IOT FLOOD WITH DETECTION AND MONITORING SYSTEM

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This report is submitted in partial fulfilment of the requirements for the Bachelor of Computer Science (Computer Networking) with Honours.

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
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2019

DECLARATION

I hereby declare that this project report entitled

IOT FLOOD WITH DETECTION AND MONITORING SYSTEM

is written by me and is my own effort and that no part has been plagiarized

without citations.

STUDENT : MUHAMMAD FIKRI ARIF BIN MOHD AMRAN

Date : 18 DECEMBER 2019

I hereby declare that I have read this project report and found

this project report is sufficient in term of the scope and quality for the award of

Bachelor of Computer Science (Computer Networking) with Honours.

SUPERVISOR : TS. ARIFF BIN IDRIS

Date : 18 DECEMBER 2019

DEDICATION

This appreciation is dedicated to the person who helps me during my time of finishing this Final Year Project. First of all, I would like to thank my mother, father and my family in giving me all who always support me in anything that I do for my studies and always give their best to fulfil my needs and give me a help in term of financial and concern I needed in order to complete this project successfully. Their contributions are extraordinary and beyond words. Besides, thanks to all those friends and people who were given their ideas, information, help, guiding and support behind me.

ACKNOWLEDGMENTS

All praises are to Allah, Lord of the Universe, the Merciful and Beneficent to Prophet Muhammad S.A.W, His Companion and the people who follow His path. First of all, I would like to express my gratitude to Almighty Allah to enable me to complete this final report project and smoothly. The Final Year Project opportunity to design the project is “IoT Flood with Detection and Monitoring System” was a great chance for learning and get more knowledge. Therefore, I consider myself a very lucky chosen one as I was provided with an opportunity to be part of it.

I would like to take this opportunity to express my deepest gratitude and special thanks to my supervisor, Mr Ts Ariff Bin Idris who in spite of being extraordinarily busy with his duties, took some time to hear, guide and keep me on the right path to develop the Final Project Year 1. I also convey my sincere gratitude to my supervisor, Mr Ts Ariff Bin Idris, for giving me useful advice and necessary guidance. I choose this moment to acknowledge his contribution too gratefully.

Therefore, I would like to extend my appreciation to the most important person, my father and my mother after all their moral support and financial support and my supervisor Mr Ts Ariff Bin Idris also too. Last but not least, special thanks to my friends for sharing experience, time helping me throughout the course of completing the Final Year Project and project report too.

ABSTRACT

The flood is one of the unavoidable natural disasters in the Melaka. Every year, the residential areas and building parks in Melaka are damaged by big floods because of the absence of an early warning. To solve this problem, the title of this project is “IoT Flood with Detection and Monitoring System" and this project can help victims of the flood happens. Other than, this project has three parts to develop this project. First part is to measure the height of the water using an ultrasonic sensor distance measuring sensor. The second part is to send the height of the water level indicator information to the Android application on the smartphone app. Then, the third party can send a message to the residences to alert the flood victims through a message on the Telegram application. The Telegram applications are made through the most popular on the smartphone and user easily to get message alert and warning when the water of flood happens.

ABSTRAK

Banjir merupakan salah satu bencana alam yang tidak dapat dielakkan di Melaka. Pada setiap tahun, kawasan kediaman dan taman bangunan di Melaka terdapat kerosakan akibat banjir besar kerana tiada amaran awal. Untuk menyelesaikan masalah ini, tajuk projek ini adalah "IoT Flood with Detection and Monitoring System" dan projek ini dapat membantu mangsa-mangsa banjir yang berlaku. Selain itu, projek ini mempunyai tiga bahagian untuk membangunkan projek ini. ketinggian air yang menggunakan sensor ultrasonik mengukur jarak sensor. Bahagian kedua adalah untuk menghantar ketinggian maklumat penunjuk paras air kepada aplikasi Android pada aplikasi telefon pintar. Kemudian, pihak ketiga boleh menghantar mesej ke kediaman untuk mengingatkan mangsa banjir melalui mesej mengenai aplikasi Telegram. Aplikasi Telegram dibuat melalui yang paling popular di telefon pintar dan pengguna dengan mudah untuk mendapatkan amaran dan amaran mesej apabila air banjir berlaku.

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API – Application Program Interface

DoID – Department of Irrigation and Drainage

FYP – Final Year Project

GPRS – General Packet Radio Service

GSM – Global System for Mobile communications

FEWDS – Flood Early Warning Detection System

FTMK – Fakulti Teknologi Maklumat dan Komunikasi

FYP – Final Year Project

IoT – Internet of Things

IJARIIE – International Journal of Advance Research and Innovative Ideas in Education

JSON – JavaScript Object Notation

ISSN – International Standard Serial Number

OODA – Observe Orient Decide Act

SDK – Software Development Kit

SMS – Short Message Service

UTeM – Universiti Teknikal Malaysia Melaka

USB – Universal Serial Bus

Wi-Fi – Wireless Fidelity

CHAPTER 1: INTRODUCTION

1.1 Introduction

As state by Star Online in July 2019, in Melaka rise to 745 people from 150 families on the day of the flood happens. However, every residential and building park cannot be safe because people do not know when the flood will be at the scene. Then, the method to solve this problem need. Therefore, this project IoT Flood with detection and monitoring system will be helping people who affected flood in Melaka.

The title of this project is namely as “IoT Flood with Detection and Monitoring System". The Flood using IoT, it can help people to decrease after effect the flood happens. Then, this IoT flood with Detection and Monitoring System which keep close can watch over various natural factors to predict happen. However, it can embrace ourselves for caution, to minimise the damage caused by the flood. Natural disasters like a flood can be affected leading to property damage and loss of lives. This "IoT Flood with Detection and Monitoring System" project has two main functions. Firstly, it can automatically detect when the flood reaches the water level. Secondly, it can push the notification of alert message when the flood of water level normal and overflow. The data information of flood from the Department of Irrigation and Drainage Melaka (DoID Melaka). When the water at normal level there is no alert. However, if the big flood, then the water level reach danger level, it will give the

notification of "DANGER". Then DoID Melaka will give the notification and message to the people who affect by the flood to leave from there area. Therefore, DoID Melaka needs to install Flood IoT products around the residential area and building park which have the potential of flood in that area.

The biggest dam in Melaka is Durian Tunggal. When the flood of waters is low tide, the water flows through the Durian Tunggal dam. The dam Durian Tunggal of the area is 4300 X 5200 in per square. During the Durian Tunggal Dam can hold of water as much 6,620 million litres. On besides that, the low rainfall caused a decrease in water levels at the 32,600 million litres in Durian Tunggal Dam.

1.2 Problem Statement (PS)

The problem arises when the situation is uncontrolled and this is lead to pick the main problem that contributes to a water level. The problem statement is as follows.

Table 1. 1 Problem Statement

PS	Problem Statement
PS1	Lack of efficient device to trigger the flood alert.
PS2	No alert of water level when the flood will happen.
PS3	Department of Irrigation and Drainage Melaka (DoID Melaka) could not predict when the will flood happens the water level.

1.3 Project Question (PQ)

After the problem, the statement has determined and several questions come up in order to discover the right objective.

Table 1. 2 Project Question

PS	PQ	Project Question
PS1	PQ1	How to improve the device to trigger the flood alert?
PS2	PQ2	How to user know the alert message when the flood will happen the water level?
PS3	PQ3	How to know the predict when the flood will happen the water level?

1.4 Project Objective (PO)

After the problem statement and project question have been determined, the project object can be made as follows.

Table 1. 3 Project Objective

PS	PQ	PO	Project Objective
PS1	PQ1	PO1	To develop a prototype of IoT flood alert system, that can detect the water level via an ultrasonic sensor.
PS2	PQ2	PO2	To display live water level status/ warning via LED display.
PS3	PQ3	PO3	To construct interactive alert notification via Telegram whenever water level reaches warning level & above.

1.5 Project Scope (PS)

This project will be testing at Fakulti Maklumat dan Komunikasi (FTMK). The function of this project is to detect water level inside the container and to monitor using apps. The scope of this project will target on several issues which based on this objective of this project. Below is the list of scope for this project.

1. Developing wireless network communication between the Android smartphone and IoT Flood using the microcontroller is Arduino.
2. Programmed the ultrasonic sensor to detect water level and can calculate percentage of height of the water level indicator.
3. Programmed the NodeMCU ESP8266 Wi-Fi communicate to the Telegram apps which to get the notification, message or alert about the water level indicator.

1.6 Expected Output

The IoT Flood with Detection and Monitoring System, the water level flood could be calculated as well as the percentage. For example, the percentage is set 90 percent then the ultrasonic sensor will trigger the sound alarm that the indicator of water level is the danger level. Meanwhile, the message is sent at the user when the output of the alert monitoring system is danger above 60 percent.

1.7 Project Contribution (PC)

This project has many contributions and the most important advantages keep the safe residential area and building park when the flood happen at the area which can help to report the detection of water level. Below is the summary of the project contribution.

Table 1. 4 Project Contribution

PS	PQ	PO	PC	Project Contribution
PS1	PQ1	PO1	PC1	Users can know information about the water level indicator of a flood when is happening where they know when their area is water level is high.
PS2	PQ2	PO2	PC2	To detect of water level using ultrasonic sensor when a big flood happens is the high level which has sent alert sound alarm, light and notification on the applications.
PS3	PQ3	PO3	PC3	The application on the smartphone developed for the user is to get information about the indicator water level and alert or message.

1.8 Report Organization

1.8.1 Chapter 1: Introduction

This first chapter will elaborate on the information of the project and also work out on problem statement and objective that will achieve. Project Scope, expected output and project contribution are also stated in this chapter.

1.8.2 Chapter 2: Literature Review

This second chapter will explain the related and previous project that have been done by others including concept, theory and system architecture and project implementation. The current problem, details and applications are also included in this chapter.

1.8.3 Chapter 3: Methodology

This third chapter discuses regarding the methodology that involves and suitable for the project like how the process of a project working even if there is any error. The milestone that needs to be completed within the time given also included in this chapter.

1.8.4 Chapter 4: Analysis and Design

This fourth chapter will elaborate on the software programming and hardware implementing as well as discussing regarding the layout of the IoT Flood application. The analysis must correct as well as data collection and it will lead to the implementation.

1.8.5 Chapter 5: Implementation

This fifth chapter will implement programming language that has been choosing and all hardware involve in this project.

1.8.6 Chapter 6: Testing

This sixth chapter is going to have the testing and debugging process of application starting from the microcontroller, application and database cloud. In this phase, the result was compared to the objective in order to state conclusion and hypothesis.

1.8.7 Chapter 7: Project Conclusion

This last chapter that including the conclusion of the output of the project and how to supposed behaviour and also the summary of the project. The suggestion of improvement in the future that can be a constraint of the task.

1.9 Conclusion

The summary of this chapter is the introduction of this project. This chapter is the appearance of complexity, goal and scope have been a problem this project. Therefore, the flood with detection is detected of water level and it alerted the light and message on the notifications at application. If this project the weakness it will improve this project within two-semester.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter is going to the discussion in details regarding the previous or current project that is done by others which is the type of components, the methodology that is used the way component is implemented and medium that be used to send the information. In this section, the information that can be related to the project and thus the project will be found to assist and to help on giving the idea generator. However, a project that has already been created can also serve as a reference to improve the current project in terms of its objectives and goals. This chapter will also compare and research the systems that other systems have previously developed by other systems before it. Based on the comparison, the advantages and disadvantages of the project can be improved and repaired for the use of the new project.

2.2 Related Work / Pervious Work

According to Kalpesh R. Dashpute, Nilesh S. bawa, Vishal B. Gaikwad and Sagar S. Sawkar in 2018, their research on “Flood Detection Using IoT”, these devices can help flood victims when the flooding happen. In this research project, the title of the project is “Arduino Flood Detector System” have been developed, to help the road user to keep away from this problem happen. It was invented based on the problem faced by motorists and commuters when the flood occurred. The project system, it will function when the admin activates the system and when water along the road detected by the distance on over that using the ultrasonic sensor. When the flood happening, the ultrasonic sensor will send a signal to the microprocessor circuit and to detect on the surface water level will be displayed in the user interface. The Short Message Service (SMS) send is automatically to that recognized resident and to detect the water level until returns to the normal level and constantly updated.

This research of this project in the design phase, the architecture is developed. This phase starts with the requirement document delivered by the requirement phase and maps the requirements into architecture. The compact architectures of these components, their interfaces and behaviours. The deliverable design document is architecture. The design document describes a plan to implement the requirements.

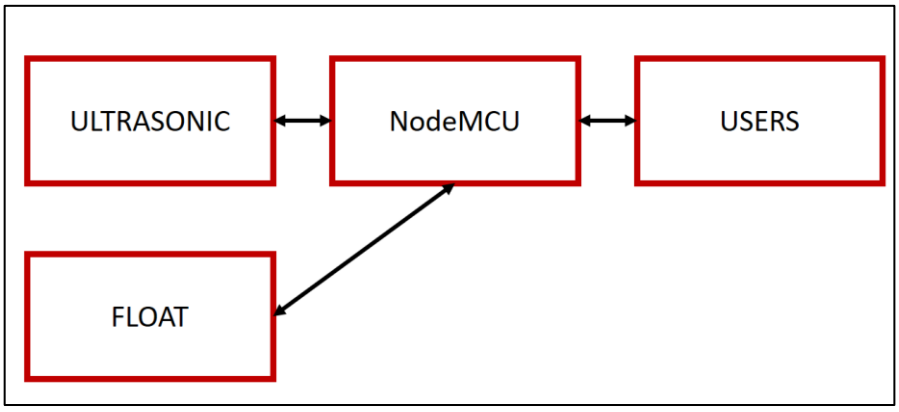

Figure 2. 1 System Architecture

Based on Joni Welman Simatupang and Faiz Naufal in 2019, their research on “Flood Early Warning Detection System Prototype Based on IoT Network”. The research of this project is about how to develop the prototype of their project is a water level monitoring system that the microcontroller Arduino Uno with an ultrasonic sensor device to measure the flood of water in real-time Then, the main server is a web database server which the information to collect and transmit thru SMS based on the SIM900 module, for example, a web database server is a cloud database system. Ultrasonic sensor module HC-SR04, the distance measuring sensor module with a range distance measurement is 2 to 500 cm. The sensor has two types is transmit and receive which can transmit overall 40 kHz ultrasonic signal and when the object is reflected after its return. From the ultrasonic sensor with the microcontroller on the water surface to measure the range. The ultrasonic sensor showed the below figure to implementation a circuit. The ultrasonic sensor connects to port 12 is a trigger pin. Then, the Arduino with ultrasonic sends a high voltage of about 1 for 10 microseconds thru this pin to trigger from the wave outcome transducer. The microcontroller receives via echo pin 1 from the object and sends the signal. The water level indicator set above on the water by the ultrasonic sensor in the water reservoir.

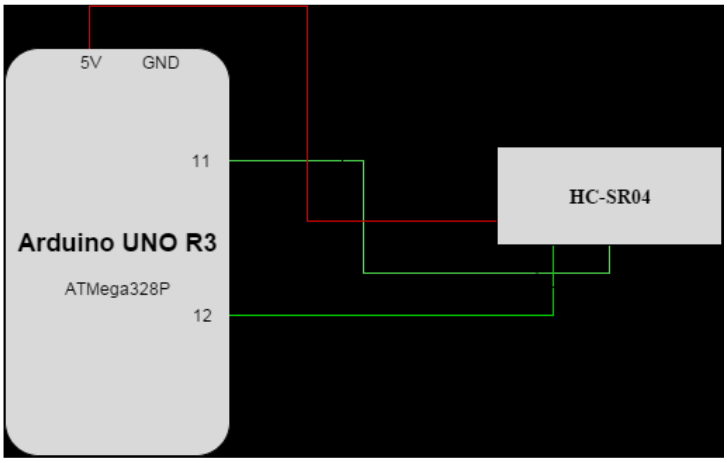

Figure 2. 2 Block diagram Android Uno with ultrasonic sensor

Their research has used the GPRS Shield based on the SIM900 module from SIMCOM is high quality and suitable with microcontroller Arduino. The cell phone of the GSM network is communication using by the GPRS Shield to provide a method. The SMS, MMS, GPRS and Audio thru via UART by sending AT commands for the shield allows that to achieve it. Represent on board of shield also has the 12 GPIOs, 2 PWMs and an ADC of the SIM900 module (2V8 logic). Other than, the microcontroller to send the data to the website and the message to the people by module interfaced the GSM and GPRS. The circuit implementation of the GSM and GPRS module is shown below this figure. The microcontroller gets and processes the data which is the ultrasonic has been measured and send to the SIM 900 module. The GPRS signal is directly sent the data to the website and the SIM 900 receives the data by message.

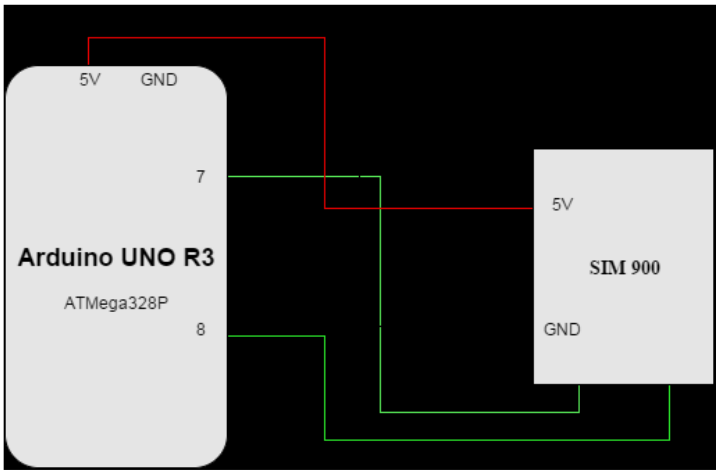

Figure 2. 3 Circuit implementation Arduino Uno with Module SIM 900

According to Joni Welman Simatupang and Faiz Naufal in 2018, the Flood Early Warning Detection System Prototype Based on IoT Network consists to make a result of this project the measurements have performed many times in condition water level by each of status condition in the water reservoir. The measurements results provide status is "SAFE" and "ALERT". The different water level reading used as a quality indicator measurement by the sensor with the real situation. Other than the determining factor is how the GSM and GPRS modules can transmit data to the web site and respond to messages sent in a programmed format. The GSM and GPRS module can decide that the system is running well, but there need to improve then still so many things. For instance, the GSM and GPRS module is the less sensitive sensor readings and the less reactiveness to some require that make an Arduino cuts the command.

Table 2. 1 Result of the range-status

Status	**Distance (cm)**
Safe	0 – 9
Alert	10 – 15
Standby	16 - 19
Beware	20 - 30

According to Hamadi Lirathni, Bechir Ben Gouissem and Tahar Ezzedine (2018), in their research on “Flood Disaster Prevention and Management IoT Architecture for Tunisian National Security”. The researcher is research on how to be a good disaster management system. Then, Disaster management systems that use Wireless Sensor Networks (WSNs) and IoT solutions have received much attention. The water cycle is a balanced system; water flowing into one side of the cycle is well-adjusted by water flowing back to the sea. As flooding is a natural event caused by an unbalance in this hydrological system, sometimes the amount flowing into one area overpass the system capacity to retain it within its natural boundaries. This situation engenders a flood, which occurs when the mass of water received by the land from rainfall, snowmelt, surface flow and flow in watercourses or inundation by the sea overpass the capacity of the land or drainage-system to discharge that water. Floods can occur on any location but land adjacent to watercourses fluvial flood plains or low- lying ground next to the coast, coastal flood plains or ponding of surface runoff in urban areas are more exposed to that events.

The researcher uses a methodology are "Observe Orient Decide Act (OODA) methodology loop". The OODA is a making decision repeating the cycle of OODA aiming to improve decision effectiveness, to begin with and develop up by military strategist and the United States Air Force Colonel John Boyd. The OODA loop decision methodology facilitates fast and accurate decision making that can be very useful in disaster management and response activities with very changing parameters and always changing the situation. OODA loop concept formalizes the situation response process; observes actual circumstances to obtain an overview of the situation before placing a plan into action. It also involves making predictions based on observations when obtaining an overview. Our target architecture is based on the OODA methodology loop. The figure depicts an overview of disaster response architecture components conducted through the OODA cycle and using OODA loop concept in the disaster prevention management and response solution permits to overlays the rapid incoming flow of disaster information on

a global view managed in temporal-spatial terms, which to improves decision making and helps achieve a nationwide coordinated.

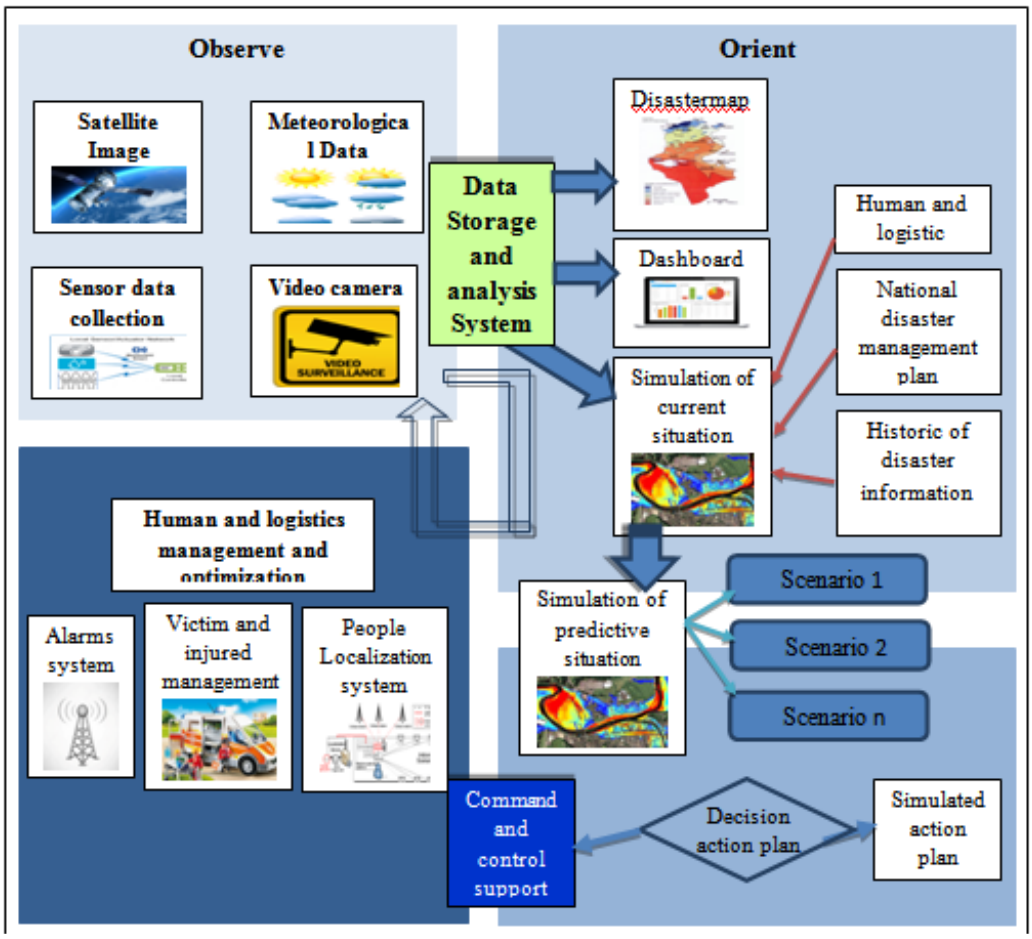

Figure 2. 4 OODA loop for disaster management and response

2.3 Critical Review or Current Problem and Justification

Table 2. 2 Critical Review

Research Title of Project	Article Resource	Author	Purpose	Description
Flood Detection Using IoT	Vol-4 Issue-2 2018, IJARIIE	Kalpesh R. Dashpute, Nilesh S. bawa, Vishal B. Gaikwad and Sagar S. Sawkar (2018)	The purpose of this project is make a flood alert system using a GSM and ultrasonic frequency sensors which is useful to make the people alert from disaster flood scene. This project ultrasonic is used to find out the water level of the flood and then the information is given to the controller and GSM, this system continuously sends the messages towards control room about the level of the flood when the water level will change.	Based on the project idea is about the ultrasonic sensor send a signal to the Arduino Uno and the sense water level will be displayed on the user interface from Android application. The Short Message Service (SMS) send is automatic to recognized resident and to detect the water level until returns to the normal level and continue updating. If the water level will repeat the process because the water level continue to rise. The SMS mobile phones the

				idea of the warning system was to propose it.
Flood Early Warning Detection System Prototype Based on IoT Network	Internetworking Indonesia Journal · May 2019, Research Gate	Joni Welman Simatupang and Faiz Naufal (2019)	The aim of this project is to prevent the large effects of flooded on the building area using FEWDS that is a flood early warning detection system. The system will be mounted on surface water level monitoring. This project to be able to read the water level at every second, display it to the supervisor and alert the affected population and relevant authorities by means of an alarm and short message system (SMS) when the level of water surpasses a user-defined threshold.	This importance of this project used ultrasonic sensor for measure water level. The SIM 300C modem can send and receive the message. Microcontroller will process and manage the all data. Water velocity increase rate and flood time can be predict by this system. Water level is measured by many times for each status condition. Different water level reading between reading by sensor and real situation show the quality indicator. The measurement results are provided for status “SAFE” is 0 cm until 9 cm in distance and status “ALERT” is 10 cm

				until 15 cm in distance.
Flood Disaster Prevention and Management IoT Architecture for Tunisian National Security	IOSR Journal of Computer Engineering (IOSR-JCE)	Hamadi Lirathni, Bechir Ben Gouissem and Tahar Ezzedine (2018)	The purpose is about the Disaster management systems that use Wireless Sensor Networks (WSNs) and IoT solutions have received much attention. The water cycle is a balanced system; water flowing into one side of the cycle is well-adjusted by water flowing back to the sea. As flooding is a natural event caused by an unbalance in this hydrological system, sometimes the amount flowing into one area overpass the system capacity to retain it within its natural boundaries. Disaster management is a life-saving task,	The description of this project is using the OODA methodology loop concept. The OODA is a making decision recurring cycle of observe-orient-decide-act. The OODA loop decision methodology facilitates fast and accurate decision making that can be very useful in disaster management and response activities. OODA loop concept formalizes the situation response process; observes actual circumstances to obtain an overview of the situation before placing a plan into action. The overview of disaster response

			hence researchers should consider the development of cutting edge technologies in this regard, to bring down the cost further. Large-scale deployment of sensors is the key technology for disaster detection and observation.	architecture components conducted through the OODA cycle and it is using OODA loop concept in the disaster prevention management and response solution permits to overlays the rapid incoming flow of disaster information onto a global view managed in temporal-spatial terms, which improves decision making and helps achieve a nationwide coordinated.

2.4 Proposed Solution or Further Research

Based on the Joni Welman Simatupang and Faiz Naufal in 2019 stated that in the project is “Flood Early Warning Detection System Prototype Based on IoT Network”, the importance of the flood scene is the alert to give information about the height of water level on flooding. The deference this project and my project is my application is about the water level of threshold to the authorized user that user can know when the height of the water level when flooding scene. Then, the user can get the information flood scene of water level from application.

2.5 Conclusion

This summary of this chapter, there is beneficial information can gather from the previous and current project so that the project will be running make it clear. Besides that, either both advantages and disadvantages can determine as the guideline to the process of making this project. Finally, analysing the previous project help make a critical analysis regarding this project and more understanding.

CHAPTER 3: PROJECT METHODOLOGY

3.1 Introduction

This chapter needs the right methodology as a guideline in order to achieve the right possible output. The methodology should fit enough for the project. The importance of having the right method that will determine and detect the fault as soon as the error occurred. The chapter is going to explain the methodology that will use in this project. This methodology will elaborate regarding the phase and step will be taken. For the software, it involves sources code such as programming, calculation and establishing the application, while hardware implementation, designing the circuit and connecting all the device. Gantt chart and Milestone also involve in this chapter as well so that the project will be running according to the planned.

3.2 Methodology

The right methodology for this project is Rapid Application Development (RAD) model since this model is based on iterative and prototyping with no particular planning concern. Hence, the step of writing the application itself contains the planning need to prototyping. The prototype is a model working equivalent to a component of the product. The crucial aspect of this particular model is to make sure that this prototypes established is reusable. There is four phase of this model which are requirements planning, prototyping, testing and cutover.

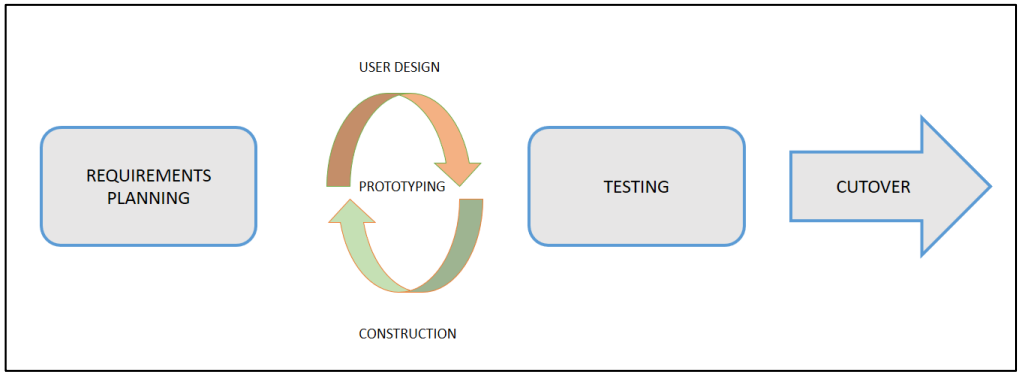

Figure 3.1 RAD Methodology Model

3.2.1 Requirements Planning

Requirements planning is the first phase in the Rapid Application Development (RAD) model. Generally, when it comes to producing a product all the information is related to the product should gather. The information such as hardware and software should reliable and precise in order to achieve the possible output later. After all, information gathers like the type of the microcontroller, type of connection, type of tools needed to develop the application, it should describe how the information can be used, when will it proceed and the most important what making this particular product success to the industry. Next, any part of the information for removing, adding or charging the data are also created in this phase. At this initial stages, users and developers need to come to a clear compliment based on the project scope and all the requirements need to be declared to have a clear way when the stages with prototyping can begin.

3.2.2 User Design

User design is the interface phases of this RAD system. The interface of the system that will be developed should be designed in these phases first to know whether the interface follows the requirement and are a good user interface or not. This models and prototype will be built at these phases to make the planning part become easier to be understood in these terms of this real product and this function. At this phases, it will figure out in more specific about this project system correlated with the planning system and the specification of the system area model, the illustration of the system design and the development planning. Besides that, these phases will confirm the interfaces that will be created and relevant and easy to be used by end-user. This allows initial modelling and prototypes to be created. This step will be repeated continuously until the target of this project achieve.

3.2.3 Prototyping

Prototyping is the second phases which contains have two parts is user design and construction. Then, for user design, it concerns the development of the hardware component and application. The circuit diagram, programming language or sources code and architecture of the product is created and encourage the user to fell the new experience. For the application system design and system flow are created and tools will be used is determined. The construction part is working on what has gathered in user design step. Component type of connection and application are established and turn into a prototype. All the architecture component and application are done and ready to be testing at the next phases.

3.2.4 Construction

Construction is the phases of this real application the coding, testing and developing a new product prototype or improving had been carried out. On the process of finishing these phases. Then, the microcontroller is Arduino equipment was being used in order to start implementing and combining the infrared sensor with the Arduino. This equipment was a complete kit of Arduino component which is used to build more types of this project. When this basic user and system design has been started, the implementation phases is where most of the real coding development, testing and adjusting take the places. This phases also will be repeated continuously until the target result or goal has been achieved.

3.2.5 Testing

Testing is the third phases, the testing phases are tested every model is testing individually in order to identify debug and fault model quickly. In the same time the application where all the interface is running well. In other that, many of the programming components have already been tested since RAD emphasis reuse. This reduces the overall testing time because the new part must be tested, and all interfaces must be fully exercised. Testing and retesting in the code, this will involve more user testing before the system live in the project system. The sensor also should work well because it acts as an important role because it did not, it brings a problem to the whole product.

3.2.6 Cutover

Cutover is the last phases of the RAD system, the objective of this cutover is to test, modified information over to a new development compared to the system that already exists before it. This phase also acts as a training platform so that the users know how to use this system more clearly. Most of the components that will be used in this project had been finalised at these stages in the RAD model in order to develop the prototype and the development of software and hardware. The final step in cutover stages allows the developer range of time to modify or adjust the component to the real-life product which is all the testing can be done at these stages.

3.3 Project Milestones

Project milestone is the timeline that shows the progress of this full report project flow on when the project should be done before the due. This milestone help on guiding the developer to divide their time properly to develop this project followed the schedule.

Table 3. 1 Milestones for Final Year Project 1 (FYP 1)

No.	Milestones	Duration	Start Date	End Date
1	Discussion project title and proposal with supervisor	2 days	18/9/2019	20/9/2019
2	Submit the proposal to supervisor	1 day	23/9/2019	23/9/2019
3	Identify the project requirement	2 days	24/9/2019	26/9/2019
4	Research for the report project Chapter 1: Introduction	2 days	27/9/2019	29/9/2019
5	Determine the contents for Chapter 1	2 days	28/9/2019	30/9/2019
6	Research for the report project Chapter 2: Literature Review	4 days	2/10/2019	6/10/2019
7	Determine the contents for Chapter 2	3 days	8/10/2019	11/10/2019
8	Submit report Chapter 1 and Chapter 2 to the supervisor	1 day	14/10/2019	14/10/2019
9	Analysis problem statement	2 days	16/10/2019	18/10/2019
10	Analysis system requirement	2 days	17/10/2019	19/10/2019
11	Determine and priority system requirement	3 days	22/10/2019	25/10/2019

12	Research information about the Arduino, ultra-sensor, LCD and other equipment for the project.	7 days	4/11/2019	11/11/2019
13	Research for the report project Chapter 3: Methodology	3 days	12/11/2019	15/11/2019
14	Determine the contents for Chapter 3	2 days	16/11/2019	18/11/2019
15	Submit report Chapter 3 to the supervisor	1 day	20/11/2019	20/11/2019
16	Research information about the ESP8266 component Arduino of Wi-Fi to connect with Arduino and connect also with application Android and Telegram	7 days	22/11/2019	29/11/2019
16	Research for the report project Chapter 4: Analysis and Design	4 days	30/11/2019	3/12/2019
17	Determine the contents for Chapter 4	3 days	5/12/2019	8/12/2019
18	Submit report Chapter 4 to the supervisor	1 day	12/12/2019	12/12/2019
19	Testing the Flood IoT project using the Arduino to connect with application Telegram and to get the notification messages	3 days	14/12/2019	16/12/2019
20	Final Year Project 1 Presentation	1 days	18/12/2019	18/12/2019

3.3.1 Gantt Chart

Gantt chart is a type of timeliness that represent in a bar chart to illustrate the project schedule. Gantt chart also will show the detail on 14 weeks and what the specific starting date and the target of finishing this project "IoT Flood with Detection and Monitoring System" until the due date. Then, the summary elements comprise the work breakdown structure of this project. This Gantt chart can show the dependency relationship between the activity, financial, times has taken on doing this project and the student follows hour the actual time of normal activity to make a project or it can be set. This chart also in the Final Year Project 1 to represent data that has been collected.

Table 3. 2 Gantt chart for Final Year Project 1 (FYP 1)

No.	Task	Week													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Title and Proposal FYP discussion with supervisor														
	Identify project requirement														
2	Correction / Enhancement Proposal FYP														
	Identify the problem														
	Submit proposal at supervisor														
3	Chapter 1 (Study and Research)														
4	Chapter 1 & Chapter 2														
5	Chapter 2 (Study and Research)														
6	Chapter 2 & Chapter 3														
	Project Demonstration														
7	Chapter 3 (Study and Research)														
8	Chapter 3 & Chapter 4														
	Project Demonstration														
9	Chapter 4 (Study and Research)														
	Project Demonstration														
	Submit all document FYP 1 and Draft Report														
10	Final Presentation FYP 1 with Supervisor														

3.4 Conclusion

This chapter of the conclusion is project methodology and milestone are reliable to be used on developing a system. The main objective of this chapter is to make sure the project been to handle on the right schedule and time that this project can be managed in a systematic and comprehensive order. The most suitable method that had been chosen for this system is Rapid Application Development (RAD). Besides that, if there debug occur at the testing phase the methodology will be used as references.

CHAPTER 4: ANALYSIS AND DESIGN

4.1 Introduction

This chapter will elaborate regarding the method used while planning and developing this project “IoT Flood with Detection and Monitoring System” by using an Arduino. Then, the analysis explains the problem and requirement analysis. Hardware and software requirement also include in this chapter. The details of idea and sketch on developing and designing the interfaces of this project from the Arduino until the application. This chapter will include the implementation of this project on how and what thing use to make this project successful. The flow of this system will be draft and shown to clearly explain how the project will function. The design will be illustrated in this chapter to show how the system looks like a beginning before the procedure to the next step of implementation phases. The design phases are important because a little mistake can affect the whole project flow. The important to be more careful and give the best solution and idea while producing and illustrating the design and flow architecture.

4.2 Problem Analysis

The problem analysis of this project, water level of flood at the outside. It is not complete as it does not have a sound alarm and alert to the people in the area residential and building Park when the big flood happen. This project will the development of water level using IoT requirement when a flood happens. Thus, there is an application that will be actualized in this task. Telegram and Android application will connect with microcontroller Arduino Mega 2560. Other Android requirements also run utilizing programming on the Arduino IDE software.

4.3 Requirement Analysis

Requirement analysis is used to find and analyse any task or requirement that going to use in order to make this project run in successfully. This chapter will explain more about the data requirement, functional requirement and other requirements.

4.3.1 Data Requirement

Data requirement is data flow of the IoT Flood Apps system. The NodeMCU ESP8266 will connect with Arduino Mega 2560 with the HC-SR04 Ultrasonic Sensor to start the hardware device to receive the value of water level indicator data. The command will program in the Arduino IDE software that sends thru via serial communication. Therefore, the ultrasonic sensor to detect the height of water level data information will deliver data by using database Firebase Cloud. Then the water level data information will send from the hardware device to the Android application when the high of water level the value is exceeding the set limit uses to monitor by using the Android application.

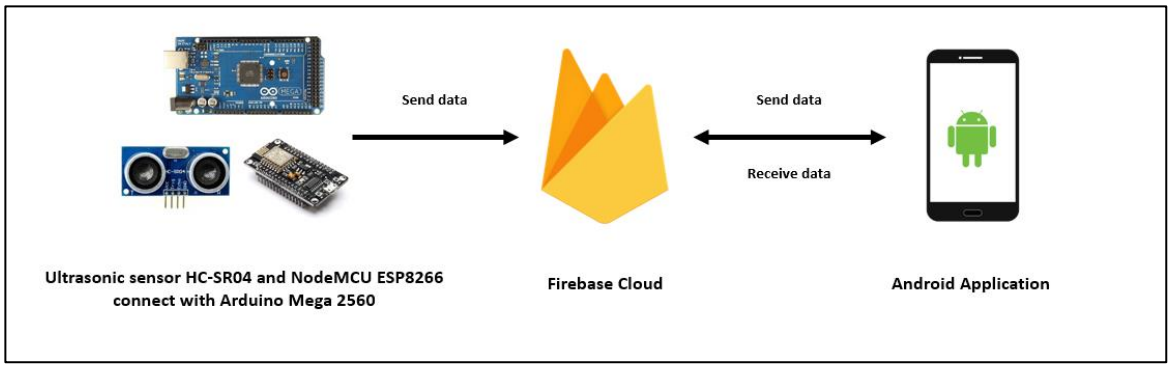

Figure 4. 1 Data Flow

4.3.2 Functional Requirement

The functional requirement is the program shows on how the data and information about the availability data water level to be received. The Telegram and Android application will show the flood of water level that can be reserve and update the data and information to an easier user to reserve the apps.

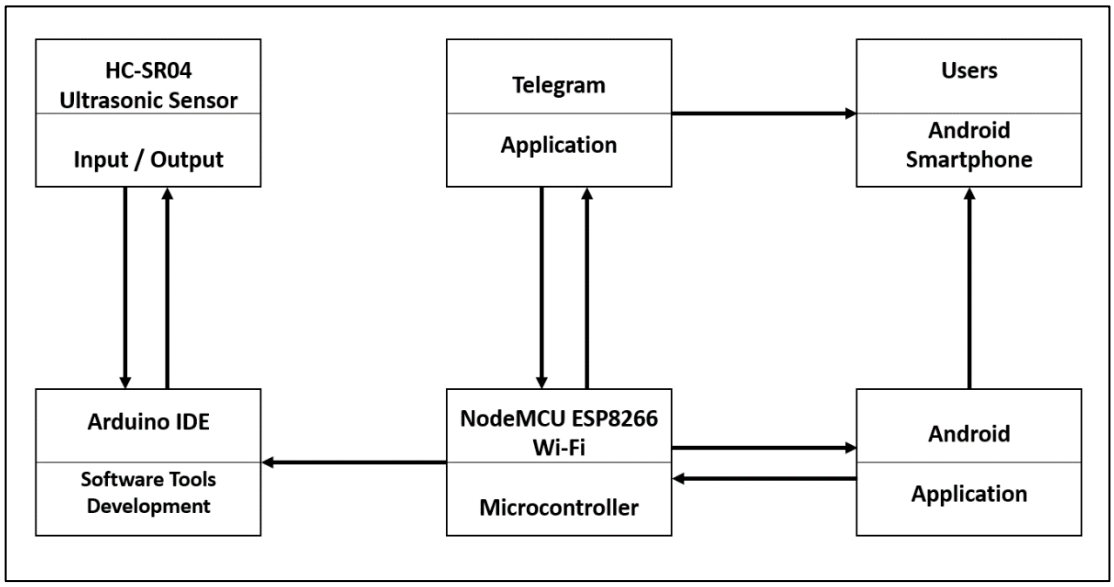

Figure 4. 2 Context Diagram

4.3.3 Non-Functional Requirement

The non-functional requirement is how the user using the IoT Flood monitoring system. The IoT Flood is a built-in application for Android users need to install the IoT Flood Application at Android and Telegram Application from Google Store or Play Store. When the user registers the IoT Flood Application at Android Application, automatically the user will connect Firebase. Then, the local server which needs to start ever time the microcontroller sends data to the apps and the data always will update on the smartphone application user. The Firebase server also connects with the IoT Flood application.

4.3.4 Other Requirement

The other requirement about the other of necessity which is the product and equipment requirement. The product and equipment requirement talked about the detail all of the product and equipment utilized in this undertaking to build up the framework.

4.3.4.1 Hardware Requirement

1. Arduino Mega 2560

The Arduino Mega is a microcontroller board based on the ATmega2560. Arduino Mega has 54 digital input or output pins of which is 14 can be used as PWM outputs, 16 analog inputs, hardware serial ports have 4 UARTs, a crystal oscillator is a 16 MHz, have a USB connection, a power jack, an ICSP header, and have a reset button. The voltage has a two such as is operating voltage is 5 V and input voltage also is 7V until 12V. The lack of the Arduino Mega is that there is no Wi-Fi module inside.

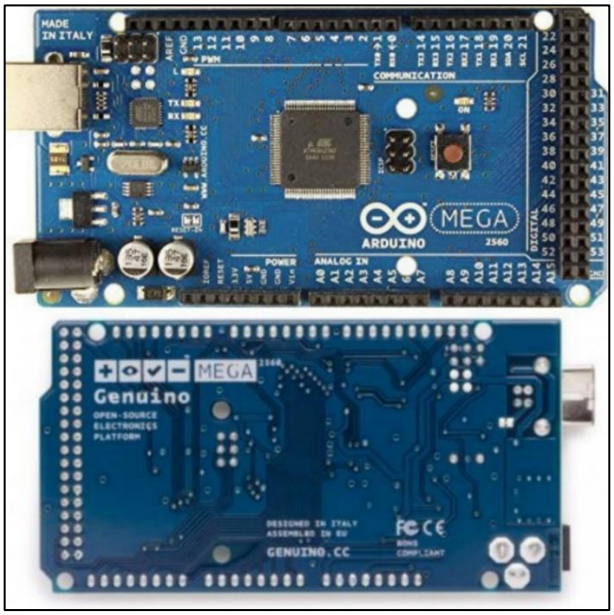

Figure 4. 3 Arduino Mega 2560

2. NodeMCU ESP8266

NodeMCU is an open-source Lua based firmware for the ESP8266 Wi-Fi SOC from Espressif and uses an on-module flash-based SPIFFS file system. NodeMCU is implemented in C and is layered on the Espressif NON-OS SDK. The firmware was initially developed as is a companion project to the popular ESP8266-based on NodeMCU development modules, but the project is now community-supported, and the firmware can now be run on any ESP module. ESP8266 is a low-cost, Wi-Fi Module chip that can be configured to connect to the Internet for the Internet of Things (IoT) and similar Technology Projects.

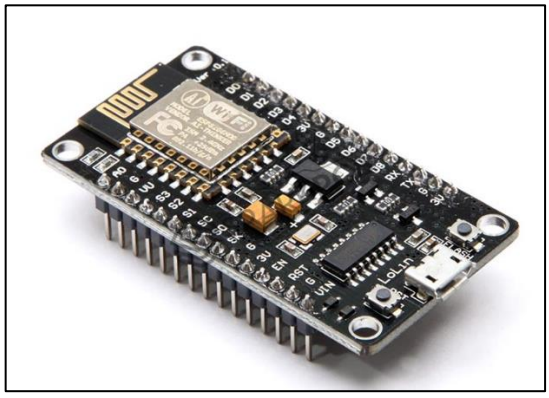

Figure 4. 4 NodeMCU ESP8266

3. Ultrasonic Sensor HC-SR04

Ultrasonic sensor HC-SR04 model is commonly used with both microcontroller and microprocessor platforms like Arduino, ARM, PIC, Raspberry Pie and others. The following guide is universally since it has to be followed irrespective of the type of computational device used. Power the Sensor using a regulated +5V through the Vcc ad Ground pins of the sensor. The current consumed by the sensor is less than 15mA and hence can be directly powered by the on board 5V pins if available. The Trigger and the Echo pins are both I/O pins and hence they can be connected to I/O pins of the microcontroller.

Ultrasonic Sensor HC-SR04 is a sensor that works on a principle similar to radar or sonar. It generates high-frequency sound and calculates the time interval between the sending of the signal and the receiving of echo. Therefore, the ultrasonic sensor can be used to measure the distance. To start the measurement, the trigger pin has to be made high for 10uS and then turned off. This action will trigger an ultrasonic wave at the frequency of 40Hz from the transmitter and the receiver will wait for the wave to return. Once the wave is returned after it getting reflected by any object the Echo pin goes high for a particular amount of time which will be equal to the time taken for the wave to return back to the sensor.

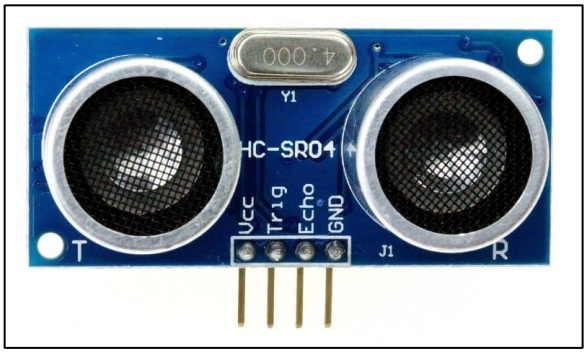

Figure 4. 5 Ultrasonic Sensor HC-SR04

4. LCD 1602a Display I2C Module

LCD (Liquid Crystal Display) is the technology used for displays in notebook and other smaller computers. This is a 16x2 LCD display screen with I2C interface is a character-type liquid crystal display, is a kind of dot matrix module to show the letters, numbers, and characters and others. It is able to display 16x2 characters on 2 lines, white characters on a blue background and a dot pitch. Generally, Arduino LCD display projects will run out of pin resources easily, especially with microcontroller Arduino and it also very complicated with the wire soldering and connection.

This I2C 16x2 Arduino LCD Screen is using an I2C communication interface. It means it only needs 4 pins for the LCD display is VCC, GND, SDA, SCL. It will save at least 4 digital or analog pins on Arduino. All connector are standard XH2.54 (Breadboard type) which is can connect with jumper wire directly. In commonly of LCD display, LCD1602a has parallel ports, that is, it would control several pins at the same time. Therefore, the LCD1602a have a four-port connection is used here for better application.

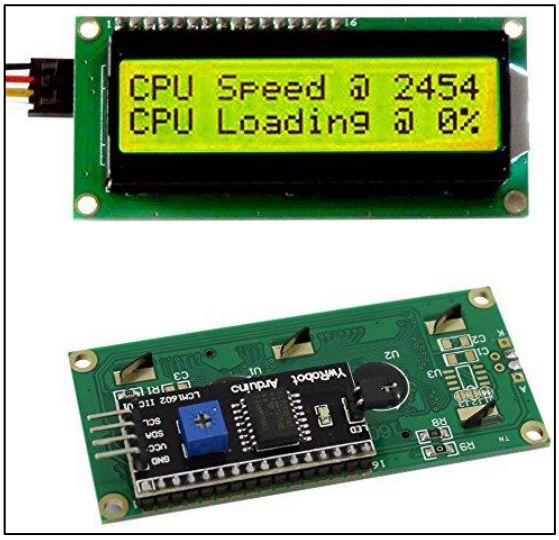

Figure 4. 6 LCD 1602a display module 4 pin

5. Light Emitting Diode (LED)

The light-emitting diode (LED) is a two-lead semiconductor light source. LEDs are typically small less than 1 square millimetre (mm2) and integrated optical components may be used to shape the radiation pattern. Light is created when the particles that convey the current join together inside the semiconductor material. Since light is created inside the strong the semiconductor material, LED are depicted as strong state gadgets. The term is strong in-state lighting, which likewise incorporates natural LED.

LED emitted low-intensity infrared light. Infrared LED is still frequently used as transmitting elements in remote-control circuits such as those in remote controls for a wide variety of consumer electronics. The first visible-light LED were of low intensity and limited to red. Modern LED is available across the visible, ultraviolet, and infrared wavelengths, with very high brightness.

Figure 4. 7 LED three colours

6. Mini Pump

The mini pump is the output module for the Arduino. This pump contains motors operating at DC voltage. It can pump 80 to 120 litres per hour, with tube drain having a diameter of 7.5 millimetres and an internal diameter of 4.7 millimetres and the maximum stroke ranges from 40 to 110 centimetres. For the power supply, it is necessary to use a voltage of between 2.5 and 6 volts, while current consumption can reach up to 220 milliamps (mA) under load.

Figure 4. 8 Mini Pump

7. Buzzer

A buzzer or beeper is an audio signalling device, which may be mechanical, electromechanical or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

Figure 4. 9 Buzzer

8. Breadboard

A breadboard is a solderless device for temporary prototype with electronics and test circuit designs. This breadboard have 800 points. The most electronic components in electronic circuits can be interconnected by inserting their leads or terminals into the holes and then making connections through wires where appropriate. The purpose of the breadboard is to make quick electrical connections between components like a resistors, LED, capacitors and others. Other that, user can test that circuit before permanently soldering it together.

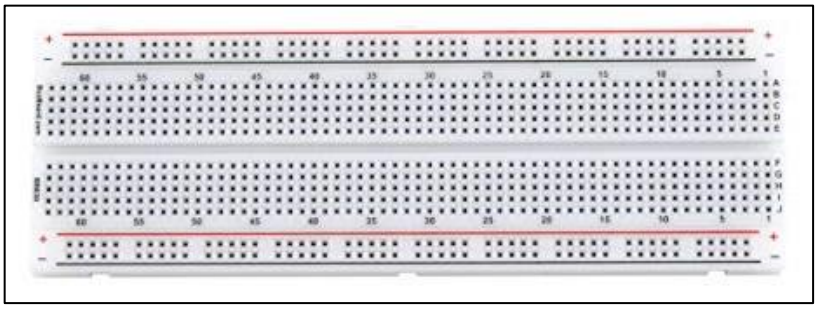

Figure 4. 10 Breadboard

9. Jumper Wires

Jumper wires are simply wires that have connector pins at each end, allowing them to be used to connect two points to each other without soldering. Jumper wires are typically used with breadboards and other prototyping tools in order to make it easy to change a circuit as needed. Jumper wires typically come in three versions such as male-to-male, male-to-female and female-to-female. The difference between each is in the end point of the wire. Male ends have a pin protruding and can plug into things, while female ends do not and are used to plug things into. The most common user usually use is Male-to-male jumper wires. When connecting two ports on a breadboard, a male-to-male wires.

Figure 4. 11 Jumper wires three types

10. Arduino USB Cable

Arduino USB cable is using it to connect Arduino Uno, Arduino Mega 2560, Arduino 101 or any board with the USB female a port of user computer. Cable length is approximately 178cm. Then, this USB cable type A/B Standard USB 2.0 cable.

Figure 4. 12 Arduino USB cable

11. Resistor

The resistor is a passive electrical component to create resistance in the flow of electric current. In almost all electrical networks and electronic circuits they can be found. The resistance is measured in ohms. An ohm is the resistance that occurs when a current of one ampere passes through a resistor with a one volt drop across its terminals. The current is proportional to the voltage across the terminal ends. The calculation of resistor is “R=V/I”. R for resistance in ohms, V for voltage in volts and I for current in milliamps (mA).

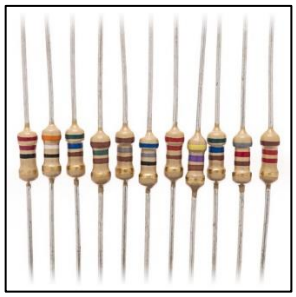

Figure 4. 13 Resistor

4.3.4.2 Software Requirement

1. Arduino IDE

Arduino IDE (Integrated Development Environment) is the Arduino boards need a platform to place all the code into a board and feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler toolchains, the Arduino project provides an IDE based on the Processing language project.

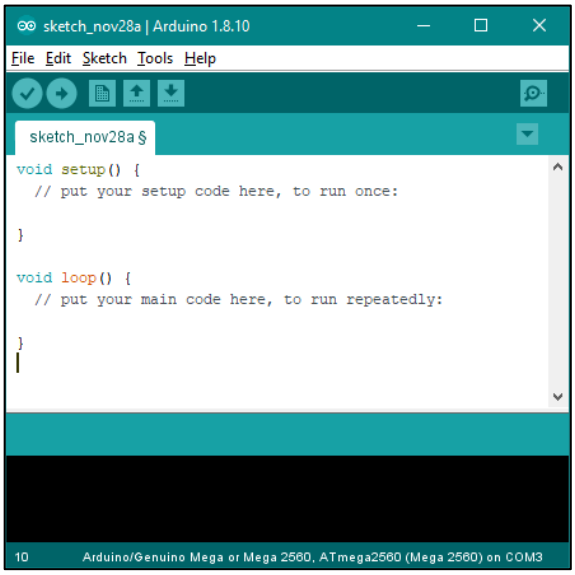

Figure 4. 14 Arduino IDE Interface

2. Telegram Application

Telegram application is a messaging application like a WhatsApp application. Telegram apps also are corresponding with Arduino library allows to achieve that with ease and can send notification from Arduino board like NodeMCU compatibles based on the ESP8266 Wi-Fi. Telegram using the BotFather is a bot to receive and send the data information. BotFather is the one bot to rule them all that use it to create new bot accounts and manage user existing bots. BotFather is the only thing user need to create Telegram a bots.

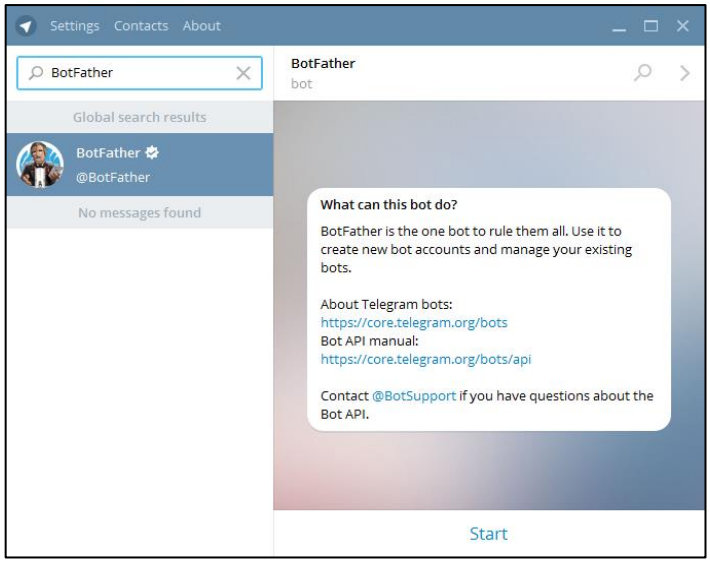

Figure 4. 15 Telegram Interface

3. Android Studio

Android Studio is the authorized integrated development environment (IDE) for Android application development. Then, based on the IntelliJ IDEA, a Java integrated development environment for software and combines its code editing and developer tools. In other that, to support application development within the Android operating system, Android Studio uses a Gradle-based build system, emulator, code templates, and Github integration. Every project in Android Studio has one or more modalities with source code and resource files. These modalities include Android app modules, Library modules, and Google App Engine modules. Besides, many Google API key can be easily used in Android Studio.

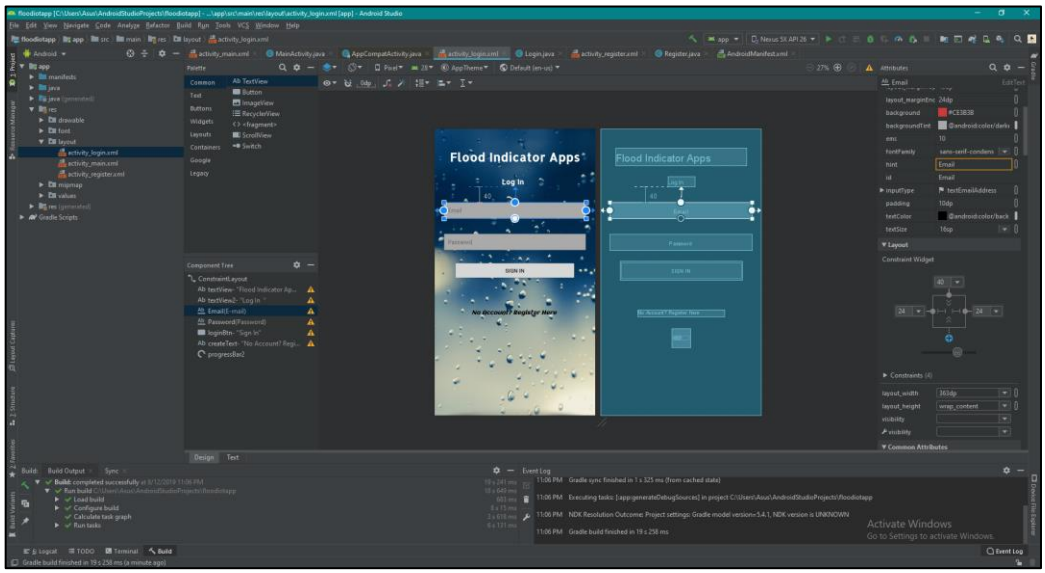

Figure 4. 16 Android Studio Interface

4. Firebase Cloud

Firebase Cloud is a mobile platform that helps the real-time Database is a cloud-hosted database then the data is stored as JSON and synchronized in real-time to every connected with the client. Furthermore, this Android Studio also has the Assistant tool window in this tool's development. The Firebase is made up of complementary features that it can mix-and-match to acceptable needs with a Google Analytics for Firebase at the core.

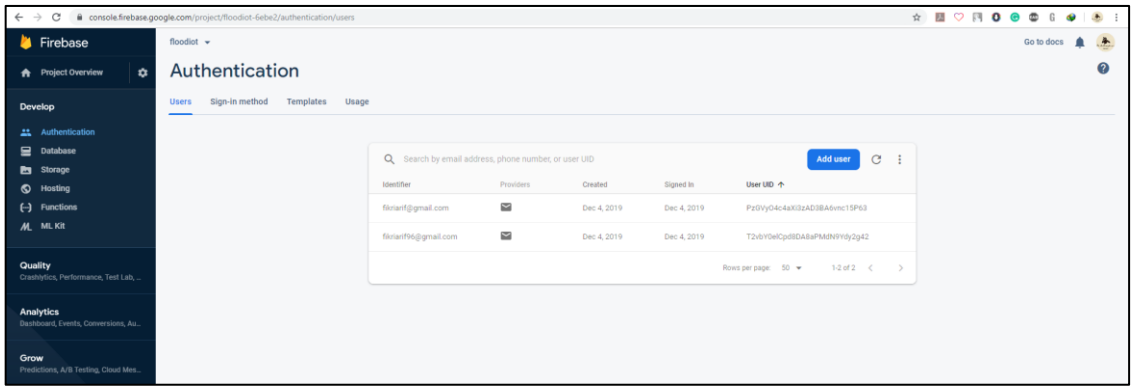

Figure 4. 17 Firebase Cloud Interface

5. Fritzing

Fritzing is an open-source tool for the prototype of design electronic hardware. Fritzing software provides for the user to design a schematic and thus apart which can be added to very professional-looking wiring circuit diagrams. Other than, Fritzing software also can be seen as electronic design automation (EDA) tool software and it is created in the Processing programming language and the Arduino microcontroller. Users allow to document their Arduino-based prototype and create a Printed circuit board (PCB) layout for manufacturing architecture.

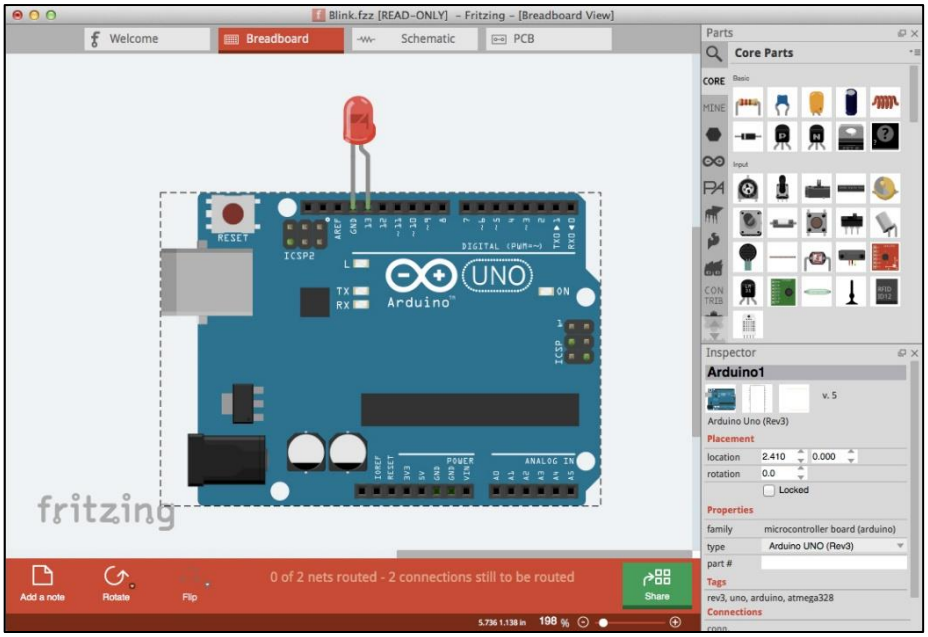

Figure 4. 18 Fritzing Interface

4.4 High-Level Design

High-level design will describe structure of the IoT Flood with Detection and Monitoring System. It will elaborate further on the agent architecture, system design and function of the system. High-level design is easy to understand even for the end-user who is not familiar with the technical report writing in the information technology.

4.4.1 System Architecture

The system architecture can be described by using a picture. It also is a term that contains the arrangement of the computer hardware and software which is included in the system which performs the described function. The figure demonstrated the framework structural and architecture for "IoT Flood with Detection and Monitoring Systems", it can notification through the Telegram application. For this venture, Arduino Mega was utilized to program the microcontroller is NodeMCU ESP8266. The microcontroller needs to animate in a way that the ultrasonic sensor HS-SR04 recognizes the water level and trigger the LED and send a warning and sound alert to the ultrasonic sensor and buzzer when the water level is high and surpasses the danger phases in the water level indicator.

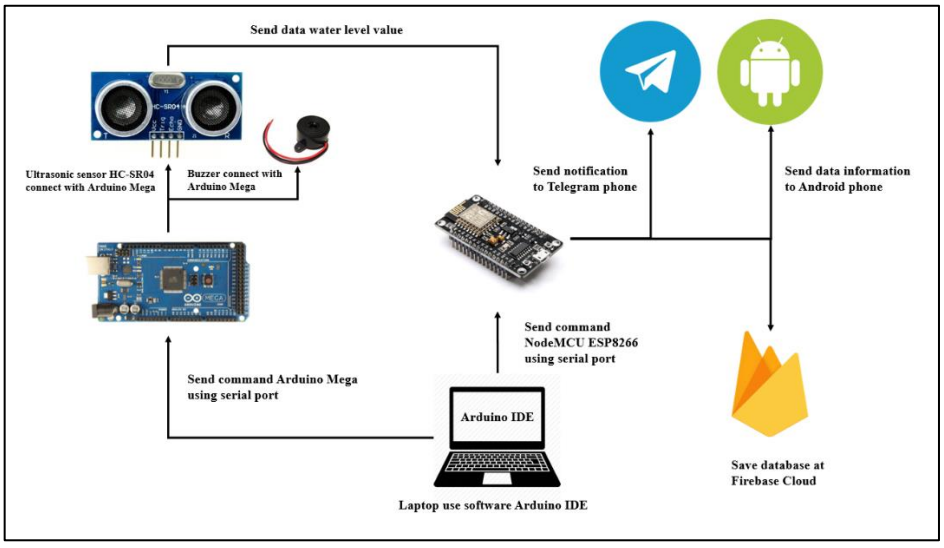

Figure 4. 19 System architecture diagram

4.4.2 Flow chart design

The system architecture also have the flow chart design. The flow chart is a graphical or symbolic representation each of a process. Each step in the process is represented by a different symbol and contains a short description of the process step and it also is linked together with arrows showing the process flow direction. The flow chart design have 5 steps process to build the IoT Flood project.

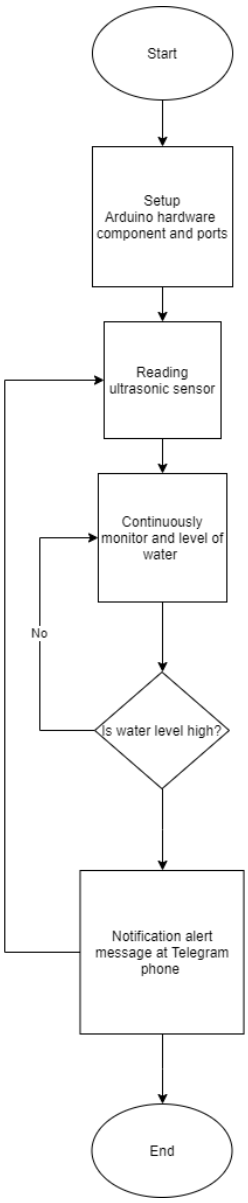

Figure 4. 20 Flow chart

4.4.3 Structured Chart

The structure diagram is a hierarchy or structure of the different components or modules of the system and shows how to structure diagram connect and interact with each other. Then the structure diagram is a conceptual modelling tool used to document the different structures that make up a system such as a database or an application. This figure has shown the structure diagram of this project “IoT Flood with Detection and Monitoring System”.

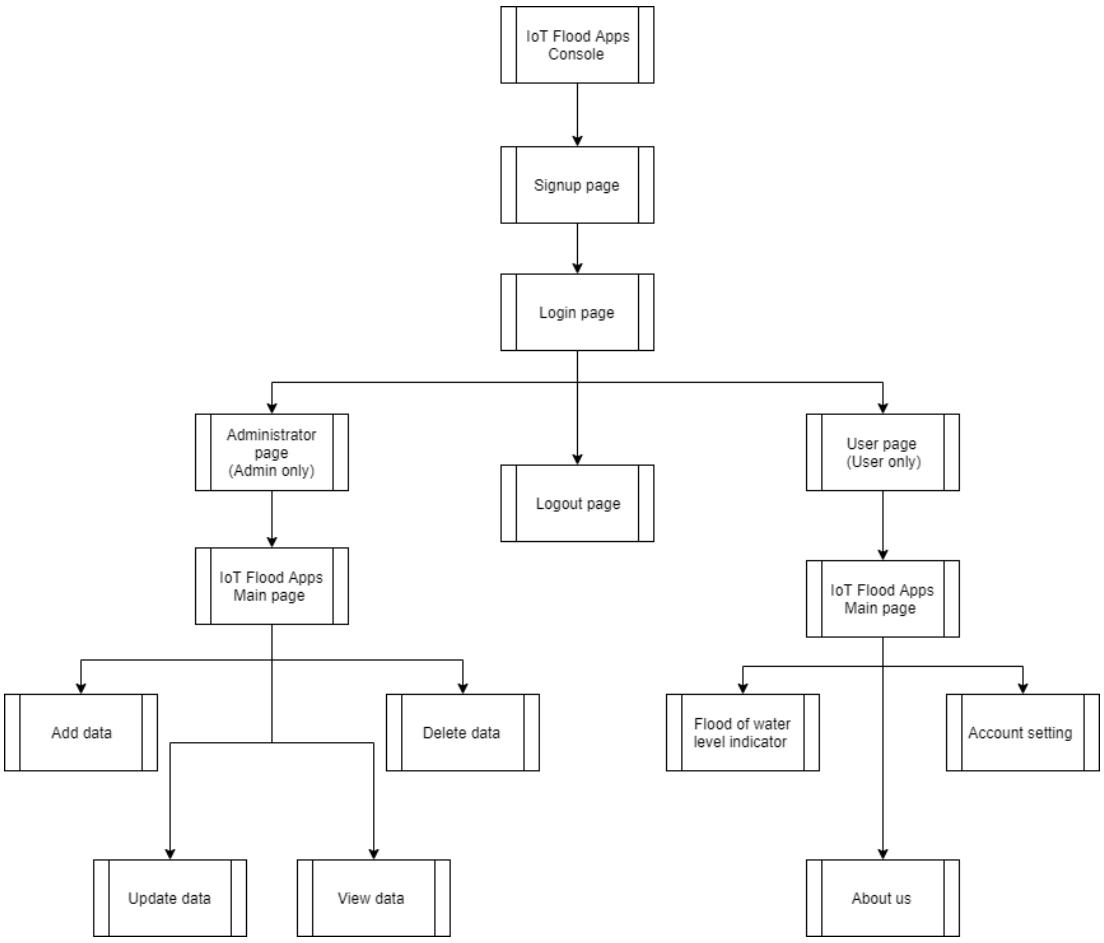

Figure 4. 21 Structured chart

4.4.4 User Interface Design

The user interface design that has been developing the Flood IoT App by using Android Studio for this project “IoT Flood with Detection and Monitoring System”.

4.4.4.1 Login interface design Flood IoT App

Figure 4. 22 Login interface design

4.4.4.2 Register interface design Flood IoT App

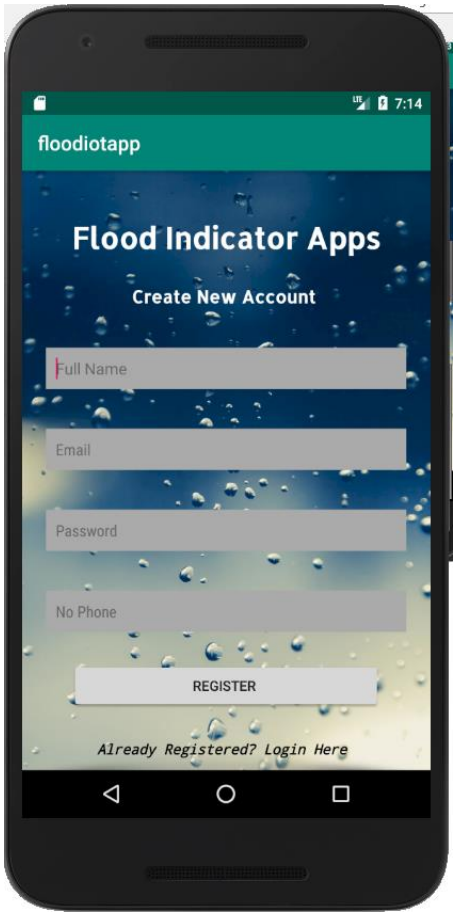

Figure 4. 23 Register interface design

4.4.4.3 Home interface design Flood IoT App

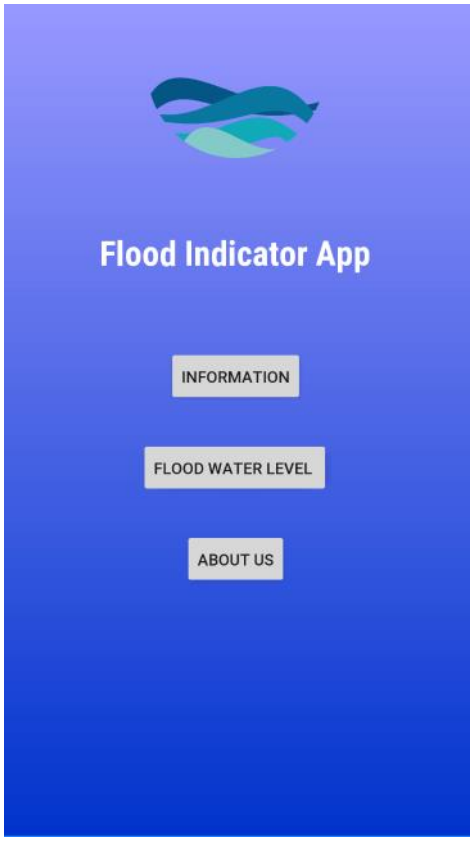

Figure 4. 24 Home interface design

4.4.4.4 Information interface design Flood IoT App

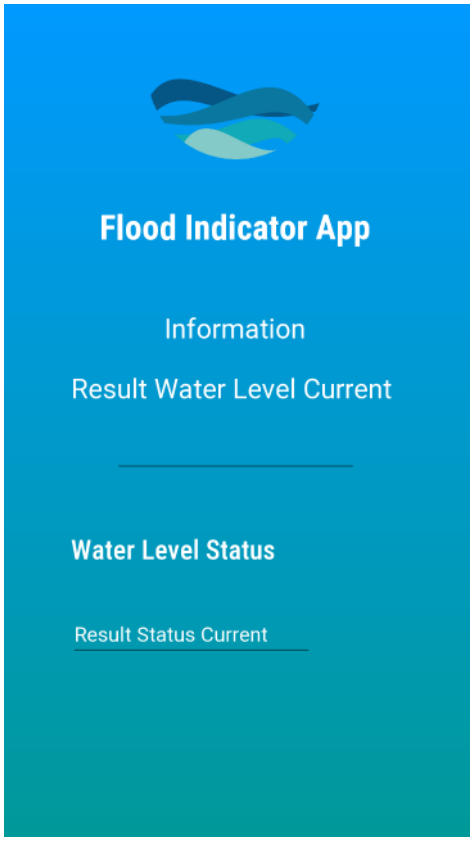

Figure 4. 25 Information interface design

4.4.4.5 Water Level interface design Flood IoT App

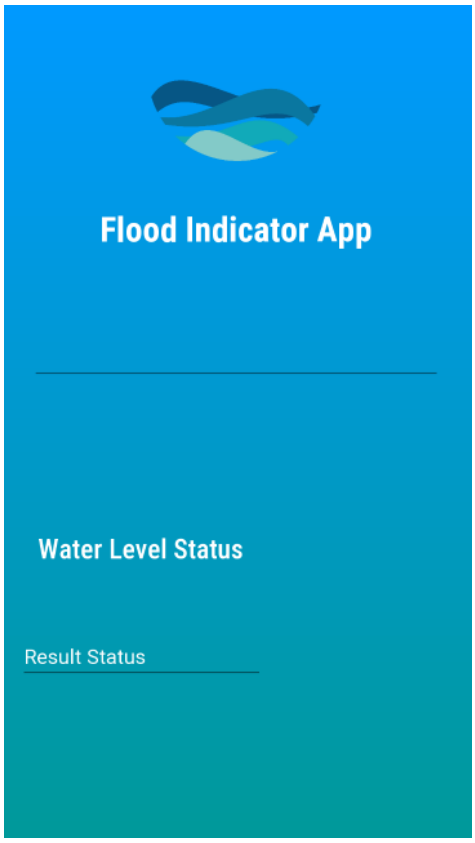

Figure 4. 26 Water Level interface design

4.4.4.6 About Us interface design Flood IoT App

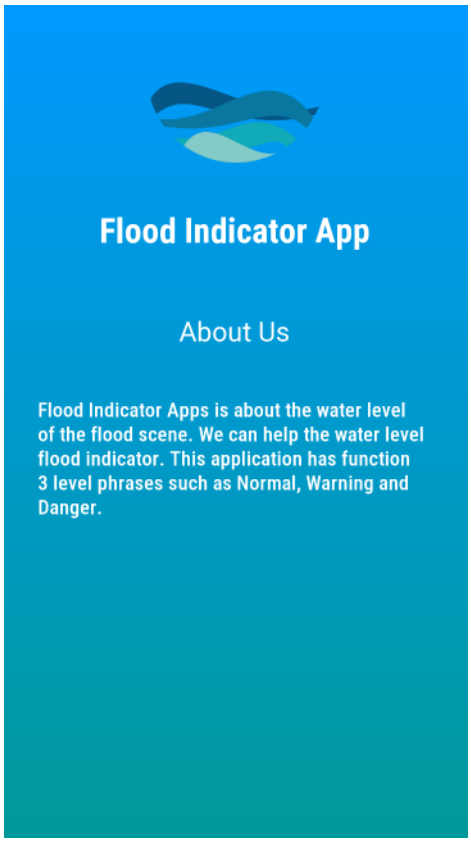

Figure 4. 27 About Us interface design

4.4.5 Sketch Circuit design

Based on sketch circuit design is a develop a circuit design using the Fritzing software to help on giving the easiest way to illustrate the circuit connection of the Arduino microcontroller, bread board and other component. This figure shows the circuit design for this IoT Flood with Detection and Monitoring System.

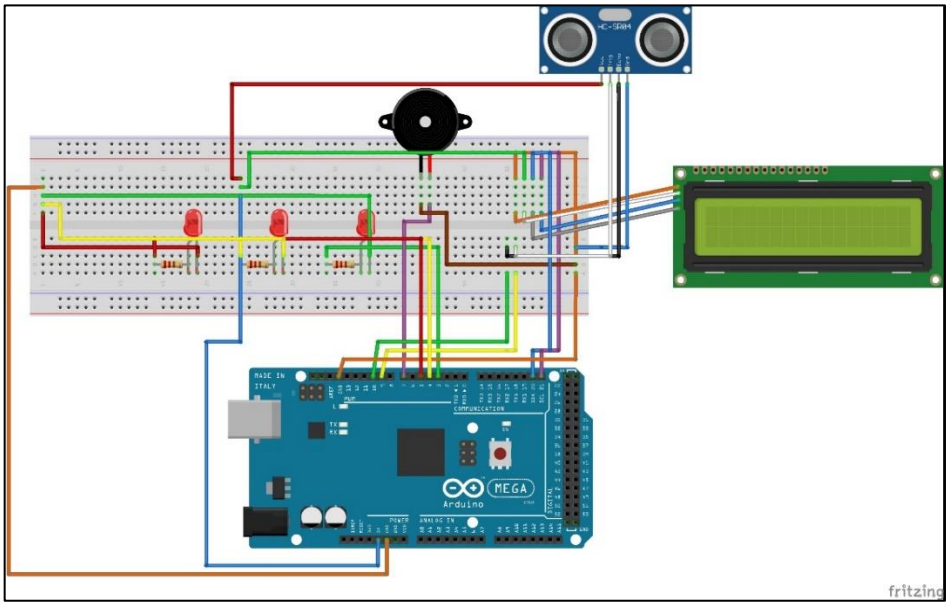

Figure 4. 28 Circuit Design

4.4.6 Prototype hardware design

The prototype hardware design is a development project is the IoT Flood using a microcontroller Arduino Mega with component Arduino such as ultrasonic sensor, buzzer, jumper wire, Arduino breadboard and NodeMCU ESP8266 Wi-Fi. The figure below is the prototype hardware design for this IoT Flood with Detection and Monitoring System.

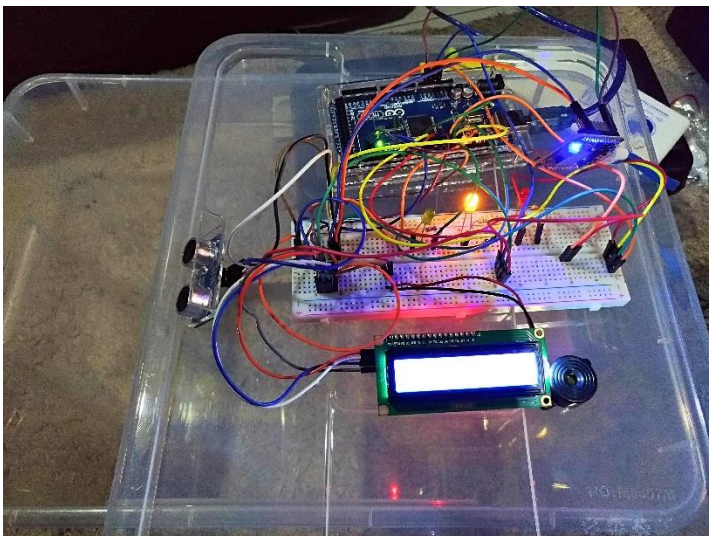

Figure 4. 29 Prototype hardware design IoT Flood

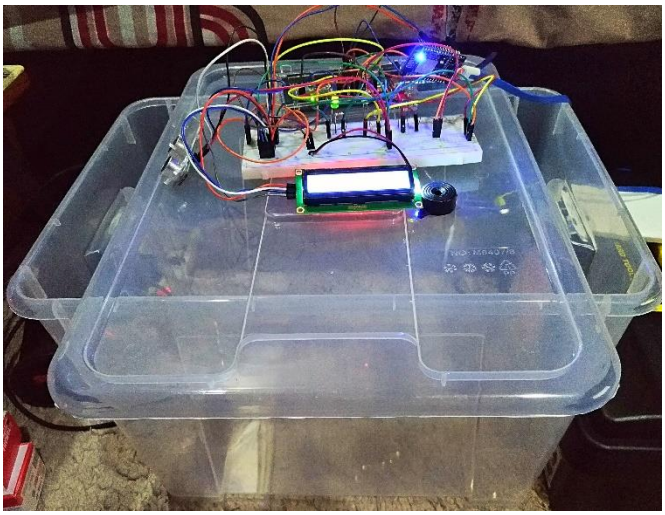

Figure 4. 30 Hardware design for IoT Flood

4.5 Conclusion

This chapter the analysis and design are one of the significant parts to actualize a responsibility for this project. All product and equipment requirements should be distinguished and contemplated before doing a venture. The Arduino Uno has small storage rather than Arduino Mega too many hardware and long source code will not support on Arduino Uno. Next, for compiling on the microcontroller Arduino Mega might not have any issue or error but when it connects to Local Server there will be input/output error. Hence for source code needs to be very organized in order to get data to IoT Flood Application from Ultrasonic Sensor. After the design has been accepted the implementation phases can proceed. The implementation phases and expected output that will be gain from this IoT Flood system will describe more in the next chapter.

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