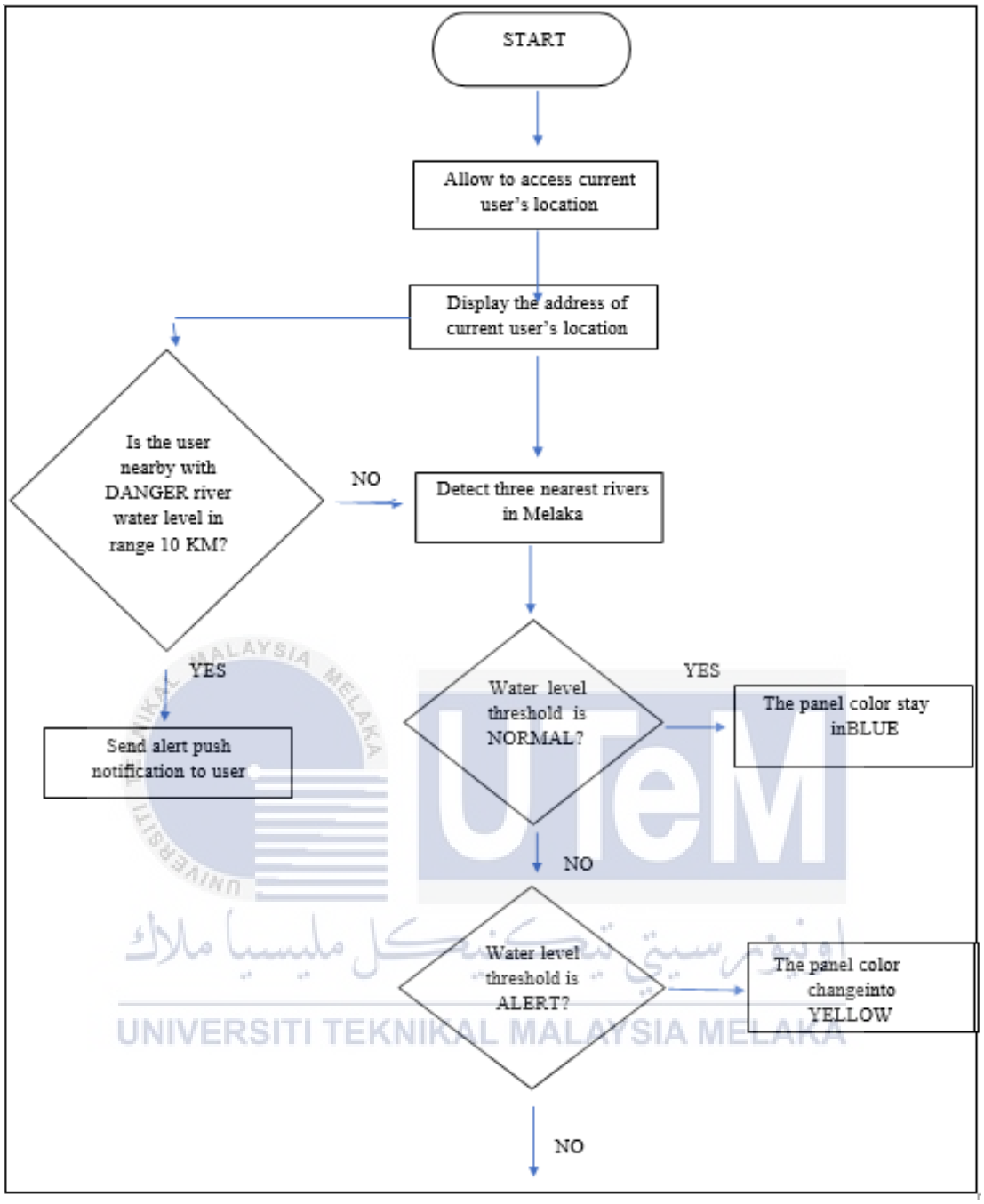
Figure 3.4: System Block Diagram

3.4 Flowchart System

Developing a mobile-based flood disaster management system by apps where people can access if they had internet connection. In Figure 3:3 below shows how the system flows from the starting of the program which is the system need to allow mobileaccessing the current user's location. Once the mobile give permission system to accesslocation, the system will be displayed the address of current user's location on the screen.The system will be notified if the user is nearby with danger river water level in range 10 kilometers or less. Alert notification will be appeared on phone notification without the user need to access in the apps.

As shown in flowchart, the GeoLocator first will detect the three nearest river water level and display the color indicator on the panel based on the river water level threshold. The panel will be stay blue color if water level thresholding is normal. The panel will be changed into yellow color if the river water level is alert status. Otherwise,if the river water level thresholding was hit into warning status, the panel will be changedinto orange color. On the other side, the panel color also will be changed into red in casethe river water level threshold was risen sharply to the level of danger. Here, the firebasewill send the data to the Flutter if the water level has reached at certain level. In the meantime, these data will be transferred to Firebase server which will store them in its database. These data will be used for real-time through mobile application.

Next, the system will be displayed the water level for all rivers in Melaka which is included nine rivers on the swiping panels. The user can recognize the water level in meter unit from all rivers simultaneously. Users can receive updates of the river water level from time to time. When it reaches at certain danger level, the system will notify user through the apps. If no, this cycle will be repeated to update upcoming water level detected by the system.



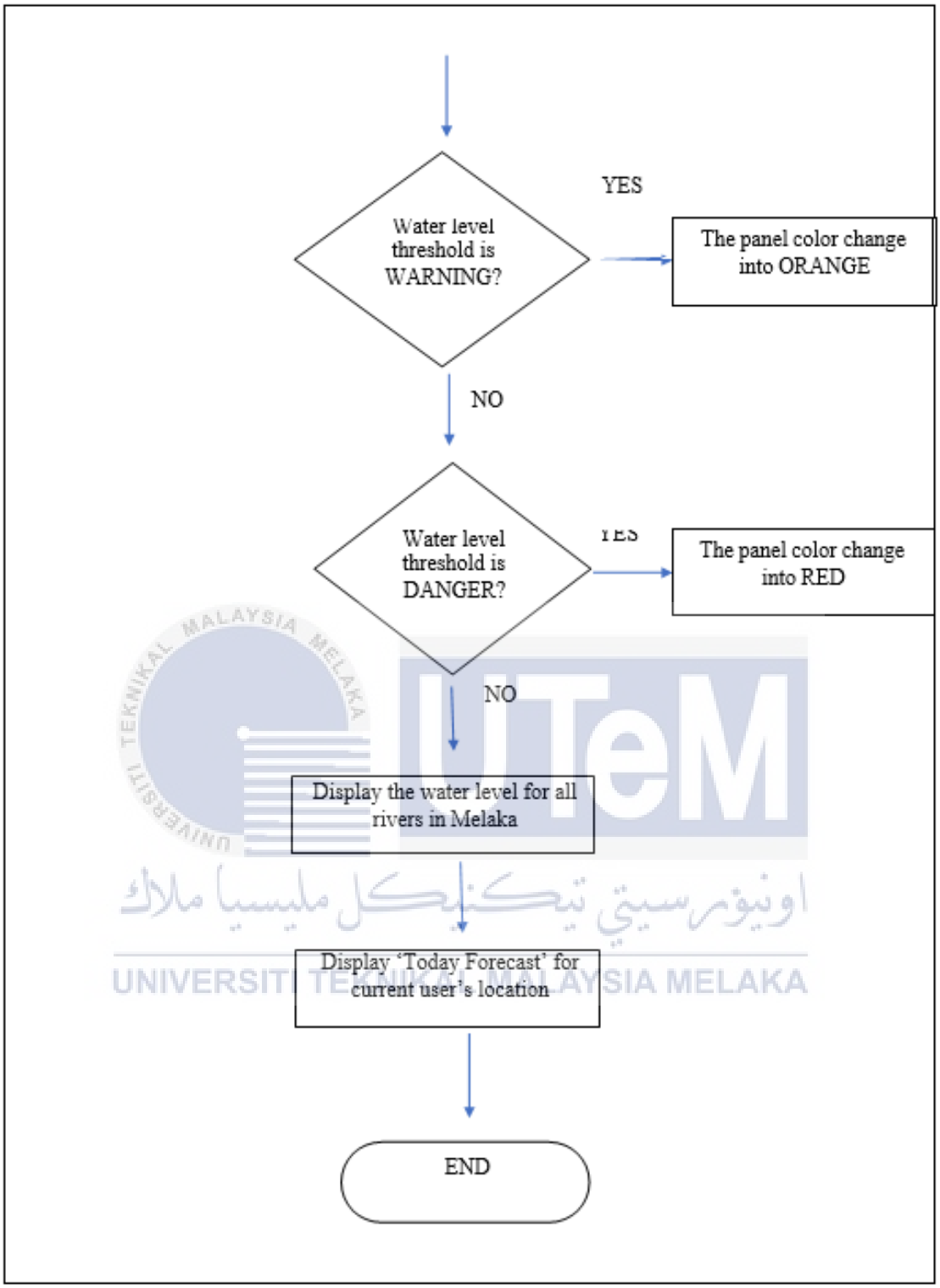


Figure 3.5: System Flowchart

3.5 Software Development

Developing a functional mobile based mechanism should be including software application such for interaction between reality phenomenon like flood disaster and the information technology. Hereby, several software has been used in the making of this research project purposely for database operation and mobile application development.

3.5.1 Flutter Software

Figure 3.6: Flutter Software

Flutter is an open-source UI framework from Google for building native mobile apps.Flutter enables to create mobile apps for both iOS and Android using a single codebase and programming language. This feature simplifies and accelerates the development of iOS and Android apps. Flutter was functioned as framework that allows the system create attractive,natively built, multi-platform apps from a single codebase. The algorithm was effortless andproductive. It's a software development kit (SDK) with prewritten code, consisting of ready-to-use and customizable widgets, as well as libraries, tools, and documentation that togetherserve to build cross-platform apps. In order to design the framework for mobile apps, the Flutter had been used. Generally, the Flutter are used Dart Language that more companion and has capability to develop apps on multiple platforms.

3.5.2 Visual Studio Code

Figure 3.7: Visual Studio Code Software

Visual Studio Code is a lightweight code editor that includes features for debugging,task execution, and version management. It seeks to provide just the tools they need for a rapid code-build-debug cycle, leaving more sophisticated processes to full-featured IDEs like Visual Studio IDE. A standalone source code editor that runs on Windows, macOS, andLinux. Visual Studio Code is the top pick for JavaScript and web developers, with tons of extensions to support just about any programming language. To design the integration of mobile apps programming, Visual Studio Code has been used. Here, several features in appswas designed such as auto-location access permission, the color indicator of water level threshold and table information based real time of all rivers water level in Melaka particularly.

3.5.3 Firebase

Figure 3.8: Firebase Software

Firebase is a platform for creating mobile and web applications. It provides hosted backend services such as a real-time database, cloud storage, authentication and others feature. The service is hosted by Google, removing the need to develop the backend of an application. Administrative access to the product can be access by the Firebase console. Thisproject will mainly use the real-time database and cloud storage features. It is crucial for retrieving the data for visualization program in mobile application. Firebase softwareprovides a real-time database data management. Plus, it provides cloud storage and less external storage is needed to save the data which likely will cost less in making the application. Water level measurement will directly be saved into a database and mobile application can call this data throughout time. Thus, users able to monitor situation of the river anytime if they were connected to system server.

3.6 Summary

This chapter describes the technique that has been offered to provide a novel and integrated approach to the creation of a water level monitoring system. The suggested methodology's major goal is to perform a simple, less rigorous, and effective estimationin such a way that it does not result in a considerable loss of accuracy of the findings. This chapter also included several software development kit to build a comprehensive and friendly user integration

CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter will explain about the result and discussion of the research. After created the framework and code editing of the project complete, a set of reliability testingis to check whether the mobile development still function in a good condition or not. After brief research and studies about the proposed system and project, it should come to expected outcomes and results that are still aligned with the project's objectives mentioned in chapter 1. Next, by conducting a survey to get a feedback from the user tosee the effectiveness of the project.

4.2 Test Results and Analysis

With an emphasis on mobile technology, the new system should improve on the previous system's response capabilities, resulting in quicker reaction times and reachinga broader variety of people in the impacted region.

To request in retrieving a record from the API and creating the database, a testingtool are needed. The relevant functioned are coincide with Postman software since it has a sophisticated API testing tool that makes automating tests a breeze. The combination all of tests and requests was came out into a single automated test sequence.

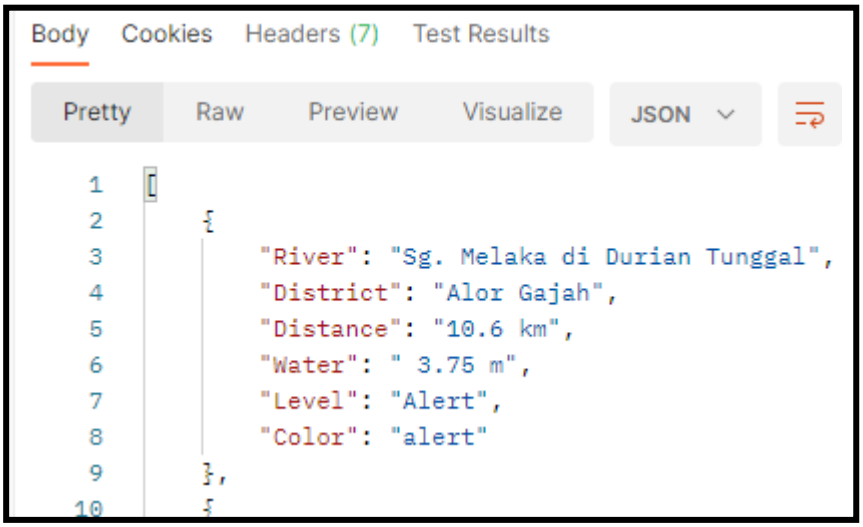


Figure 4.1: Test Result for Nearby River in Melaka.

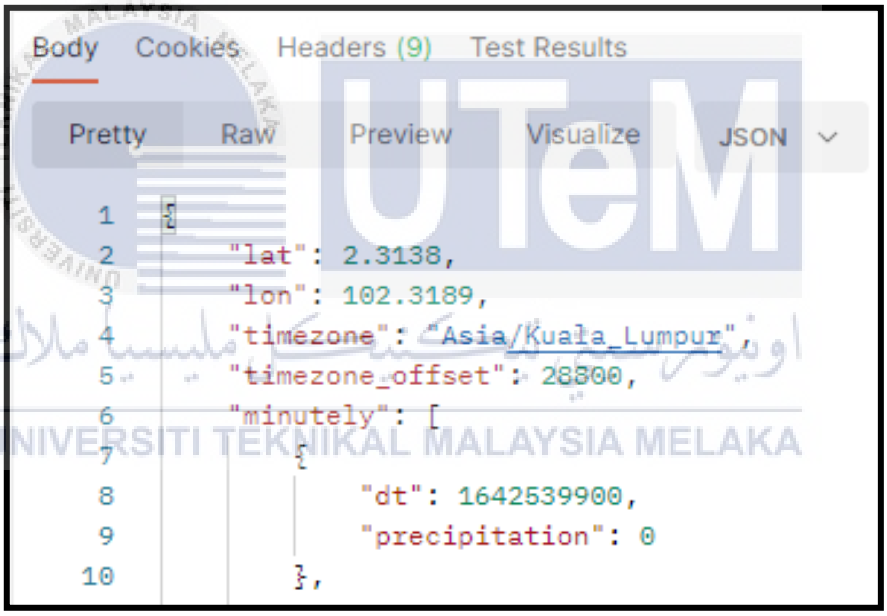


Figure 4.2: Test Result for Weather Details.

A testing result for nearby river in Melaka are configured by Get Method. The item chosen are river name, district, distance, water, level and color for the mobile application system by shown in figure 4.1. Next, the figure 4.2 shows the initial result isappearing on the Postman console by retrieving a record from the *openweathermap* server to be integrated in mobile application design.

4.3 Software Testing

The other software applied in the system is Flutter. A mobile application functionally to display the water level reading and gives notifications when it reaches warning and danger level. To design the application, several extensions should be included which are Firebase and Notification function. Both extensions are not providedby MIT App in general. At first, the interface is set up by adding components from palette. Each of components can be program in blocks section. MIT App uses simple code which preferred as blocks. It is a method by combining several blocks to form a functionate coding program. By adding these blocks, the application can be run smoothly. For this project application, there are two screens included in the apps, Screen1that act as home screen and Screen2 that shows the water level readings. Figure 4:14 andFigure 4:15 below show that set up of home screen and display page Screen2

Figure 4.3: The Flow of Firebase

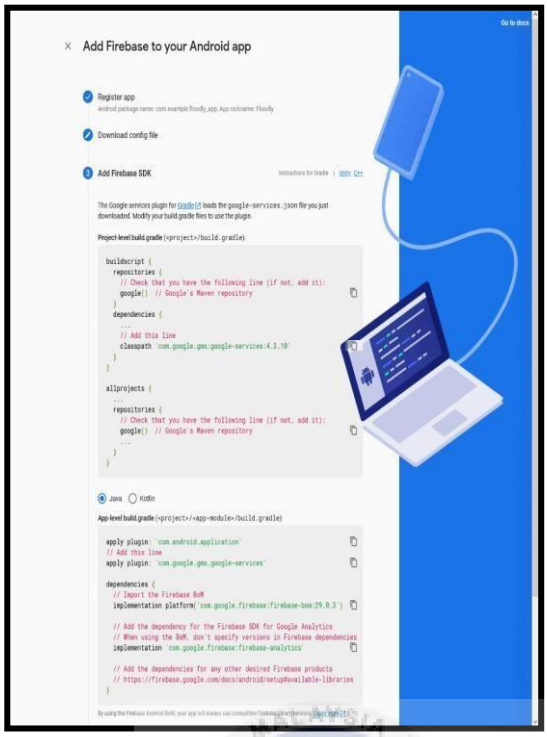


Figure 4.4: Firebase SDK

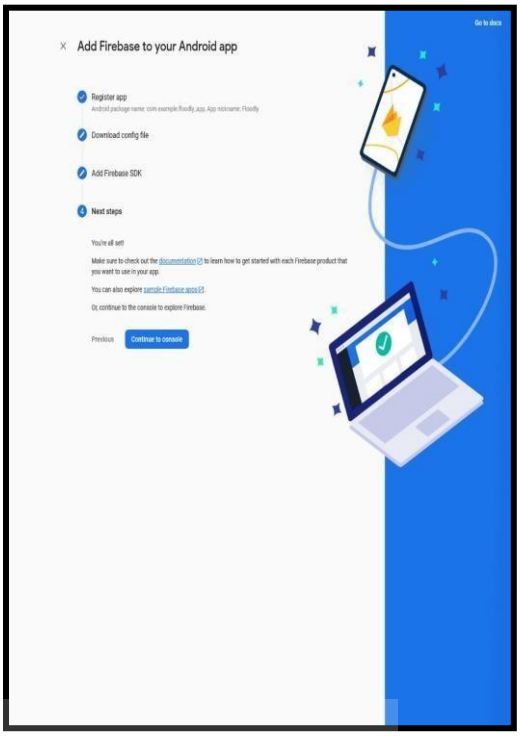


Figure 4.5: Final Firebase Configuration

Adding Firebase to flutter app involves tasks both in the Firebase console and in Flutter project. After downloaded the Firebase config files from the console, its requiredto move them into the Flutter file project. Firebase SDK bundle the Google Cloud clientlibraries for Cloud Firestore alongside client libraries and SDKs for several other Firebase features. SDK also able to initialize access to Cloud Firestore and several otherservices from a single SDK. The Firebase SDKs support Cloud Firestore was accessed readable by using Dart Language.

Figure 4.6: Screen 1

Figure 4.7: Screen 2

Figure 4.8: Screen 3

4.4 REST API Testing

An API (Application Programming Interface) is a set of functions that allows applications to access data and interact with external software components, operating systems, or microservices. To simplify, an API delivers a user response to a system andsends the system's response back to a user. An API functions like a virtual middleman, relaying information from one interface, like a mobile app, to another. APIs connect different parts of a software platform to ensure that information ends up in the right place

API testing is a method of software testing that comprises directly evaluating application programming interfaces as well as testing them as part of integration testingto see if they fulfil functionality, reliability, performance, and security standards. API testing is done at the message layer since APIs don't have a graphical user interface. APItesting's primary goal is to find defects, such as inconsistencies or departures from expected behavior. Continuous testing is also critical to ensure that it continues to function once the public gets access to it.

Weather APIs are Application Programming Interfaces that provide access to current and historical weather data on a global scale. The chosen public weather APIs is *OpenWeatherMap* API. This REST APIs can be used to build powerful weather apps.

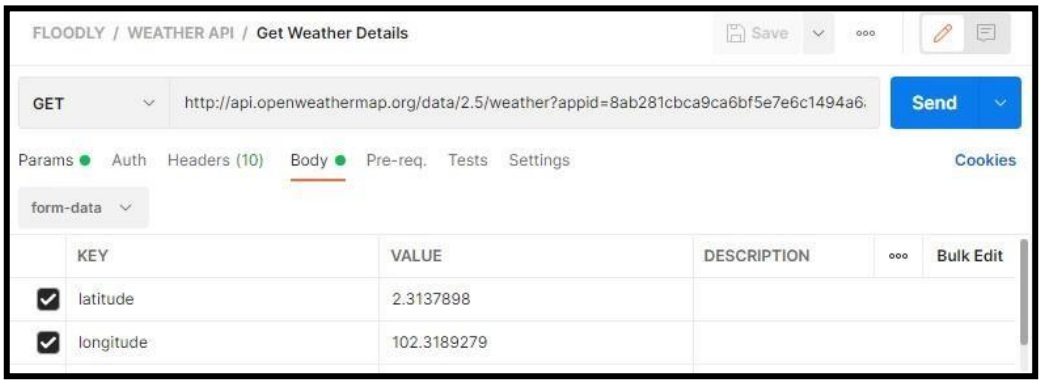


Figure 4.9: Get Weather Details

Figure 4.10: Get Weather Based on Latitude and Longitude

By gaining the *openweathermap* API, the system able to requests the server to retrieve data by GET method in order designing REST API.

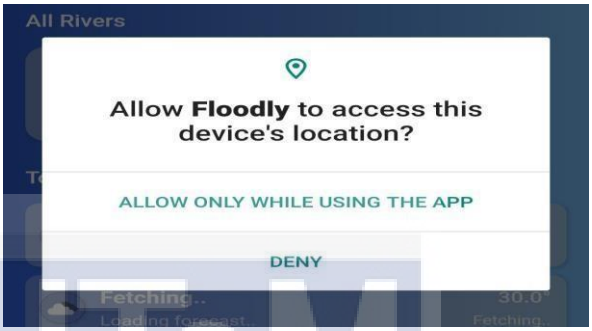
Figure 4.11: Get All River in Melaka

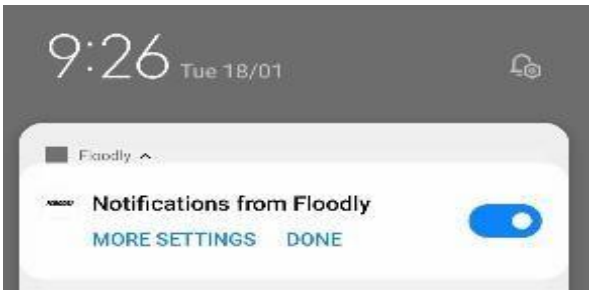
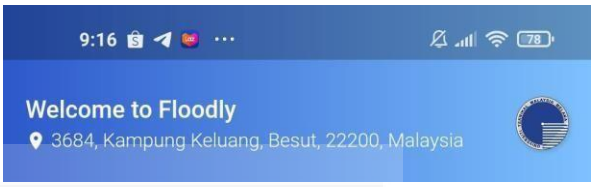
Figure 4.12: Get Nearby River by Latitude and Longitude

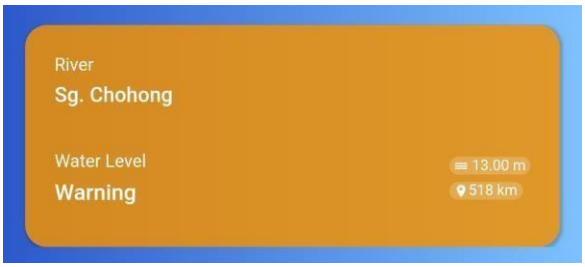
This method are integration of latitude and longitude by POST method to send thedata the from *publicinfobanjir* server In general, both GET and POST method is used totransfer data from client to server in HTTP protocol but main difference between POSTand GET method is that GET carries request parameter appended in URL string while POST carries request parameter in message body which makes it more secure way of transferring data from client to server.

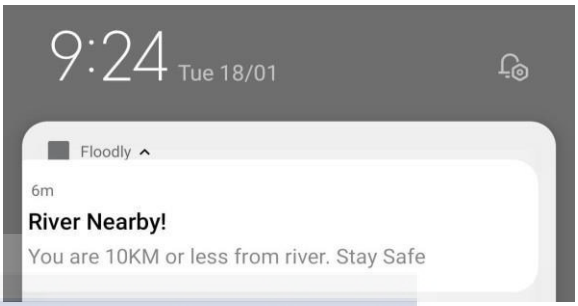
4.5 Flow of Program Design

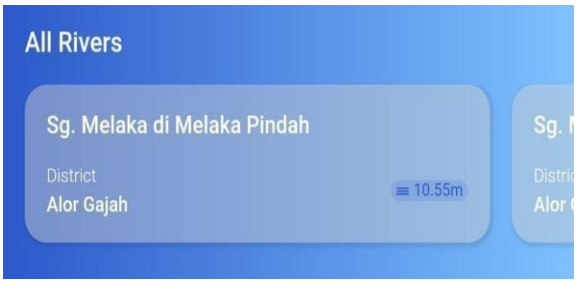
The flow of program design has been coming out for actual result in table 4.1. However, the flow perhaps different happened based on user's current situation since the navigator system was applied.

No	Description	Result
1.	Once the user click the Floodly Apps, the system will ask the permission to access the device'slocation.	 Figure 4.13: Location Access Permission
2.	After the device get location permission, the system will be automatically fetching thedata from the API server.	 Figure 4.14: Data Fetching

3.	To receive the push notification from the system, user must be 'On' the notifications from the Floodly Application in setting notification.	 Figure 4.15: Setting Notification
4.	The current device's location will being as initial result on the top of screen with detail address as long as tracked by Google Maps.	 Figure 4.16: Real Time Current Location
5.	Next, the main objective of this project which is to display water level threshold at three nearest rivers with the current user's location in Melaka. If the water level does not exceed the danger level,	 Figure 4.17: Normal Water Level Threshold

	then the value level is normal and the panel color indicator will be stay in blue.	
6.	As shown in figure 4.10, the panel color indicator was changed into yellow because the system received data of river water level threshold are warning status at Sungai Chohong.	 Figure 4.18: Warning Water Level Threshold
7.	Otherwise, the panel color indicator will be changed into red in case another two rivers are danger water level threshold. The indicator panel able to change into 4 colors based on the water level threshold such as the following settings:	 Figure 4.19: Danger Water Level Threshold

	1. Normal: Blue 2. Alert: Yellow 3. Warning: Orange 4. Danger: Red	
8.	Since the user was 'On'the setting notification as shown in figure 4.7 above,the system will be sendingthe push alert notification to the user if the user was nearby with the danger water level in ranged 10 Kilometers or less. The system will be remind to stay safe and take precautions.	 Figure 4.20: Push Alert Notication

9.	Next, the system able todisplay the swipe-ablepanel regarding the water level for all rivers in Melaka. There are 9 riversthat will be appear on the screen by swiping the panel.	 Figure 4.21: AllRivers Water LevelThreshold
10.	Besides, the system able to display the daily weather forecast of current user's location. The system can make forecasting for everyhour in the day.	 Figure 4.22: Today Forecast

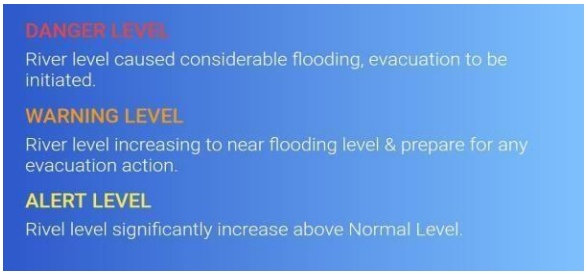
11.	On the screen 2, the system will be displayed the water level threshold image for user guideline.	 Figure 4.23: Water Level Threshold Guideline
12.	There are three kind of water level threshold that represents own color on the panel water level indicator included the simply description	 Figure 4.24: Water Level Threshold Explaination

Table 4.1: The Flow of Program Design.

4.6 Result Analysis and survey

The survey is conducted in the scope of 50 respondents from Melaka residents. The objective of this survey is to obtain feedback and analyses the effectiveness of the water level thresholding color indicator and whole the system application of flood disaster management.

Question 1: Would the mobile application that manage flood disaster be helpful intime of crisis?

Figure 4:25 shown 70% or 35 respondents agree the mobile application that manage flood disaster be helpful in time of crisis. This is because the average of them has a smartphone. Having a system like this of course very helpful for flood victims to get immediate help through smartphones. However, about 18 % or 9 respondents and 8 % or 4 respondents being neutral or disagree that the system is helpful during crisis.

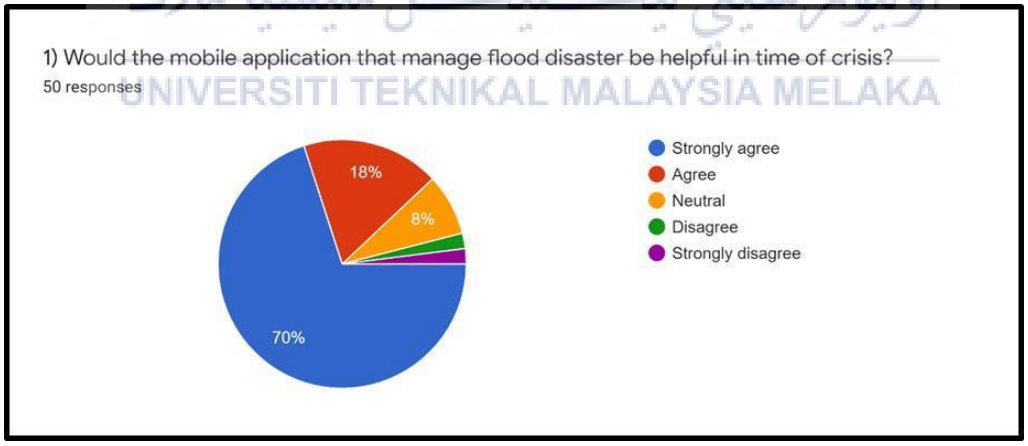


Figure 4.25: Question 1

Question 2: Is it important for an organization to have a resource management application to assist in flood emergency?

Figure 4.26 shown that 90% respondent are strongly agree and agree with the question given regarding the importance of resource management application to assist in flood emergency for an organization. However, there are 8% or 4 respondents gave the neutral opinion. Otherwise, only 1 person expressed his disagreement by answering the survey question.

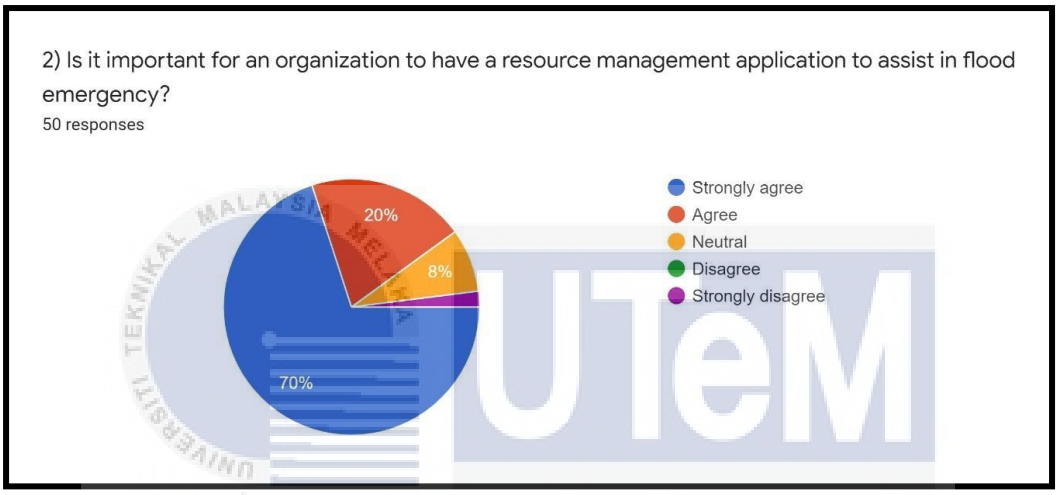


Figure 4.26: Question 2

Question 3: Is the mobile based flood disaster management system very helpful forthe public to prepare for flood precautionary measures?

Figure 4.27 shown 66% of respondent or 33 persons are strongly agreed with this statement question regarding the mobile based flood disaster management system very helpful for the public to prepare for flood precautionary measures. However, there are 3 peoples are neutral, a person disagreed and another one person is strongly disagreed.

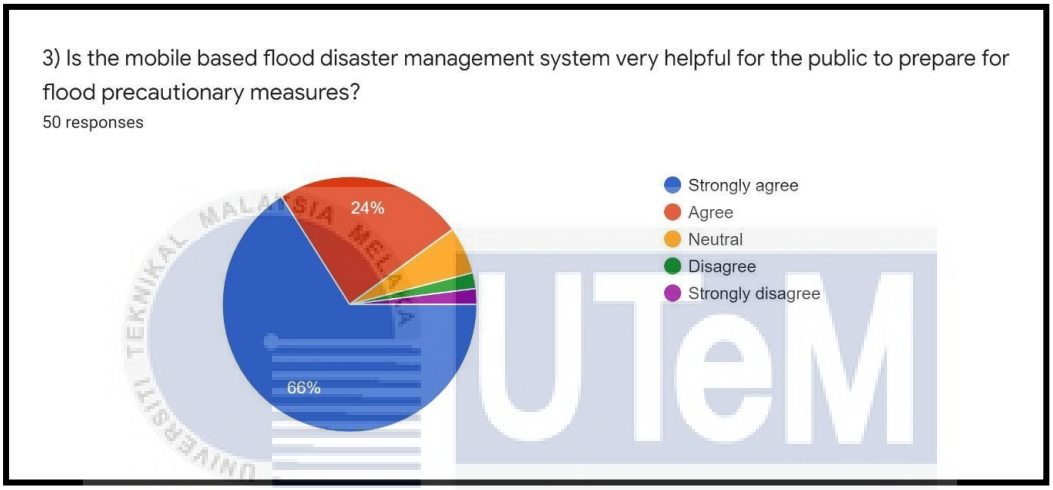


Figure 4.27: Question 3

Question 4: The mobile based flood disaster management system is greatly helping track the current location of the user very accurately and quickly

Figure 4.28 shows 64% or 32 peoples are strongly agreed and 22% or 11 peoplesare agreed with the statement mobile based flood disaster management system is greatlyhelps track the current location of the user very accurately and quickly. There are 12% or 6 respondents are neutral opinion and only 2% or a person who strongly disagree withthis statement.

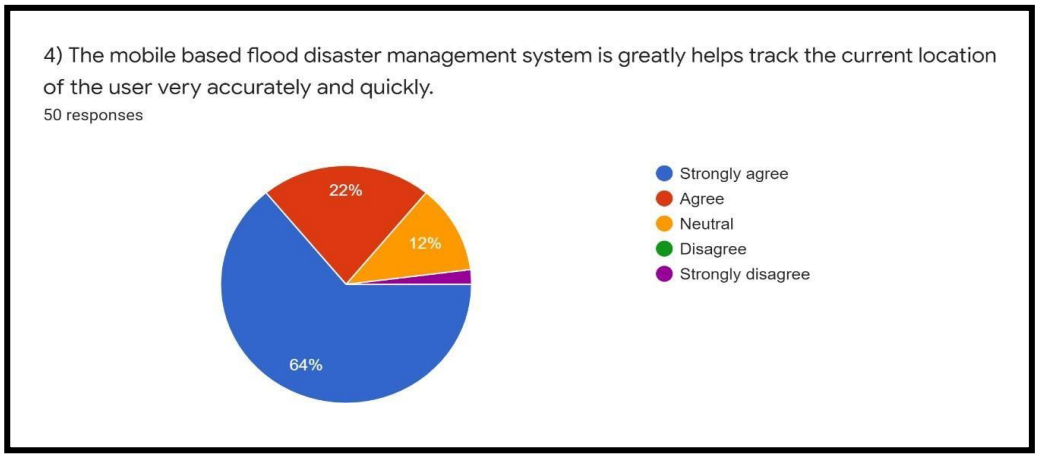


Figure 4.28: Question 4

Question 5: This apps is the Geographic Information System (GIS) approaches flood disaster management at Melaka state effectively.

Figure 4.29 shown the chart analysis regarding the question survey of Geographic Information System (GIS). It can approach the flood disaster management at Melaka state effectively. As a result, there are 58% or 29 peoples are strongly agreed, 24% or 12peoples are agreed, 14% or 7 peoples are neutral. However, a person is not agreed and aperson are strongly disagreed.

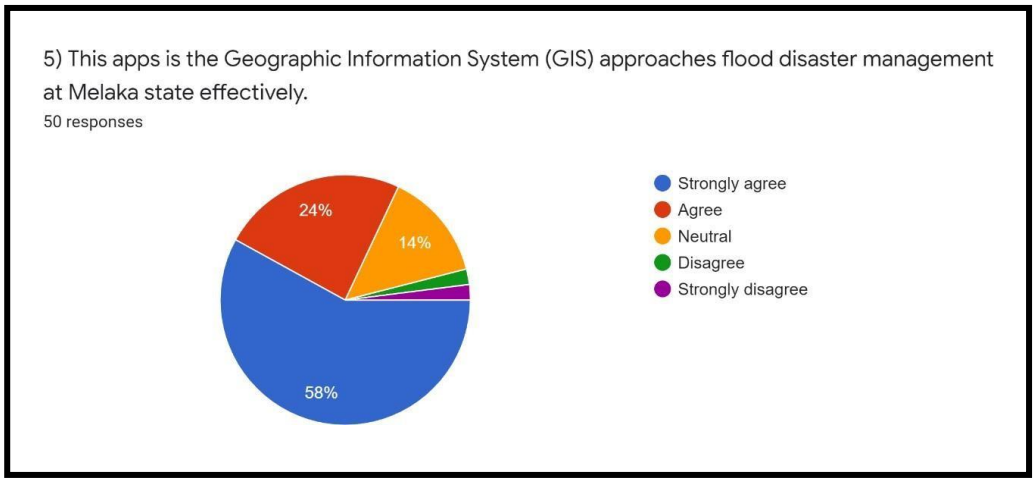


Figure 4.29: Question 5

Question 6: A firebase in this mobile-based flood disaster management system application is user-friendly.

Figure 4.30 shown the chart of result survey statement where is firebase in this mobile-based flood disaster management system application is user-friendly. The result is found 66% or 33 respondents are strongly agreed and 28% or 14 respondents are agreed with this statement. Otherwise, there are 6% or 3 respondents are neutral opinion.

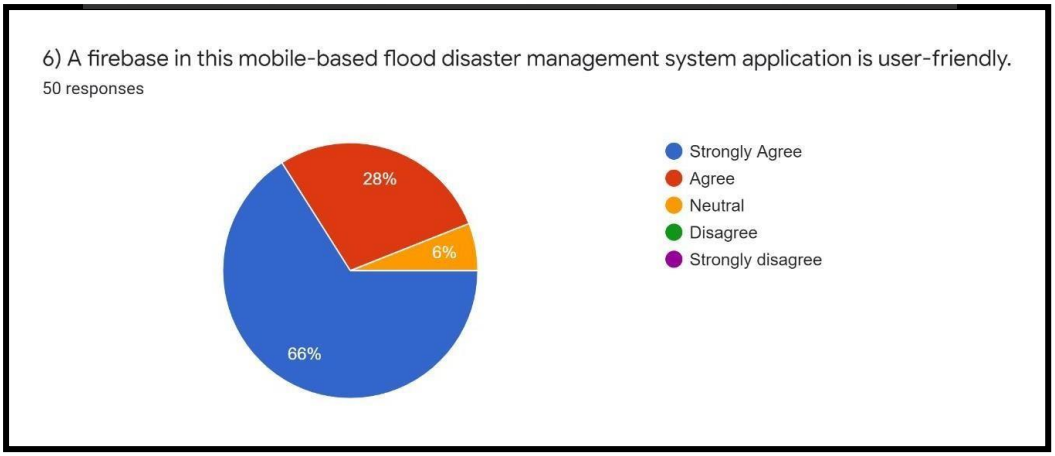


Figure 4.30: Question 6

Question 7: The water level notification that designed in mobile based flood disaster management system is very effective in helping users to notify the water level statusof nearby rivers in their area by displaying the color indicator on the notification.

Figure 4.31 was featuring the 76% or 38 respondents are strongly agree meanwhile 14% or 7 respondents are agree with the statement said the water level notification that designed in mobile based flood disaster management system is very effective in helping users to notify the water level status of nearby rivers in their area bydisplaying the color indicator on the notification. However, there are 10% or 5 respondents are neutral opinion position towards the color indicator water level notification designed.

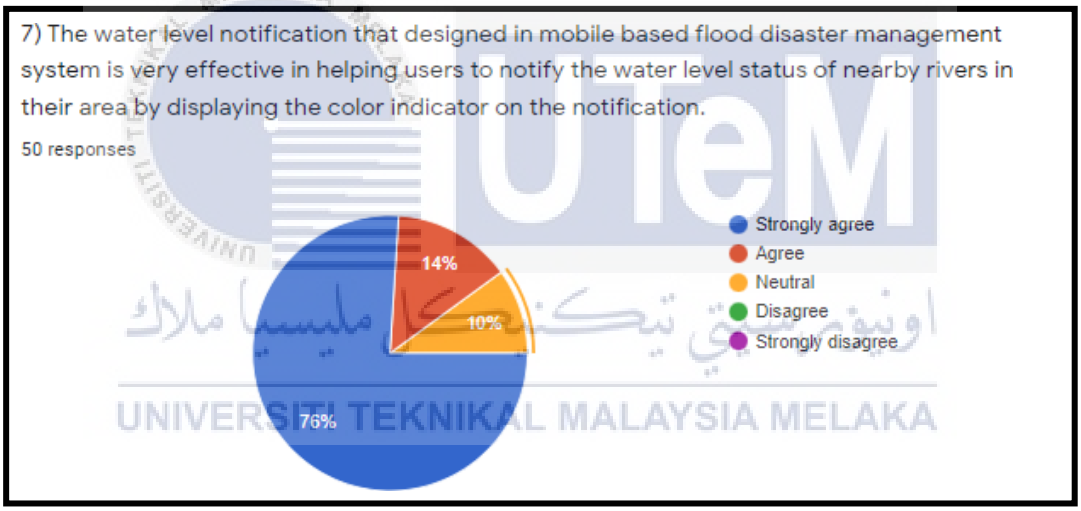


Figure 4.31: Question 7

Question 8: The water level information for all rivers in Melaka make it easier forusers to be constantly updated on water levels throughout the Melaka river.

Basically, this chart shown to obtain the people's feedback regarding the water level information for all rivers in Melaka make it easier for users to be constantly updated

on water levels throughout the Melaka river. The result shows 76% or 38 respondents are strongly agreed meanwhile 16% or 8 respondents are agreed. Besides, there are 8% or 4 respondents are neutral mindset position towards the system application created

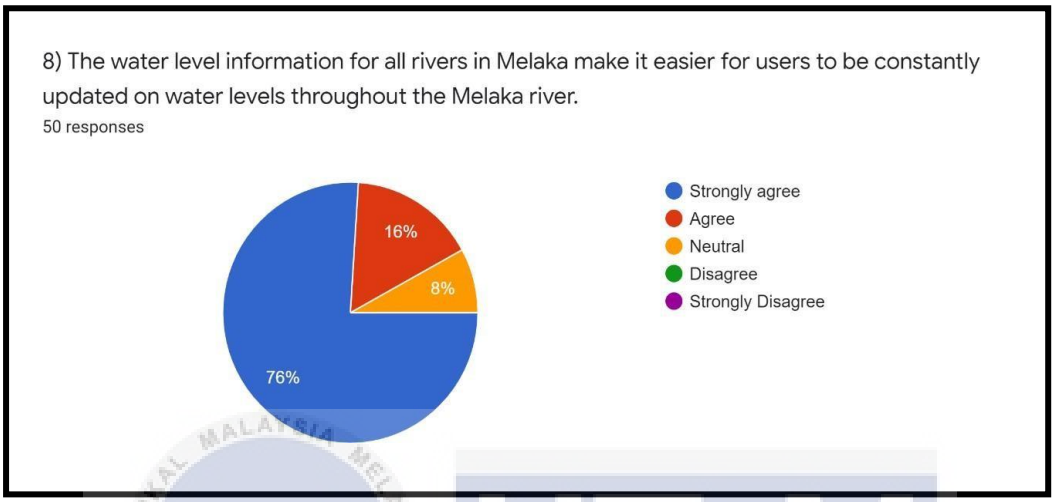


Figure 4.32: Question 8

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Question 9: The mobile based flood disaster management system is able to measurethe weather forecast at the user's current location every hour of the day.

Figure 4.33 shown 80% or 40 respondents are strongly agreed and 16% or 8 respondents are agreed with the mobile based flood disaster management system is ableto measure the weather forecast at the user's current location every hour of the day. However, there are 4% or 2 respondents are neutral mind-opinion. Overall, this result proves the system development designed is needed and successfully achieved the goal of project objective concept.

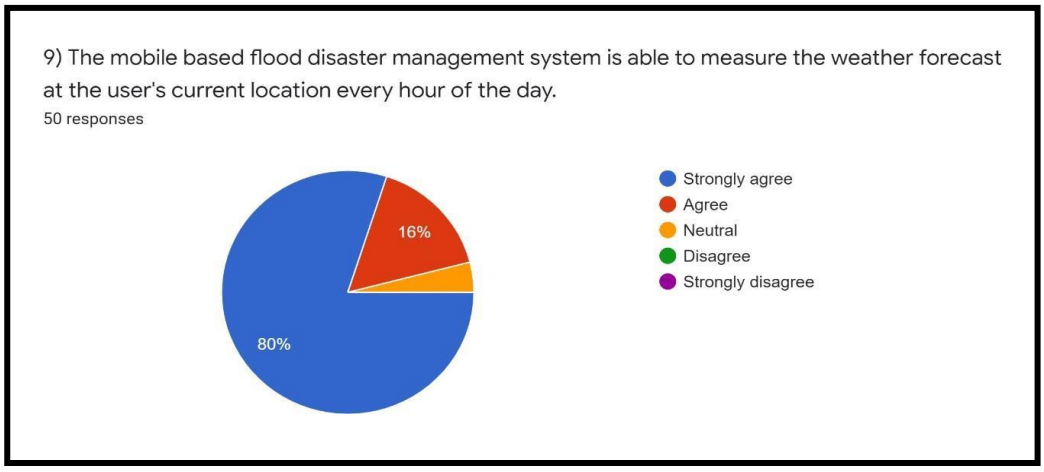

Figure 4.33: Question 9

Question 10: This project is highly desirable to be upgraded by integrating with government departments, private and NGOs so that to be able to connect flood victims simply by going through mobile apps.

The chart analysis shows 76% or 28 respondents are strongly agreed meanwhile 18% are agree with this project is highly desirable to be upgraded by integrating with government departments, private and NGOs so that to be able to connect flood victims simply by going through mobile apps. However, there are 6% or 3 respondents from 50respondents are totally not agreed with this recommendation statement. One of them said, he not agreed because worried about the data personal information is abused if thesystem is integrating with any unidentified party.

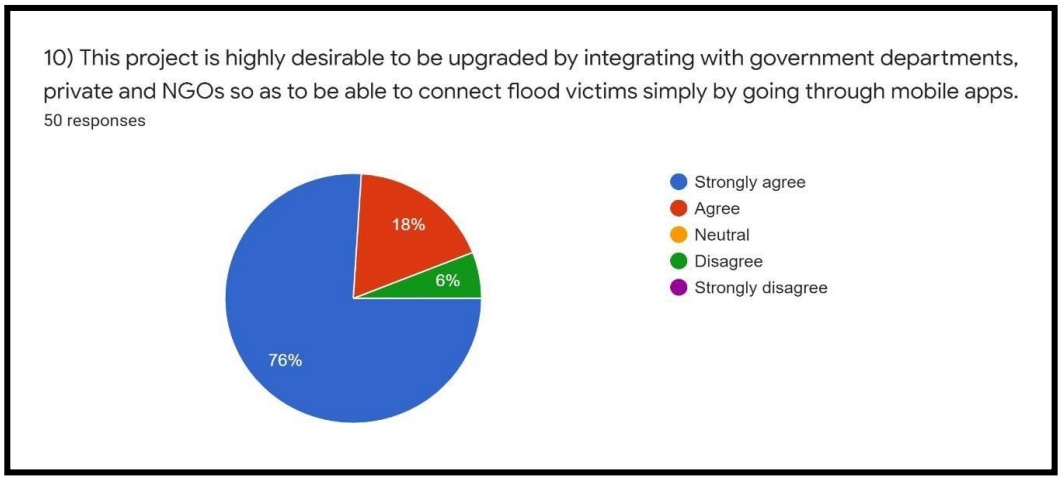

Figure 4.34: Question 10

4.7 Summary

For this chapter, the software verification and REST API testing are created in order to build the prototype explained. Recorded data for flow of program design and system trial has been discussed and shown in orderly manner. This chapter also includedsurvey question feedback on system application for further studies.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

In this chapter, this project was concluded based on chapter 1 until chapter 4 thatexplains the expected progress before starting the project and the details about the resultand discussion of the project. This project is successfully done due to the objective statedin chapter 1.

5.2 Conclusion

The project is about the Development of Mobile Based Flood Disaster Management System has been designed and tested successfully. Three main software have been developed: Flutter, Visual Studio Code, and Firebase, as shown in chapter 3. Firstly, the Flutter functioned as framework to create the mobile application in developing a Geographic Information System to approach flood disaster management effectively. Secondly, to develop a firebase in the mobile-based flood disaster management system application that is user friendly. The application is helpful in time of crisis in term of precautious actions facing the flood disaster. The project also achieves the third objective which is to verify the efficiency of river water level push notification to the problem statement by conducting a survey that consists of 10 survey questions and 50 respondents of Melaka residents. All the project objectives are accomplished.

5.3 Future Work

This section will discuss the limitation of this project and the recommendation forthis project. This project used a Dart Language as the primary program language to develop a Geographic Information System (GIS) to approach flood disaster managementeffectively for the mobile based application system.

I. Improve the fetching occur when transferring data. Fetching data take place during data transmission from Visual Studio Code to Firebase. This delay happens to avoid data mix up into database structure. An optimum timing shouldbe calculated in advance implementation.

II. Improve push notifications upon the applications. Push notification will appear in mobile phones when water level reaches warning and danger level only if theapplications still running in the background. Thus, new notification services should be provided in the apps.

III. Improve by adding the sign up and sign in feature among the users and the government and NGO's authority that can be accessible and integrating with kindof website and server in Malaysia such as The Ministry of Health's server and Firefighters and Rescuers Department's server. This program will he helpful to the flood victims especially when the crisis disaster happened.

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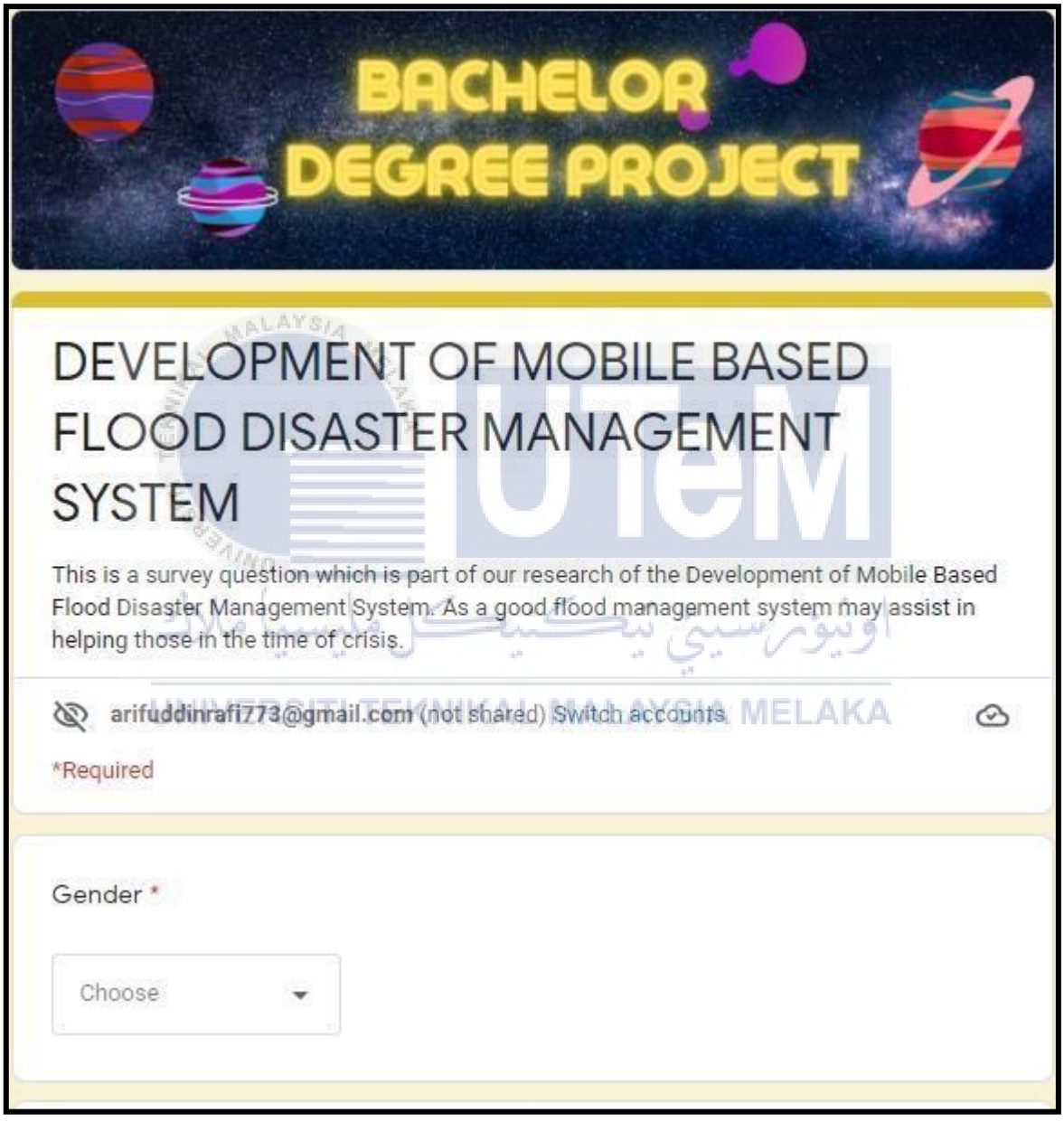
APPENDICES

Appendix A: Survey Google Form



10 Survey Questions

1) Would the mobile application that manage flood disaster be helpful in time of crisis?

- ◯ Strongly agree
- ◯ Agree
- ◯ Neutral
- ◯ Disagree
- ◯ Strongly disagree

2) Is it important for an organization to have a resource management application to assist in flood emergency?

- ◯ Strongly agree
- ◯ Agree
- ◯ Neutral
- ◯ Disagree
- ◯ Strongly disagree

3) Is the mobile based flood disaster management system very helpful for the public to prepare for flood precautionary measures?

- ◯ Strongly agree
- ◯ Agree
- ◯ Neutral
- ◯ Disagree
- ◯ Strongly disagree

4) The mobile based flood disaster management system is greatly helps track the current location of the user very accurately and quickly.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neutral
- ◯ Disagree
- ◯ Strongly disagree

5) This apps is the Geographic Information System (GIS) approaches flood disaster management at Melaka state effectively.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neutral
- ◯ Disagree
- ◯ Strongly disagree

6) A firebase in this mobile-based flood disaster management system application is user-friendly.

- ◯ Strongly Agree
- ◯ Agree
- ◯ Neutral
- ◯ Disagree
- ◯ Strongly disagree

7) The water level notification that designed in mobile based flood disaster management system is very effective in helping users to notify the water level status of nearby rivers in their area by displaying the color indicator on the notification.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neutral
- ◯ Disagree
- ◯ Strongly disagree

8) The water level information for all rivers in Melaka make it easier for users to be constantly updated on water levels throughout the Melaka river.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neutral
- ◯ Disagree
- ◯ Strongly Disagree

9) The mobile based flood disaster management system is able to measure the weather forecast at the user's current location every hour of the day.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neutral
- ◯ Disagree
- ◯ Strongly disagree

10) This project is highly desirable to be upgraded by integrating with government departments, private and NGOs so as to be able to connect flood victims simply by going through mobile apps.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neutral
- ◯ Disagree
- ◯ Strongly disagree