Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF SMART WATER QUALITY & FLOOD MONITORING SYSTEM USING MICROCONTROLLER AND CLOUD SERVER

MUHAMMAD AFWAN BIN MUHAMAD ZAMRI

Bachelor of Electronics Engineering Technology (Telecommunications) with Honours

2023

DEVELOPMENT OF SMART WATER QUALITY & FLOOD MONITORING SYSTEM USING MICROCONTROLLER AND CLOUD SERVER

MUHAMMAD AFWAN BIN MUHAMAD ZAMRI

A project report submitted
in partial fulfilment of the requirements for the degree of
Bachelor of Electronics Engineering Technology
(Telecommunications) with Honours

Faculty of Electrical and Electronic Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2023

DECLARATION

I declare that this project report entitled "DEVELOPMENT OF SMART WATER QUALITY & FLOOD MONITORING SYSTEM USING MICROCONTROLLER AND CLOUD SERVER" is the result of my research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in the candidature of any other degree.

Signature : 

Student Name : MUHAMMAD AFWAN BIN MUHAMAD ZAMRI

Date : 27/1/2023

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 Electronics Engineering Technology (Telecommunications) with Honours.

Signature : 

Supervisor Name : FAUZI BIN HJ ABDUL WAHAB

Date : 27/01/2023

DEDICATIONS

Special dedication to my parents
MUHAMAD ZAMRI BIN MAT YUSOP
and
NORIZA BINTI BAHAROM

My supportive and kind supervisor,
FAUZI BIN HJ ABDUL WAHAB

ABSTRACT

Water is an essential natural resource that is very important to humankind. Malaysia is a tropical country with an almost unlimited supply of fresh water. A good ecosystem requires water to be of good quality. When it rains heavily, a flood may hit the surrounding areas of the river. Many properties will be destroyed, or people's lives may be threatened. This project will focus on developing flood and water quality monitoring systems in the rivers. With the convenience of IoT Technology, an intelligent system can deliver valuable warning alerting information for both quality and flood hazards to respective personnel or the public. This flood and water quality monitoring system used an Arduino as a microcontroller that will control the input and output of the system. The ultrasonic sensor is used to detect the water level while the Turbidity sensor is used to check the quality of the water. For the expected result, this project will monitor the water level condition and the quality of the water.

ABSTRAK

Air merupakan salah satu sumber semula jadi yang penting kepada manusia. Malaysia adalah sebuah negara tropika dengan bekalan air tawar yang banyak. Ekosistem yang baik memerlukan air di dalam kualiti yang baik. Apabila hujan lebat, banjir mungkin melanda di kawasan sekitar sungai. Banyak harta benda akan musnah, atau nyawa orang ramai akan terancam. Projek ini akan tertumpu kepada pembangunan pemantauan banjir dan sistem pemantauan kualiti air di sungai. Dengan kemudahan Teknologi IoT, sistem pintar boleh menyampaikan maklumat amaran yang berharga untuk kedua-dua kualiti dan bahaya banjir kepada orang ramai. Sistem pemantauan kualiti banjir dan air ini menggunakan Arduino sebagai mikro-controller yang akan mengawal input dan output sistem. Sensor ultrasonik digunakan untuk mengesan paras air manakala sensor Turbidity digunakan untuk memeriksa kualiti air. Untuk hasil sasaran, projek ini akan memantau keadaan paras air dan kualiti air.

ACKNOWLEDGMENT

First and foremost, I would like to express my gratitude to my supervisor, Fauzi Bin Hj Abdul Wahab for their precious guidance, words of wisdom and patient throughout this project.

I am also indebted to Universiti Teknikal Malaysia Melaka (UTeM) for the financial support which enables me to accomplish the project. Not forgetting my fellow friends for their willingness of sharing their thoughts and ideas regarding the project.

Finally, my highest appreciation goes to my parents and family members for their love and prayer during the period of my study.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

1.1 Background

Floods are natural disasters that can happen when heavy rain is non-stop pouring. Floods are one of the natural disasters that always happen in Malaysia during the rainy season which happens at the end of the year. There are many types of flooding, but very common in Malaysia is river flood and flash flood. Some floods can happen when it rains heavily non-stop. Recently massive floods hit an unexpected area in Selangor that had rarely flooded before this [1].

Water is one of the main sources for all living things, many plants and animals need water to survive. Humans also need water to survive, that is because water is used by our bodies to assist control the body's temperature and used by other physical processes. Moreover, the water that is used by humans needs good quality for safe drinking. Water quality refers to the water condition it's good to drink. However, the impacts of the flood will damage the water sources and affect water quality. It happens when mud carried by rain goes into the river water, affecting the quality of river water or water sources [2]. Poor water quality can cause health risks.

That's why a monitoring system for flood and water quality is needed. Firstly, Flood Monitoring System is a technology that is used to monitor the water level in dams or rivers. While some areas are more vulnerable to flooding than other places, installing flood warning systems near a dam or river provides important data that can save property and more lives. In Malaysia problem happened when some of the flood alerting systems had a technical issue. It happened in some places in Negeri Sembilan when the flood's siren does not work to

warn the nearest resident [3]. A good Flood Monitoring System is needed to avoid these incidents happening.

Secondly, the Water Quality Monitoring System is a technology that is used to monitor the quality of water in rivers. It can be assessed by collecting some of the water samples for laboratory examination or by utilising Turbidity sensors that can capture data at a single point in time or regular intervals over a long period. Monitoring water quality is critical for determining whether the water is clean. It displays the quality of water in a single moment as well as over weeks, months, and years [4].

This project's purpose is to solve the problems that occurred. By giving alerts to the public or personnel via a cloud server when water on a high-risk level happened. The proposed system has flexibility by using sensors to detect water levels and check the quality of water. This project aims to develop a system that can monitor floods with the capability to monitor the water level and quality. For expected results, this project can decrease casualties and save more lives.

1.2 Problem Statement

A flood may hit the surrounding areas of a dam or river when rains heavily and the quality of water on the rivers will also affect when the floods happen. The impact of floods is they can destroy many properties. According to the Department of Statistics, damage to public assets and infrastructure cost RM2 billion followed by house damage costing RM1.6 billion, the report from the government about the flood that happen in early January this year in Malaysia [5]. Other than that, people's lives also can be threatened by floods. Anxiety, fear, rage, frustration, sadness, and loss are some of the feelings that flood victims may experience. It's common for people who have been through traumatic events like floods to have trouble sleeping, lose their appetite, have melancholy or angry moods, and feel anxious. Besides that, floods also can damage water sources and affect the quality of water. For example, floods may change the terrain by destroying riverbanks and causing them to collapse. Sediment becomes trapped in the water as floods bring debris from eroding banks, lowering water quality, and causing hazardous algae blooms [6]. Therefore, in this project, a system of flood monitoring and water quality monitoring system will be made. The system also will give a notification about the water level and quality of water to the user's phone so they can know about the real-time situation.

1.3 Project Objective

To make a project an objective is needed. Below is the objective for this project:

1) To identify the effect of flood and water quality.
2) To develop a Flood and Water Quality Monitoring System in the river.
3) To develop an alerting system that can deliver valuable warnings alerting flood hazards to the respective user.
4) To analyse and optimize system performance.

1.4 Scope of Project

To accomplish the objectives of this project, several things should be considered which is:

a) Identify the effect of flood and water quality on people.
b) Develop a monitoring system for flood and water quality that monitors water level and the turbidity of water.
c) Develop an alerting message in Blynk to alert users about the water level and turbidity of water.
d) Measure and analyse complete system performance.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Flood Monitoring System is a technology that uses to monitor the water level such as in dams or rivers. Some areas are more vulnerable to flooding than others, installing flood warning systems near a dam or river provides important data that can protect property and save lives. Water Quality Monitoring System is a technology that uses to monitor the quality of water in the river. The turbidity of the water will be measured to know if it is good or not. This chapter will look at what has been established based on previous studies. The flood and water quality monitoring system, as well as associated work on this project and development methods to be used to build the system, will be described.

2.2 Related Work

2.2.1 Flood Monitoring and Alerting System Using Arduino in IoT

The paper "Flood Monitoring and Alerting System Using Arduino in IoT" [7] developed a flood monitoring and alerting system. The mechanism for this project is the water level sensor to track the water level and the temperature sensor to detect the humidity level connected to Arduino, the water limit sensor to maintain the level of water. The sensor that is connected to the microcontroller will analyse the real-time data if there is a changeover Waterflow or humidity level and send the data to the application. By using an IoT (ESP8266) connected to Arduino as a module for sending the alert message to the nearby surrounding.

2.2.2 Flood Monitoring and Alerting System

The author of "Flood Monitoring and Alerting System" [8], is using Arduino as a microcontroller connected by the ultrasonic sensor to read the distance between water and the sensor. The water was measured, and the water level was calculated then it will compare to the set threshold if the water level is more than the threshold value it will make a voice call to a residence to alert them via GSM SIM 900A and update the web page. When the water level is lower than the threshold value it will update the web page only. This paper uses APR33A3, this component is a device to record voice it will interface d with GSM and the recorded voice will play when the call happens.

2.2.3 IoT Based Water Flood Detection and Early Warning System

In the paper "IoT Based Water Flood Detection and Early Warning System" [9], the author uses an Android application for monitoring the data. Firstly, Water Level Detection Sensors, Temperature Sensors and Humidity sensors are placed near the river to detect the flood in water bodies. Next, the water level detection sensor function as a transmitting unit that is used to detect the water level at the time of the floods. Temperature Sensors and Humidity Sensors are used to measure the live temperature and humidity of the water bodies. Then, the data is displayed on an LCD for the end user to see the data. When the sensor detects water level increases at a certain level in the water body, it will send an alert SMS via a GSM modem to the people who are nearby the water body. The collected data from the sensors will transmit to the Android application, Thingview. The application will display the flow graph level of the water level in the river, temperature, and humidity values. It also can send SMS to the registered contact mobile numbers.

2.2.4 IoT Based Smart Water Quality Monitoring System

The paper "IoT based smart water quality monitoring system" [10] focused on a water quality monitoring system that uses ATMEGA328 as a microcontroller that will convert the analogue data to digital and LCD will display the output value. The sensors are connected to a microcontroller that will measure the real-time values and the values will upload to the cloud. If the values are more than the threshold value, it will communicate to the concerned end user. A Wi-Fi module is a wireless module to connect software and hardware part.

2.2.5 Smart Water Quality Monitoring System Using IoT Technology

The paper "Smart Water Quality Monitoring System Using IoT Technology" [11], This project is about a smart water quality monitoring system using IoT. The mechanism for this project is that WQM chooses water parameters such as temperature, pH level, water level, and CO2 using various device nodes. The data is sent to the web server using this way. The data updated at regular intervals on the server may be obtained or viewed from anywhere around the globe. If the sensors fail or enter abnormal circumstances, a buzzer will sound.

2.2.6 Smart IoT Flood Monitoring System

The paper "Smart IoT Flood Monitoring System" [12] is an IoT flood monitoring system that uses a web server to display the data and alert the public. The HC-SR04 module sensor will be used to detect the water level of the river. The mbed NXP LPC1768 is a microcontroller that will collect the data for this system. A buzzer will act as an alarm to alert the public and authorities when there is an upcoming flood. The data will be uploaded to the web server. This project uses LCD and LED that function as display and will indicate the level of water.

2.2.7 Smart Monitoring System of Najran Dam

The project “Smart Monitoring System of Najran Dam” [13] was focused on the flood warning system and monitoring Dam system of Najran Dam. The mechanism for a flood early warning system is the water level sensors and water flow sensor will measure the flow and level of water and the Arduino as a microcontroller read the data from the sensor then alerting messages will send to people via GSM shield based on the data collected.

2.2.8 Smart Water Quality Monitoring System with Cost-Effective Using IoT

The paper “Smart Water Quality Monitoring System with Cost-Effective Using IoT” [14] uses four sensors which are a pH sensor, turbidity sensor, ultrasonic sensor, and DHT-11 sensor. The sensors will collect real-time data and then the data will process by Arduino which is a microcontroller for this project. Then all the data upload to the ThingSpeak server via a Wi-Fi module. Users can log in to the server to access the data by using the user ID and password.

2.2.9 Implementation of GSM Communication on Flood Monitoring Systems Based on Multiple Locations Visualization

This project “Implementation of GSM Communication on Flood Monitoring Systems Based on Multiple Locations Visualization” [15] has two systems flood detection system and a flood monitoring system server. For flood detection systems they use Arduino as a microcontroller, then connected to several sensors as input including ultrasonic sensors to measure water levels, rain sensors to determine the rain conditions and temperature sensors. For flood monitoring system servers, they use a GSM modem, web server application, MySQL database, PHP engine and Gammu. The data from sensors will send to the flood monitoring

system server using SMS via the GSM transmitter module. Then the flood monitoring system server that has a GSM receiver module will display the output on the server application.

2.2.10 Flood Warning and Monitoring System (FWMS) using GSM Technology

On the other hand, the paper "Flood Warning and Monitoring System (FWMS) using GSM Technology" [16] uses the GSM SIM900A module embedded in Arduino as the microcontroller. Sensors were monitoring and collect real-time data and are then connected to a microcontroller which is work as a processor. This project system has three different levels of flood warning "normal", "Warning" and "danger". This project is also capable to give alerts by sending a warning SMS or call to users and the Fire and Rescue Department via the GSM module. When the levels are on "warning" or "danger" a buzzer will be turned on as a warning notification to users. Users also can monitor the level of water status by sending an SMS to the system.

2.2.11 IoT Based Early Warning System for Torrential Floods

For "IoT Based Early Warning System for Torrential Floods" [17] the system is based on a network of automated meteorological stations (AMS) that send data to a central server at regular intervals, where it is processed and shown to users with the necessary authorisation level. Data is collected using an Arduino as a microcontroller. Water levels are measured using ultrasonic sensors, while temperature, relative humidity, and ambient pressure are measured using a combination sensor. A soil vibration sensor is an optional feature that may be used to identify potential landslides and to acquire extra data for the production of a larger meteorological image. The data collection, processing, and alerting web application is developed in the PHP programming language and hosted on the Apache webserver. The information is saved in a MySQL database. The software is available on a separate web domain

and may be used on a variety of platforms, including PCs, laptops, and smartphones. AMS also features an internal alert system that sends SMS messages to selected mobile phone numbers in the event of a substantial change in sensor data.

2.2.12 Flood Detection and Water Monitoring System Using IoT

The project "Flood Detection and Water Monitoring System Using IoT" [18] was focused on IoT while Arduino is used as a microcontroller for this system. All the sensors are connected to the Arduino. The sensors detect their surroundings and provide real-time data to the cloud which users may view and access via their mobile platform. When the water level reaches a certain height, the system issues a warning. The volume of water or the distance between the sensor and the water level is measured using an ultrasonic sensor. Meanwhile, the flow and amount of water transported are measured using a flow sensor. DHT11 sensor for measuring temperature and humidity. When the water level reaches the float sensor, it causes the float sensor to move higher, completing the circuit and sending a stress signal to the user, alerting them of a probable rise in water level. Data is uploaded and modified in the cloud with accuracy to the sensor, allowing for real-time modifications in the mobile app.

2.2.13 Designing Early Warning Flood Detection and Monitoring System via IoT

The author "Designing Early Warning Flood Detection and Monitoring System via IoT" [19] uses the Blynk app as a platform. NodeMCU was used to connect the system to Wi-Fi. The ultrasonic sensor has been used for detects the water level. This project also allows users to view the duration of the water level from their smartphone. A solenoid valve was used for water excess to flow out to suitable places. In this project, a GPS has been used to provide the exact location of the flood area. Users can get an alert message on the Blynk app when the level of water is at a WARNING or CRITICAL level.

2.2.14 Flood Disaster Indicator of Water Level Monitoring System

The paper “Flood Disaster Indicator of Water Level Monitoring System” [20] used GSM to deliver data and an Arduino board is used to operate the entire system. This project uses float switch sensors to assess the water level and then analyses the data to identify the sort of hazard present. An alarm message is issued to the user based on the observed level. The GSM is utilised to send SMS messages between the various system components. The output will be presented in SMS messages to users and also displayed on LCD.

2.2.15 A GSM Based Water Quality Monitoring System using Arduino

The author of “A GSM Based Water Quality Monitoring System using Arduino” [21] focused on GSM based water monitoring system it uses three sensors is pH sensor, a conductivity sensor, and temperature sensor, an Arduino processing module, and two data transmission modules (Arduino and GSM) are used in this system. The data is captured as analogue signals by the three sensors. Then the data obtained from the sensors is accepted and processed by Arduino and sent to the Web page through the GSM module. The microcontroller will process and analyse the digital data, and the GSM module will send an SMS including the water quality parameters to the smartphone or PC, which will also be shown on the Arduino's LCD.

2.2.16 Internet of Things Enabled Real-Time Water Quality Monitoring System

The project from “Internet of Things Enabled Real-Time Water Quality Monitoring System” [22] uses TI CC3200 as a controller, it is a single-chip microcontroller with an in-built Wi-Fi module and ARM Cortex M4 core. Then the sensors were connected to the controller for the data processor. The real data has been collected by the sensor by placing the sensors into different solutions of water. the value can be viewed by using LCD. Then the data will

send into the “Ubidots” cloud the cloud server that has been used for this project. Lastly, users can monitor the data on the cloud server. From the cloud server, it will send an alert message about the water quality status.

2.2.17 Automated Water Quality Monitoring System Development via LabVIEW for Aquaculture Industry (Tilapia) in Malaysia

The paper “Automated Water Quality Monitoring System Development via LabVIEW for Aquaculture Industry (Tilapia) in Malaysia” [23] is about water quality monitoring that focused on aquaculture. This project uses a pH sensor and temperature sensor for monitoring water quality. DAQ NI myRIO-1900 for an interface between sensor and software. The data that has been transferred through a Wi-Fi connection can be monitored in LabVIEW on a PC.

2.2.18 Water Quality Monitoring System Using IoT

The author of “Water Quality Monitoring System Using IoT” [24] uses an ESP32 as a control device in this project, which connects to an existing Wi-Fi network and establishes a webserver. ESP32 into Station (STA) mode and develop a webserver that will deliver web pages to any connected client on the network. pH and conductivity sensors were utilised in this project. The sensors have been submerged in water and produce a pH and conductivity value dependent on the water quality in which they are placed. The sensors are connected to the ESP32 through a code written in the Arduino IDE and uploaded to the device. All of the devices attached to the microcontroller are controlled by it. Then the data is sent to the web server.

2.2.19 Water Quality Monitoring System with Parameter of pH, Temperature, Turbidity, and Salinity Based on Internet of Things

The paper “Water Quality Monitoring System with Parameter of pH, Temperature, Turbidity, and Salinity Based on Internet of Things” [25] are using sensors then put in the aquarium to measure water quality, temperature, pH value, turbidity, and salt levels. This project’s objective is to make sure that the quality of the water is always up to standard. Then, Arduino and the ethernet shield act as microcontrollers that operate sensors and servers that collect data from Arduino and store and send it to a web server. When the sensor identifies water quality that isn't up to standard, a buzzer rings.

2.2.20 Smart Monitoring System and Early Warning Water Level “SMOORT” using Raspberry Pi Technology

The paper “Smart Monitoring System and Early Warning Water Level “SMOORT” using Raspberry Pi Technology” [26] was using a Raspberry Pi 3 running Raspbian 4.19, with 1 GB of RAM, a Micro SD card slot with 32 GB of storage, an ultrasonic sensor, an LED, a buzzer, jumper wires (M to F), resistors, and a breadboard. When the system detects that the water level has risen over the set limit, it will activate the LED and siren, as well as send an early warning message to communities via WhatsApp. This project will include a web-based system for monitoring water levels in rivers connected to the prototype.

2.3 Comparison of Related Work

Author	Title	Year	Method/Component	Description	Advantage	Disadvantage
Nandhini N a *et al.*	Flood Monitoring and Alerting System Using Arduino In IoT	2021	- Arduino Uno - ESP8266 - Water level sensor - Temperature sensor - Vibrating sensor - 16X2 LCD - Arduino IDE - Embedded C	- Using Arduino as a microcontroller. - Water level sensor to track the water level and temperature sensor to detect the humidity level connected to Arduino. - The sensor that is connected to the microcontroller will analyse the real-time data if there is a changeover Waterflow or humidity level and send the data to the application. - ESP8266 is a module for sending the alert message to the nearby surrounding.	- Less cost. - Real-time data. - Having an alerting message system.	- Should have an alarm to alert surroundings.
S. Jana Priya *et al.*	Flood Monitoring and Alerting System	2017	- Arduino Uno - GSM SIM 900A - Ultrasonic sensor - Ethernet shield - APR33A3	- Using Arduino as a microcontroller. - Ultrasonic sensor uses to read the distance between water and the sensor. - The water was measured, and the water level was calculated then it will compare to the set threshold. - If the water level is more than the threshold value, it will make a voice call to a residence to alert them via GSM SIM 900A and update the web page.	- Real-time data. - Less cost. - Having a voice call system to alert users.	- GSM may cause interference with some electronic devices.

				- When the water level is lower than the threshold value it will update the web page only.		
Varsha Lakshmikantha *et al.*	IoT Based Smart Water Quality Monitoring System	2021	- ATMEGA328 - Temperature sensor - Turbidity sensor - pH sensor - conductivity sensor - humidity sensor - $C0_2$ sensor - Wi-Fi module - Cloud server - LCD	- Using ATMEGA328 as a microcontroller. - The sensors connected to the microcontroller will measure the real-time values. - The values will upload to the cloud. - If the values are more than the threshold value it will communicate with the concerned end user.		- High cost
M. Chitra, D *et al.*	IoT Based Water Flood Detection and Early Warning System	2020	- ATMEGA328 - GSM Modem - Water level detection sensor - Temperature and humidity sensor - LCD - Arduino IDE - Thingview (Android Application)	- Using the Thingview Android application. - Sensors are placed near the river to detect the flood in the water bodies. - The water level detection sensor acts as a transmitting unit which is used to detect the water level at the time of the floods. - Temperature Sensors and Humidity Sensors are used to measure the live temperature and the humidity of the water bodies. - The collected data from the water body is transmitted to LCD to display on the screen for the end-user.	- Real-time data. - Users can monitor anytime and anywhere as long as having a connection. - Alerting people nearby.	- High cost. - GSM may cause interference with some electronic devices. - The usage of GSM increases electromagnetic radiation.

				- The sensor detects the water level and sends an alert message (SMS) via GSM modem to the people who are nearby the water body.		
Shahirah Binti Zahir *et al*	Smart IoT Flood Monitoring System	2019	- Ultrasonic sensor - mbed NXP LPC1768 - Buzzer - LCD - LED - Stepper Motor - Wi-Fi Module	- Using embed NXP LPC1768 is a microcontroller - Using a web server to display the data. - Ultrasonic HC-SR04 module sensor will be used to detect the water level of the river. - The data will update to the webserver.	- Real-time data.	- Do not have an alerting message system.
A. H. M. Almawgani *et al.*	Smart Monitoring System of Najran Dam	2020	- Arduino - GSM shield - LCD - Water level sensor - Water flow sensor	- Using Arduino as a microcontroller. - Water level sensor and water flow measure water level and flow of water. - Alerting message will send to people via GSM.	- Having a GSM SMS alerting system. - Having an alarm to alert surroundings.	- The usage of GSM increases electromagnetic radiation.

Sathish Pasika *et al.*	Smart Water Quality Monitoring System with Cost-Effective Using IoT	2020	- pH sensor - turbidity sensor - ultrasonic sensor - DHT-11 sensor - Arduino mega - Wi-Fi module - ThingSpeak server	- Arduino as a microcontroller. - The data will collect from the pH sensor, ultrasonic sensor, DHT-11 sensor and turbidity sensor. - All the data will upload to the ThingSpeak server via the Wi-Fi module. - User can log in to the server by using a user ID and password.	- Real-time data. - Users can monitor anytime and anywhere as long as having a connection.	- High cost
Dedi Satria *et al.*	Implementation of GSM Communication on Flood Monitoring Systems Based on Multiple Locations Visualization	2019	- Gsm Transceiver & Receiver Module - Temperature Sensor - Rain Sensor - Ultrasonic Sensor - Rain Sensor - Arduino - SMS Gateway Application - Server Application - PC	- Using Arduino as a microcontroller for the floods monitoring system. - Using ultrasonic sensors to measure water levels, rain sensors to determine the rain conditions and temperature sensors. - Using a GSM modem, web server application, MySQL database, PHP engine and Gammu for the flood monitoring system. - The data from sensors will send to the flood monitoring system server using SMS via the GSM transmitter module. - The flood monitoring system server that has a GSM receiver module will display the output on the server application.	- Real-time data - Users can monitor anytime and anywhere as long as having a connection. - Having a GSM SMS alerting system.	- The usage of GSM increases electromagnetic radiation. - GSM may cause interference with some electronic devices.

Nurzaid Muhd Zain *et al.*	Flood Warning and Monitoring System (FWMS) using GSM Technology	2020	- Arduino Uno - Ultrasonic sensor - LCD - GSM SIM900A module - Piezo buzzer	- Using Arduino as a microcontroller. - Sensors will monitor and collect real-time data. - A warning SMS or call will be sent to users and the Fire and Rescue Department via the GSM module. - When the levels are on "warning" or "danger" a buzzer will be turned on as a warning notification to users. - Users can monitor the level of water status by sending an SMS to the system.	- Real-time data. - Having a GSM calling and SMS alerting system. - Users can monitor anytime and anywhere by sending SMS to the system.	- GSM may cause interference with some electronic devices
Enes Šarak *et al.*	IoT Based Early Warning System for Torrential Floods	2020	- Arduino - Ultrasonic sensor - Temperature sensor - Pressure sensor - Humidity sensor - Vibration sensor - Power supply and storing unit - GSM module	- Using Arduino as a microcontroller. - Based on a network of automated meteorological stations (AMS) that send data to a central server at regular intervals. - Using ultrasonic sensors for measured water levels, while temperature, relative humidity, and ambient pressure are measured using a combination sensor. - Use a soil vibration sensor to identify potential landslides and to acquire extra data for the	- Real-time data. - Having many sensors. - Having an SMS alerting system.	- Users cannot monitor data.

				production of a larger meteorological image. - AMS also features an internal alert system that sends SMS messages to selected mobile phone numbers in the event of a substantial change in sensor data.		
Minakshi Roy *et al.*	Flood Detection and Water Monitoring System Using IoT	2020	- Arduino Wemos D1 R1. - Ultrasonic sensor. - Flow sensor. - Dht11(Temperature and humidity sensor). - Float sensor. - LCD Display	- Using Arduino is used as a microcontroller. - The sensors detect their surroundings and provide real-time data to the cloud. - users can view and access it via their mobile platform. - The volume of water or the distance between the sensor and the water level is measured using an ultrasonic sensor. - The flow and amount of water transported are measured using a flow sensor. - The DHT11 sensor measures the temperature and humidity. - The data is uploaded and modified in the cloud with accuracy to the sensor.	- Users can monitor anytime and anywhere as long as having a connection. - Real-time data.	- Need a connection for connecting to the server.

MI. Hadi, F. Yakub *et al.*	Designing Early Warning Flood Detection and Monitoring System via IoT	2020	- NodeMCU - Ultrasonic sensor - GPS - Solenoid valve - Blynk App	- Using the BLYNK app as a platform. - Using NodeMCU to connect the system to Wi-Fi. - Using an ultrasonic sensor to detect the current water level. - Use a solenoid valve for excess water to flow out to suitable places. - Use GPS to provide the exact location of the flood area. - Users can get an alert message on the BLYNK app when levelling water at a WARNING or CRITICAL level.	- Real-time data. - Can know the flood's exact location. - Having alerting system. - Users can monitor anytime and anywhere as long as having a connection	- Cannot have interference for GPS accuracy.
Wan Haszerila Wan Hassan *et al.*	Flood Disaster Indicator of Water Level Monitoring System	2019	- Arduino Uno - GSM modem - Float switch sensors (RSF50 Series) - LCD	- Arduino as a microcontroller. - Float switch sensors to assess the water level and analyse the data to identify the sort of hazard present. - The output will be presented in SMS messages to users and also displayed on LCD.	- Having an SMS alerting system.	- GSM may be having interference with some other electronic devices.

S.Gokulanathan *et al.*	A GSM Based Water Quality Monitoring System using Arduino	2019	- Arduino Uno - GSM modem - pH sensor -Temperature sensor - Electric conductivity sensor - LCD	- Arduino as a microcontroller. - The data will collect by pH sensor, conductivity sensor, and temperature sensor. - The GSM module will send an SMS including the water quality parameters to the smartphone or PC.	- Having an SMS alerting system.	- GSM may be having interference with some other electronic devices.
S. Geetha and S. Gouthami	Internet of Things Enabled Real-Time Water Quality Monitoring System	2016	- Turbidity sensor - Conductivity sensor - Water level sensor - pH sensor - TI CC3200 - Ubidots cloud server	- Using TI CC3200 as a controller. - The sensor is placed in a different solution of water. - The real data has to be collected by the sensor. - The data will send to the Ubidots cloud server. - The cloud server sends an alert message about the water quality status.	- Real-time data. - Having alerting system. - Users can monitor anytime and anywhere as long as having a connection	- Need a connection for connecting to the server.
Suruchi Pokhrel *et al.*	Water Quality Monitoring System Using IoT	2020	- pH sensor - conductivity sensor - ESP 32 - Mongo DB - Arduino IDE	- Using ESP32 as a controller. - The sensors are submerged in water and produce a PH and conductivity value dependent on the water quality in which they are placed. - The sensors are connected to the ESP32 through a bit of code written in the Arduino IDE and uploaded to the device.	- Real-time data.	- Need a connection for connecting to the server.

				- The data in the microcontroller are sent to the web server by HTTP methods.		
Yazi Adityas *et al.*	Water Quality Monitoring System with Parameter of pH, Temperature, Turbidity, and Salinity Based on Internet of Things	2021	- Arduino - Temperature sensor - pH sensor - turbidity sensor - Salinity sensor - Buzzer - Ethernet shield - Mikrotik RB951UI	- Arduino as a microcontroller. - The data were collected by temperature sensor, pH sensor, turbidity sensor, and salt levels sensor. - The collected data is sent to the web server. - The buzzer ring when water quality is not up to standard.	- Having an alarm system. - Having many sensors. - Real-time data.	- Needed messaging alerting system.
Edward Arlis Chouwanto *et al.*	Smart Monitoring System and Early Warning Water Level "SMOORT" using Raspberry Pi Technology	2021	- Raspberry Pi - Ultrasonic sensor - LED - Buzzer	- Using a Raspberry Pi 3. - Using ultrasonic to detect the water level. - Warning messages sent to communities via WhatsApp.	- Having a messaging alerting system. - Real-time data.	- High cost. - Needed Internet connection.

Table 1: Comparison of related work

2.4 Summary

After a review of all previous project literature reviews that has be studied, an understanding has been achieved. Next, a comparison must be made to know which component could be used to develop a project that will be developed soon. After studying multiple previous kinds of literature, an idea has come up for the future development project. It is because many previous projects about flood monitoring or water quality monitoring only focus on one feature. There are at least several previous kinds of literature that have a system of flood monitoring and water quality monitoring in one system. This project will combine two features in one project.

CHAPTER 3
METHODOLOGY

3.1 Introduction

This chapter detailed the approach needed to perform the research to ensure that the objective was met. Flow process software and hardware are used in the process. The hardware development components are included in this chapter.

3.2 Methodology

The development of this project was divided into two main parts which were hardware architecture and software development. Both hardware and software parts play an important role to make this system works properly and effectively.

3.2.1 Block Diagram

To begin, a project block diagram is the most important tool for ensuring that the project is properly set up. The monitoring system is an important aspect of this project. This project is aimed to build a system that can monitor floods and water quality. The sensor will be controlled by ESP8266. The ESP8266 will be set up by programming or coding for the data processor. Then, the data will be transmitted to Blynk. Lastly, the output will show the parameters of the system for monitored on a smartphone or web via Blynk.

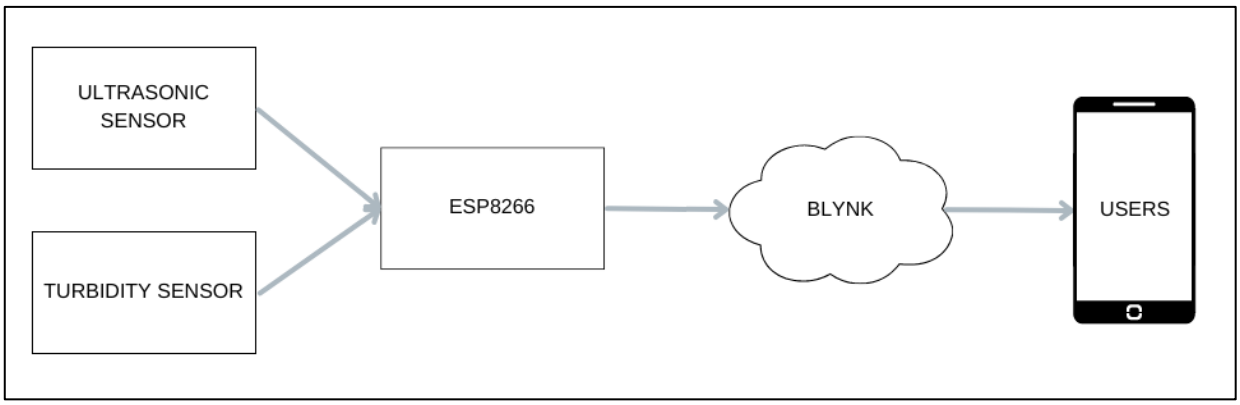


Figure 1: Project Block Diagram

3.2.2 Flowchart

A flow chart is a diagram that represents the process or procedure of a project. It demonstrates how to do the task in a step-by-step manner. The project's flow charts, software and hardware used, how the processes work, and how to develop and implement the project will all be covered in detail.

From the flowchart in figure 2 firstly, the data have been collected from sensors. Next, sensors will calculate the water level. Then, the data will upload to the cloud server (Blynk). If the sensor detects the water level as “Normal”, “Medium” or “High” it will send the information to users (notification). If not, the process will go back to the sensor to calculate again the water level.

For the flowchart in figure 3 firstly, the data have been collected from sensors. Next, data will be read from the sensor. Then, the data will upload to the cloud server (Blynk). If the sensor detects water’s turbidity on “Clear”, “Moderate” or “Cloudy” then it will send the information to users (notification). If not, the process will back-read the data from the sensors.

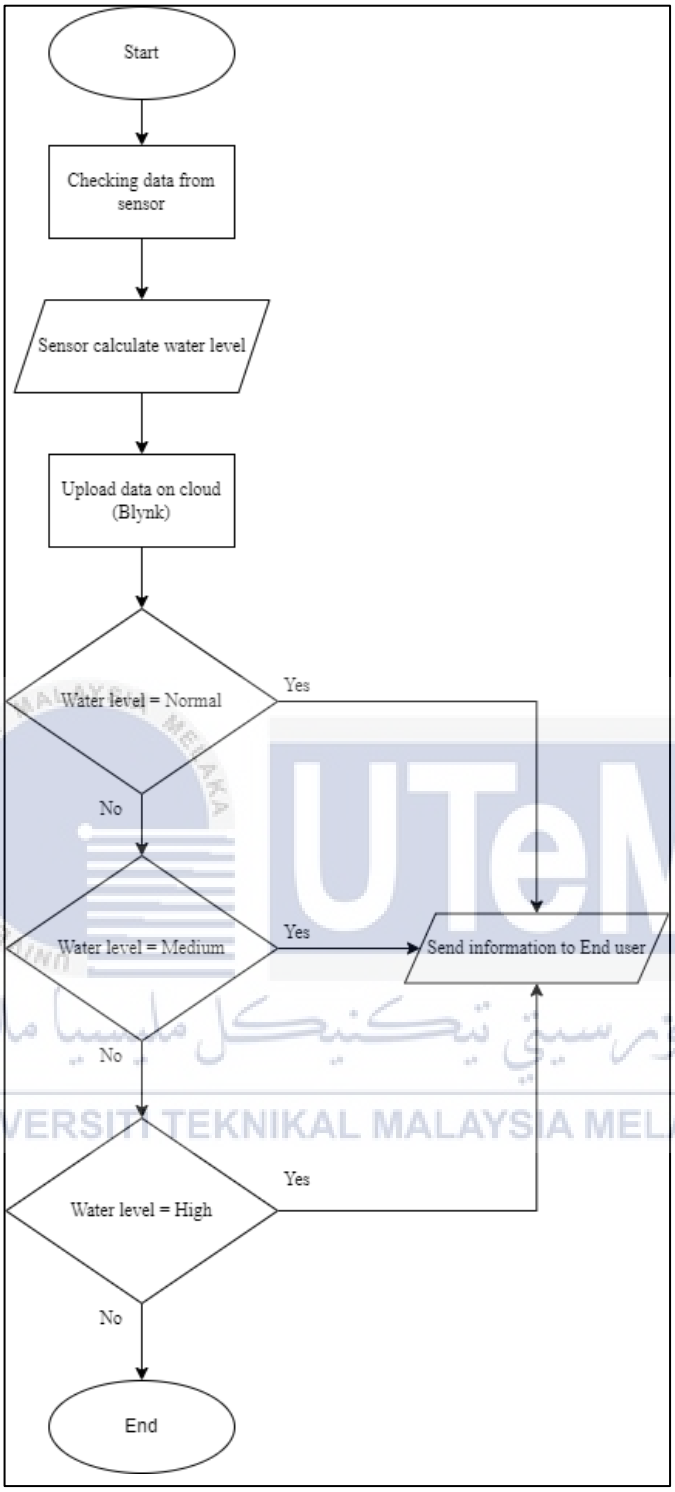


Figure 2: Flowchart for Flood Monitoring

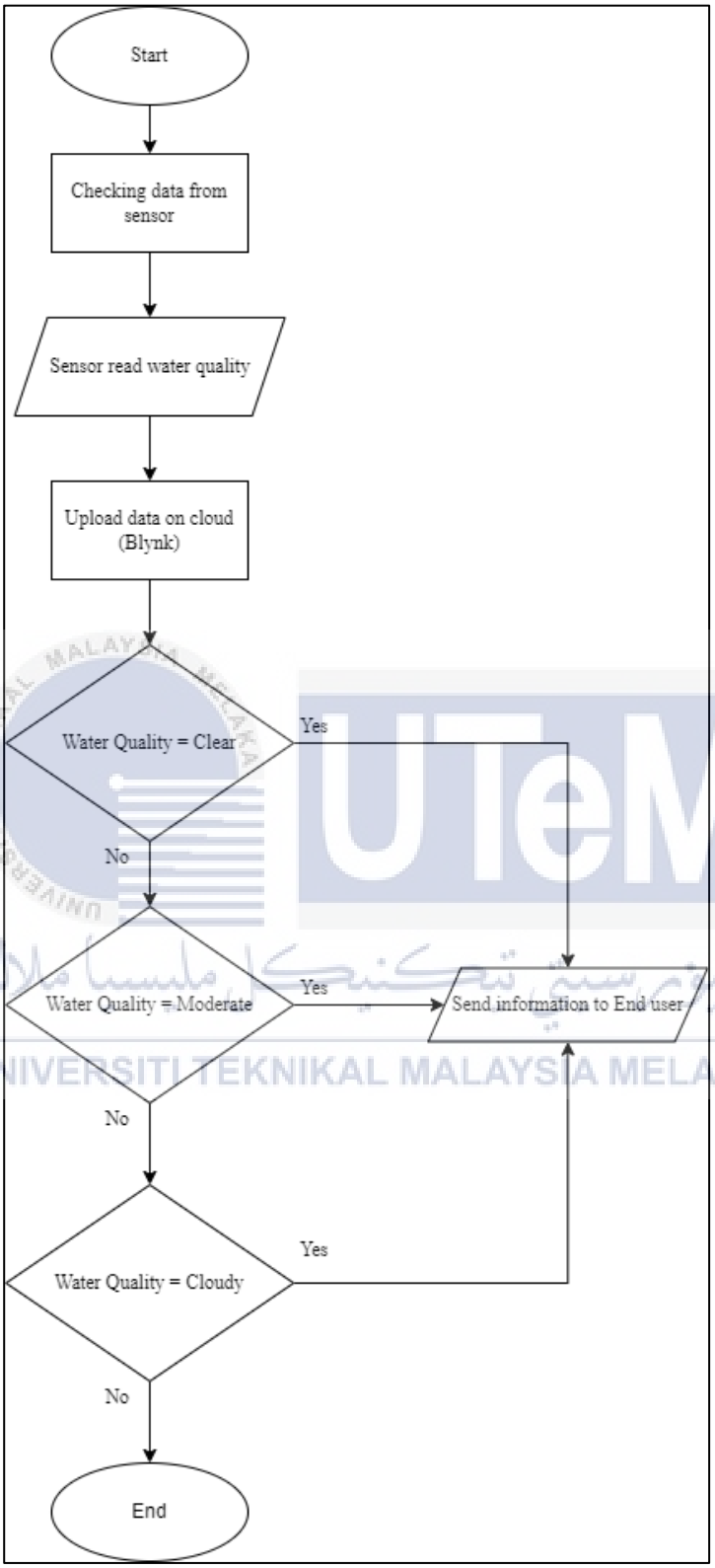


Figure 3: Flowchart for Water Quality Monitoring

3.2.3 Schematic Diagram

For this project circuit created on Proteus, this project has implemented both an ultrasonic sensor and a turbidity sensor. These sensors are connected to a NodeMCU ESP8266 microcontroller, which is responsible for processing the sensor data and transmitting it to Blynk software.

The ultrasonic sensor is used to measure the distance between the sensor and the water. It works by emitting a high-frequency sound pulse and measuring the time it takes for the pulse to be reflected in the sensor. This information is then used to calculate the distance to the water.

The turbidity sensor, on the other hand, is used to measure the number of suspended particles in a liquid. It works by shining a light through the liquid and measuring the amount of light that is absorbed. The more particles present, the more light that is absorbed, and the lower the turbidity reading will be.

Both sensors are connected to the NodeMCU ESP8266 via wires. The microcontroller is responsible for reading the sensor data and transmitting Blynk software. This allows the user to monitor the sensor readings in real time and make any necessary adjustments.

Overall, the Proteus circuit for this project is a simple yet effective way to monitor the distance and turbidity of a given environment using a combination of sensors and microcontroller technology.

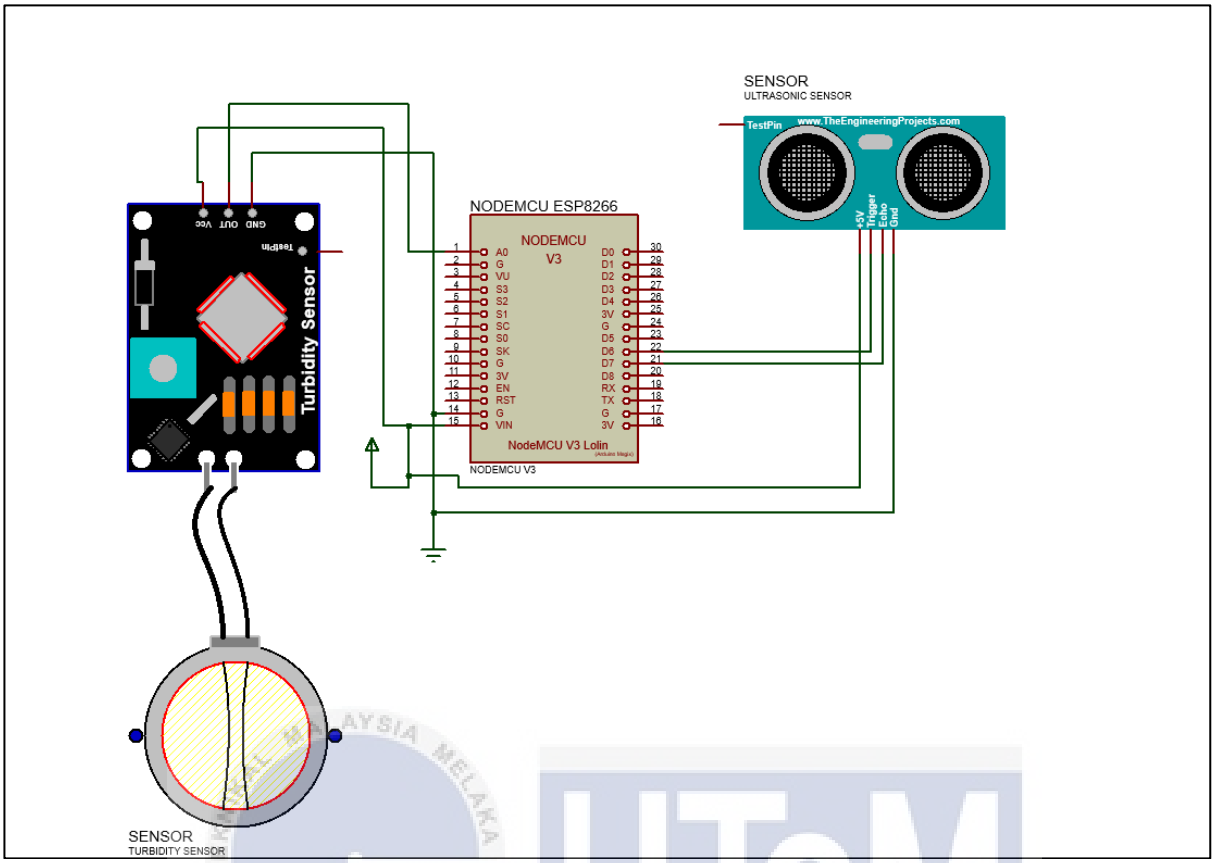


Figure 4: Project Schematic Diagram

3.3 Hardware Development

In general, hardware development is more complicated than software development for two reasons: more processes must be followed, and there is only one chance to launch the appropriate product.

3.3.1 Equipment

3.3.1.1 NodeMCU ESP8266

For this project, an ESP8266 is utilised as a Wi-Fi module. The ESP8266 is a self-contained SOC with an integrated TCP/IP protocol stack that can provide access to a Wi-Fi network to any microcontroller. The ESP8266 can either host an application or offload all Wi-Fi networking functionality to a separate application processor. Each ESP8266 module is pre-programmed with AT command set software, allowing it to be easily connected to an Arduino and provide about as much Wi-Fi functionality as a Wi-Fi Shield. Because of its high level of on-chip integration, it only requires a small amount of external circuitry, including the front-end module, which is designed to fit on a small PCB.

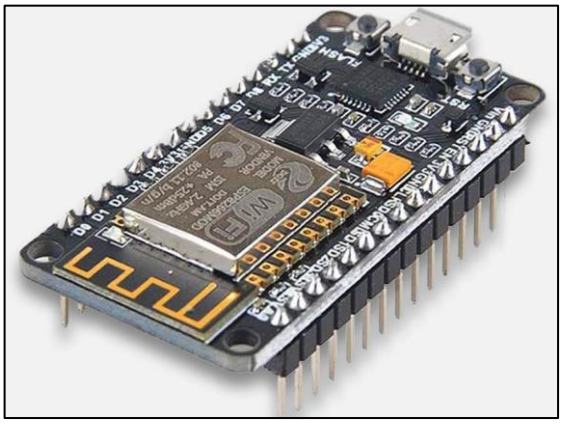


Figure 5: NodeMCU ESP8266

3.3.1.2 Ultrasonic Sensor

This project uses an ultrasonic sensor to measure the water level. Ultrasonic sensor uses ultrasonic sound waves to measure the distance between two objects and modify the reflected sound into an electrical signal. Ultrasonic waves move quicker than recognizable sounds. The transmitter will send out ultrasonic sound pulses, while the receiver will listen for echoed waves.

Figure 6: Ultrasonic Sensor

3.3.1.3 Turbidity Sensor

For this project, the turbidity sensor will determine the relative clarity of the liquid and classify it as "clear", "moderate", or "cloudy". A turbidity sensor is a device that measures the number of suspended particles in a liquid, such as water. Turbidity is an important water quality parameter because it is an indicator of the amount of sediment, algae, and other contaminants present in the water. A turbidity sensor typically works by shining a light through the liquid and measuring the amount of light that is scattered or absorbed by the suspended particles. Turbidity sensors are used in a variety of applications, including water treatment plants, aquaculture, and environmental monitoring. They are often used to monitor the quality of drinking water, as high turbidity levels can indicate the presence of harmful contaminants that can affect the taste, odour, and appearance of the water. Turbidity sensors can also be used to monitor the effectiveness of water treatment processes, as well as to detect changes in water quality over time.

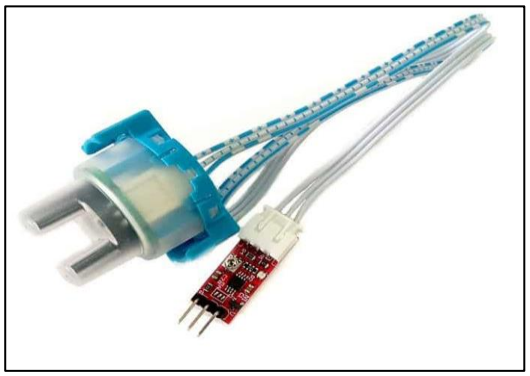


Figure 7: Turbidity Sensor

3.4 Software Development

Software development is the process of creating and maintaining computer programs. It involves a wide range of activities, including designing and planning the software, writing, and testing code, debugging errors and maintaining the software once it has been deployed.

The first step in the software development process is gathering requirements. This involves identifying the needs and goals of the end users and determining the necessary features and functionality of the software. The next step is designing the software, which involves creating a detailed plan for how the software will be structured and how it will function.

Once the design phase is complete, the next step is writing the code. This involves writing the instructions that will tell the computer what to do. The code is written in Arduino IDE software. After the code has been written, it must be tested to ensure that it functions correctly. This is done through a process called debugging, which involves identifying and fixing any errors or problems in the code. The ESP8266 board will function as it has been programmed from the IDE.

Once the software has been tested and debugged, it is ready to be deployed. This involves installing the software on the computers or devices it was intended for and making any necessary updates or maintenance. To get this project running smoothly, the software users need to meet the requirement of the project.

3.4.1 Arduino IDE

Arduino is an open-source electronics platform that combines hardware and software to make it easy for people to build a variety of electronic projects. The Arduino Integrated Development Environment (IDE) is a software application that provides a text editor for writing, testing, and uploading code to the Arduino board. It also includes a library of pre-written functions and code examples to help users get started quickly. One of the key features of the Arduino IDE is its simplicity. It is designed to be easy to use, even for people who have little or no programming experience.

Figure 8: Arduino IDE

3.4.2 Proteus

To design a circuit for this project, the software that has been used is Proteus software. This software functions to design a circuit and simulation for this project's development. It has a component library for circuit design and simulation. Other than that, it also can be used to simulate the microcontroller by putting a Hex file from the Arduino IDE into the microcontroller model in Proteus.

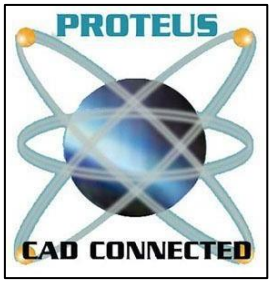


Figure 9: Proteus Software

3.4.3 Blynk

Blynk is a mobile application that allows users to control and monitor various devices remotely. It provides a platform for users to create their dashboards and connect various devices, such as microcontrollers, sensors, and home appliances, to the internet. With Blynk, users can control their devices and collect data from them through their smartphones or tablet.

In this project, Blynk works by using a server that acts as a bridge between the user's devices and the user's smartphone. The Blynk app communicates with the server, which in turn sends commands to the connected devices. The server also receives data from the devices and sends it back to the Blynk app, allowing the user to monitor their devices in real time.

In addition to remote control and monitoring, Blynk also offers a range of features such as customizable dashboards, notification alerts, and data visualization tools. These features make it easy for users to create interactive and user-friendly interfaces for their devices.

Figure 10: Blynk Software

3.5 Project Cost

Table 2 below shows the Cost for this project:

COMPONENT	VALUE	COST	
NodeMCU ESP8266	1	RM 19.90	RM 19.90
Ultrasonic Sensor	1	RM 3.14	RM 3.14
Turbidity Sensor	1	RM 36.80	RM 36.80
Wire	2	RM 5.00	RM 10.00
Transparent Storage Box	1	RM 22.99	RM 22.99
Enclosure Box	1	RM 15.00	RM 15.00
NodeMCU Base	1	RM 10.00	RM 10.00
TOTAL			**RM 117.83**

Table 2: List of Components and Costs for This Project

3.6 Limitation of Proposed Methodology

There is a potential limitation of a project when using Ultrasonic and Turbidity is that both sensors may be affected by the temperature of the water. Ultrasonic sensors can sometimes produce inaccurate readings when the temperature of the water is very different from the temperature of the sensor itself, and turbidity sensors can also be affected by changes in temperature. Additionally, both types of sensors may be affected by the presence of bubbles or other contaminants in the water, which could also impact their accuracy. Finally, the range and resolution of the sensors may also be a limitation, as they may not be able to accurately measure very small changes in water level or turbidity.

Another potential limitation, of using Blynk is that it relies on an internet connection to function, which means that if the device loses its connection, it may be unable to communicate with the Blynk servers or perform certain tasks. This could be a problem if you are using the device in an environment where internet connectivity is unreliable or if you need the device to be able to operate independently without an internet connection.

3.7 Summary

The methodology includes a detailed description of the block diagram of the flood monitoring system, which consists of an ultrasonic sensor, a turbidity sensor, NodeMCU ESP8266, and Blynk. The ultrasonic sensor is used to measure the water level, while the turbidity sensor is used to measure the clarity of the water. NodeMCU ESP8266 receives the readings from the sensors and processes them, displaying the results on the Blynk.

The flowchart of the project is also described in this chapter. It outlines the various steps involved in the functioning of the system, including the initialization of the sensors, the measurement of the water level and turbidity, and the display of the results on the display unit.

In terms of hardware, the chapter describes the specific components that were used in

the project. The software used in the project, including the programming language and the specific libraries or frameworks employed, is also discussed.

Overall, the chapter provides a comprehensive overview of the methodology employed in the flood monitoring project, including the body diagram, flowchart, schematic diagram, hardware, and software used.

CHAPTER 4
RESULTS AND DISCUSSION

4.1 Introduction

This chapter aims to discuss the analysis and results of developing this project. The project utilizes an ultrasonic sensor, and a turbidity sensor serves as a Flood Monitoring and Water Quality Monitoring system that will be monitored on Blynk. The ultrasonic sensor is used to measure the water level in a tank (transparent box), while the turbidity sensor measures the clarity of the water. These two sensors work together to provide real-time data on the water conditions, which can then be accessed and analysed through the Blynk app and the web. This project is important because it helps to ensure that situation of water level and the water quality being used is safe and clean for various applications, such as irrigation or drinking. Overall, the combination of these sensors and Blynk allows for efficient and accurate monitoring of water levels and water quality, making it a valuable tool for various industries and applications.

4.2 Prototype of the Project

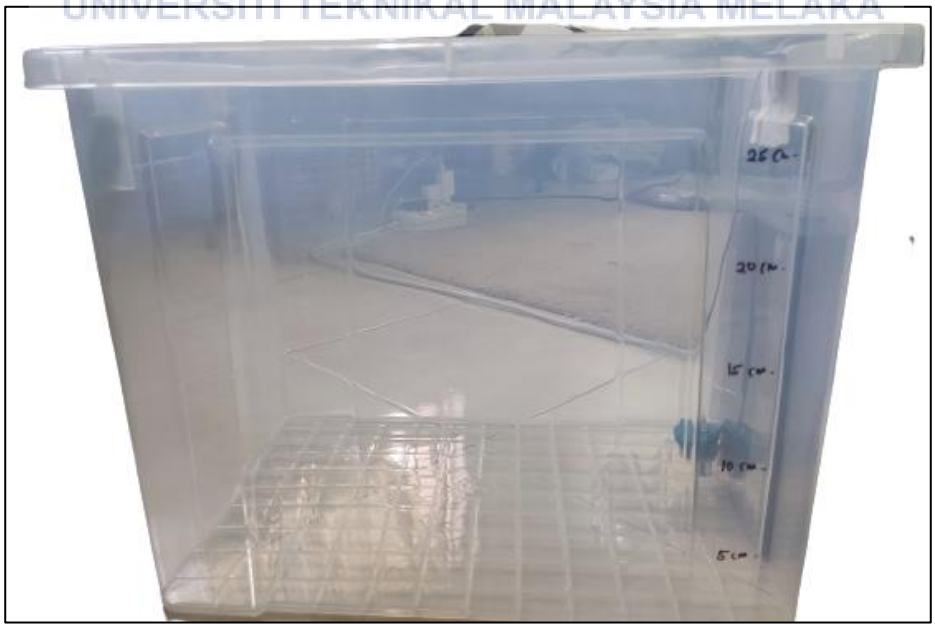


Figure 11: Prototype of Project

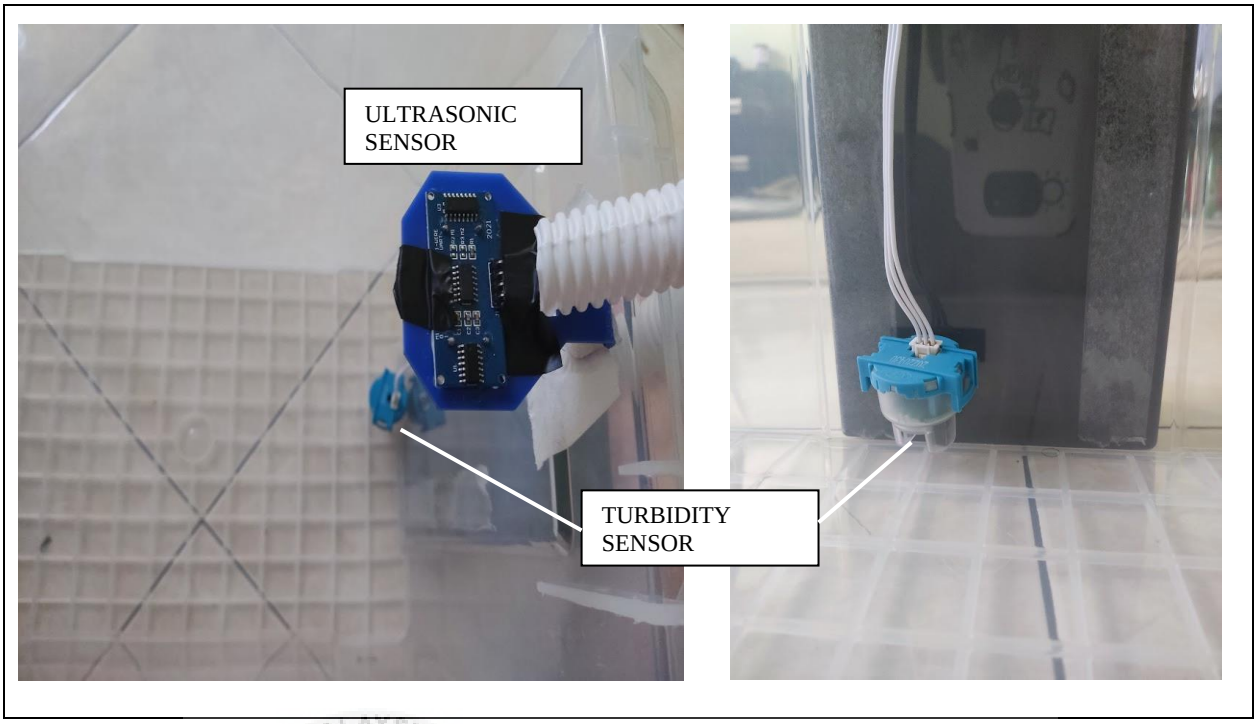


Figure 12: Both Sensor used in Project

Figure 11 shows the main body of the prototype for this project, using a transparent box that will then be filled with water. Figure 12 shows both sensors, the ultrasonic sensor will measure the height of water in a transparent box and the turbidity sensor will measure the turbidity of water.

4.3 Blynk Development

The data collected by both sensors will be displayed on Blynk, allowing for easy monitoring of the flood and water quality conditions, Figure 12 shows the Blynk interface for this project. In addition, the Blynk platform is also able to provide notifications and emails to the user. This allows the user to monitor the data in real time for any changes or abnormalities in the water level or water quality conditions. Figure 13 shows the setting for each parameter in both systems.

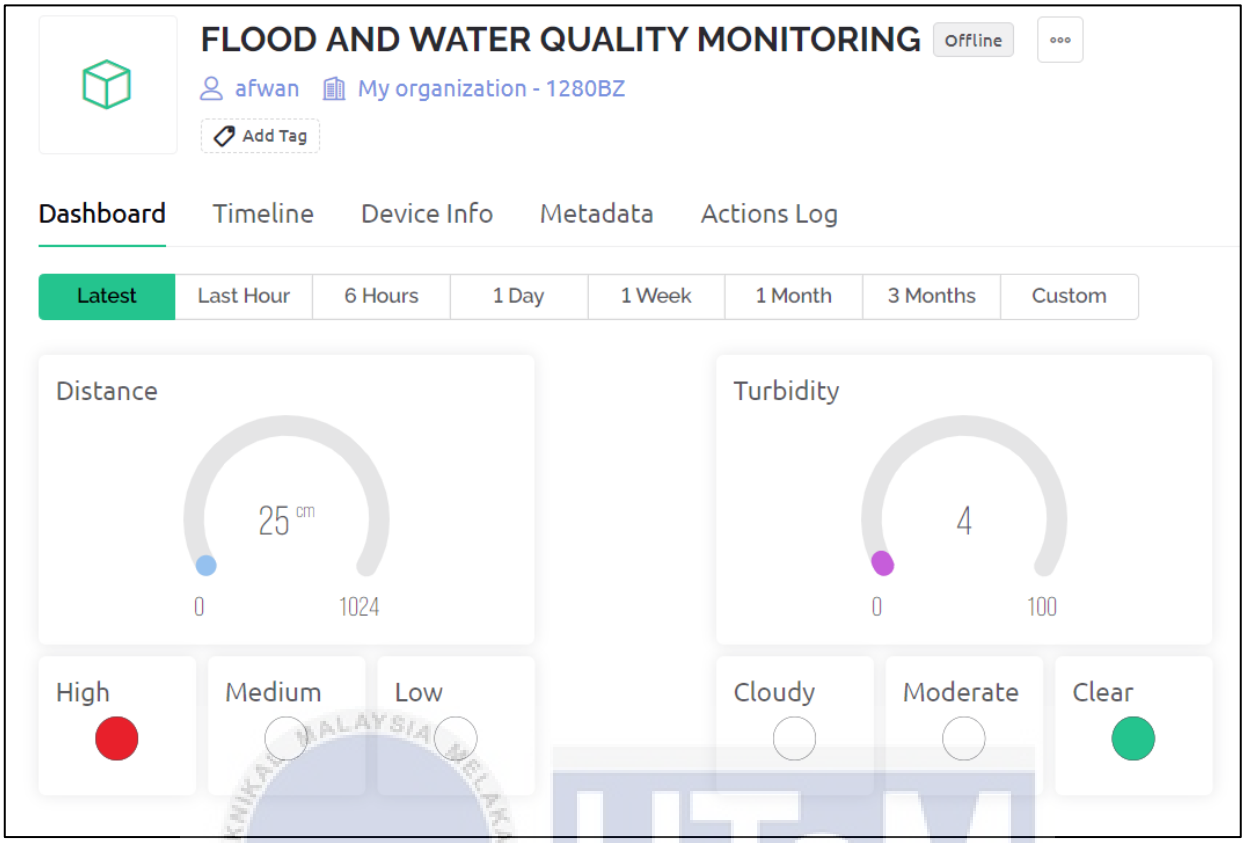


Figure 13: Blynk Interface for Flood and Water Quality Monitoring

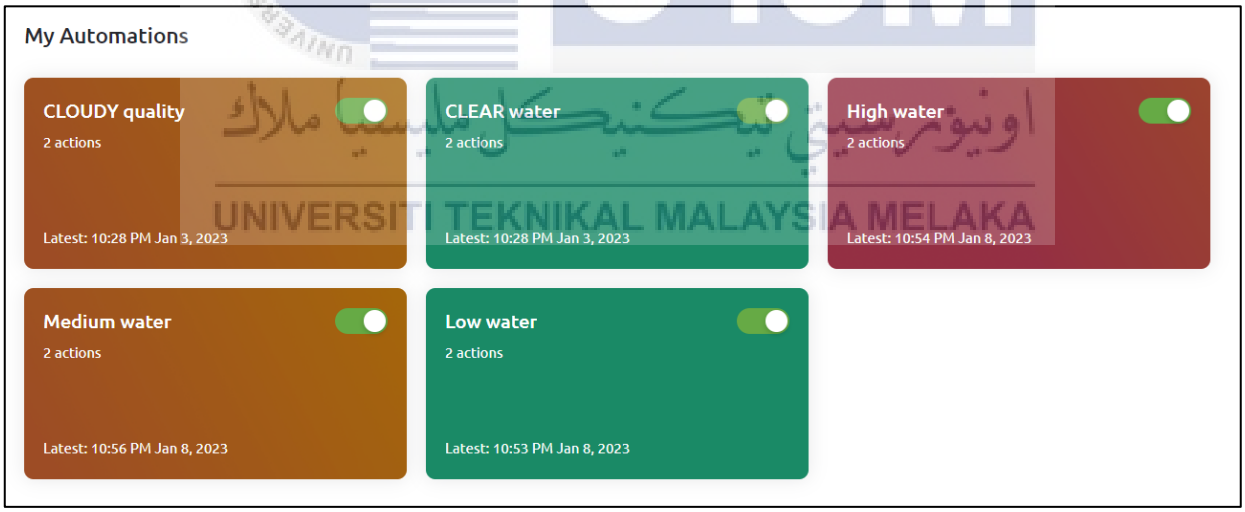


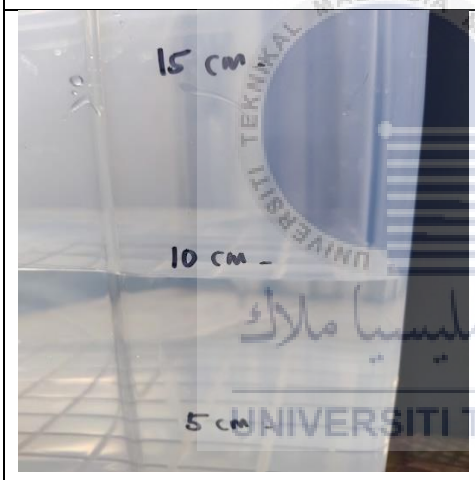
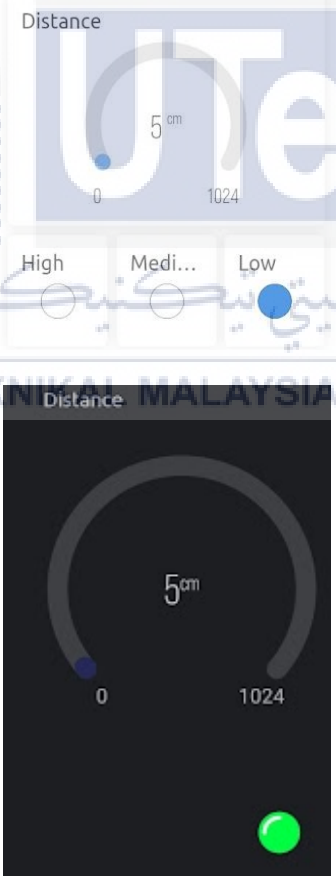
Figure 14: Automations in Blynk Web

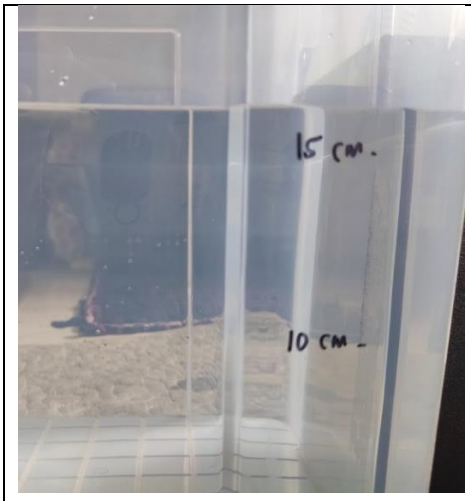
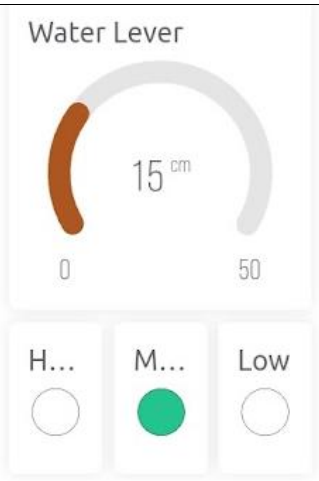
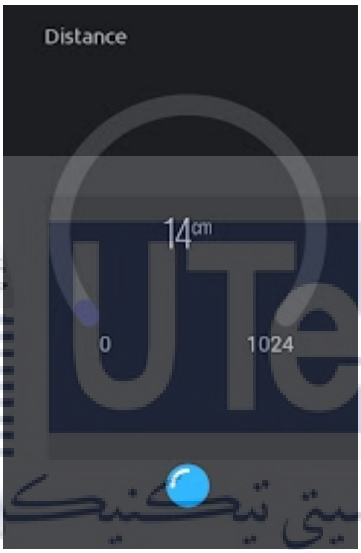
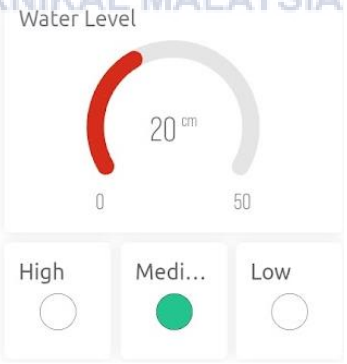
4.4 Results

The Flood Monitoring system using an ultrasonic sensor appears to be functioning as intended. It can measure and classify water levels into three levels: "LOW", "MEDIUM", and "HIGH". The Water Quality Monitoring system aspect of the project, which uses a turbidity sensor, is also functioning properly. It can measure and classify the water into three categories: "CLEAR", "MODERATE", and "CLOUDY". Overall, the project appears to be successful in its goals of monitoring both flood levels and water quality.

4.4.1 Result of Flood Monitoring System

Table 3 shows the results of the Flood Monitoring System.

Result	Blynk	Description
		- The level of water in the transparent box is 10 cm. - And the display on Blynk will show water level is 5cm measured by the ultrasonic sensor. - Above is Blynk for the web and below is the Blynk for the smartphone. - The water level is at a low level.

	 	- When the water level increased to 15cm. The ultrasonic sensor will measure the distance and show the data on Blynk. - Both platforms of Blynk used will synchronous the data. - The level of water is medium.
		- The water volume will increase again, this time the ultrasonic sensor measured the water level as 20cm. - Blynk display the data on both platforms. - The water level is high.

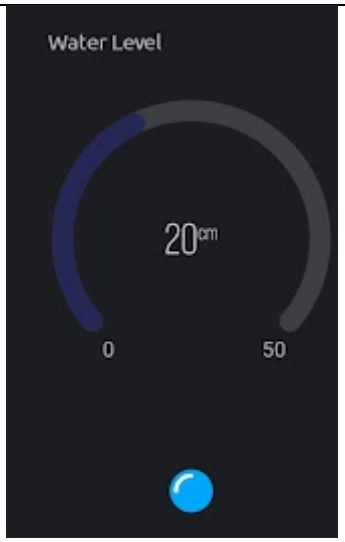
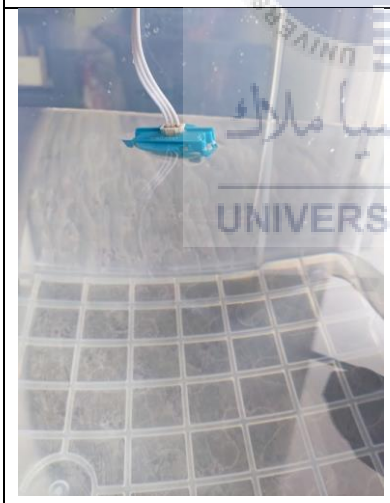
		

Table 3: Results of the Flood Monitoring System

4.4.2 Result of Water Quality Monitoring System

Table 3 shows the results of the Water Quality Monitoring System.

Result	Blynk	Description
		- The Turbidity sensor will be put in clear water. - Turbidity sensor will measure the clarity of water and send data to Blynk. - Blynk display the measured value. - The water quality is clear.

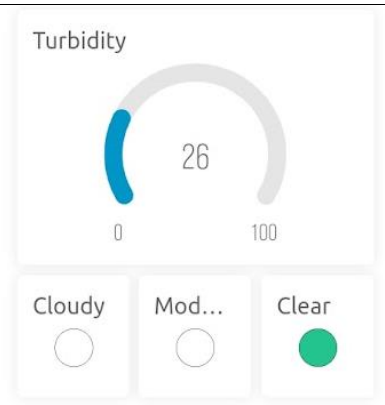
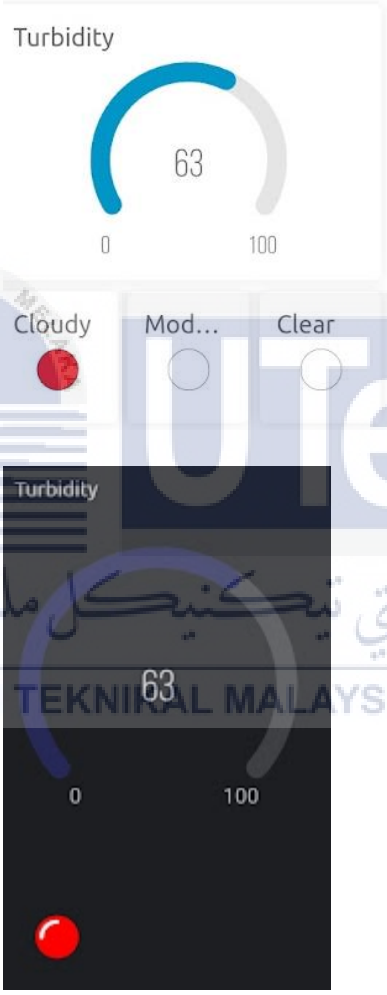
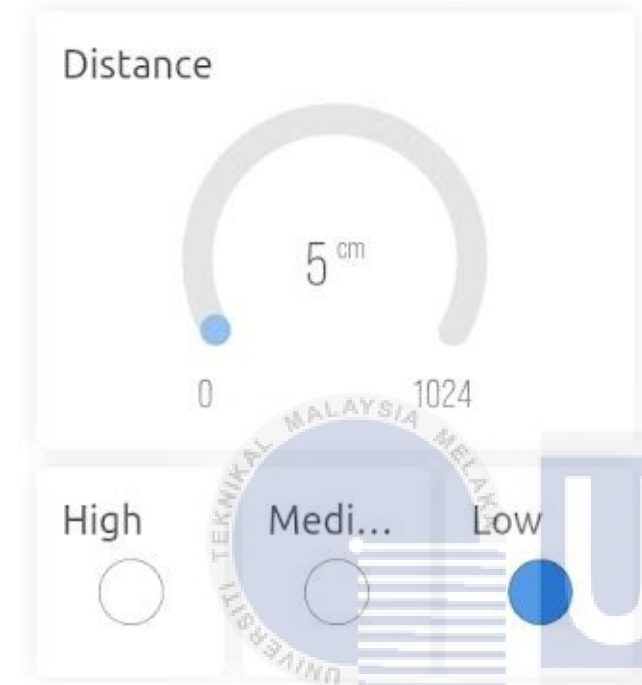
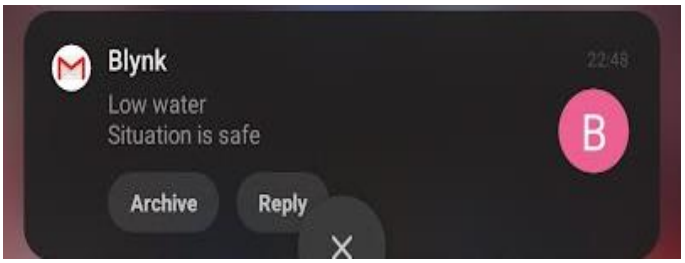
		
		- The turbidity sensor is now being placed in water mixed with mud. - Turbidity sensor will measure the clarity of the water. -The measured value will display on Blynk as 63. - The water quality is cloudy.

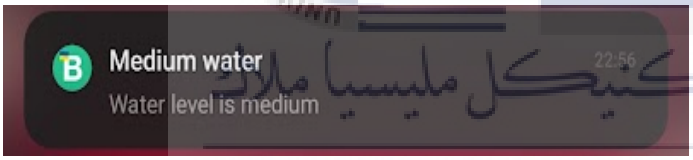
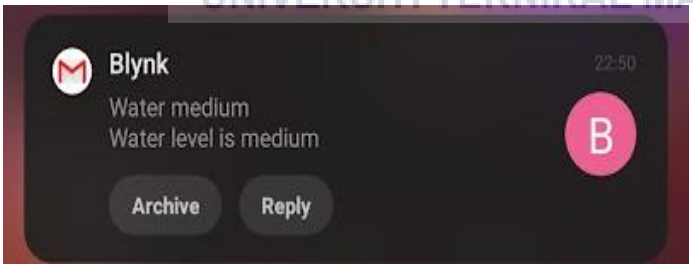
Table 4: Results of the Water Quality Monitoring System

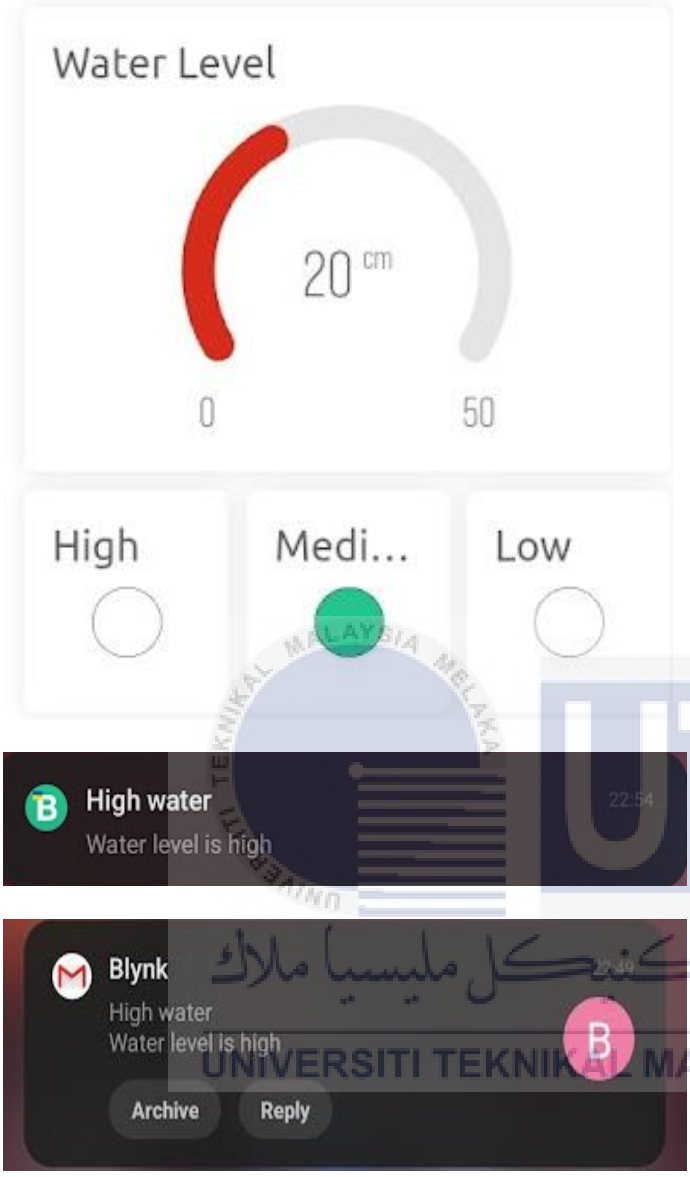
4.5 Data Analysis

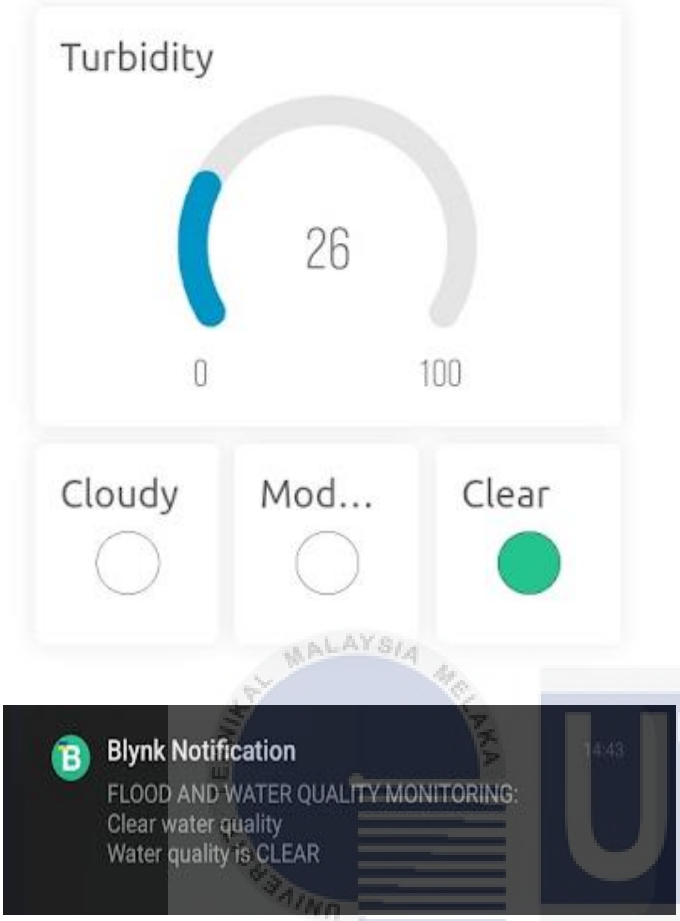
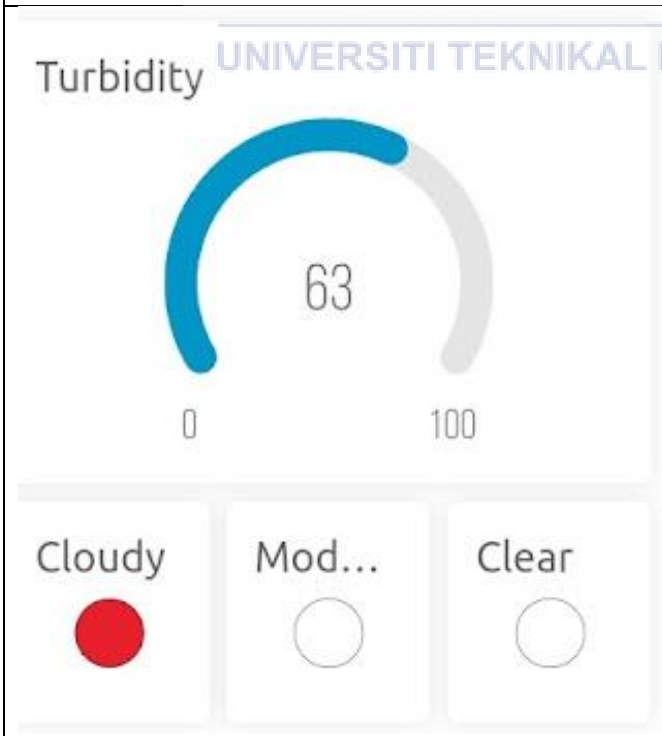
Table 5 shows data and analysis of the Flood and Water Quality Monitoring System.

<table>
<tr><td colspan="2">Situation 1: The water level in the river is 0 to 10 cm.</td></tr>
<tr><td>Data</td><td>Analysis</td></tr>
<tr><td> 


</td><td>- Distance of water = 5cm.
- Water level = low
- Blynk send notification and email to users.</td></tr>
</table>

Situation 2: The water level in the river is 11 to 20 cm.	
  	- Distance of water = 15 cm. - Water level = Medium - Blynk send notification and email to users.

Situation 3: The water level in the river is above 20 cm	
	- Distance of water = 20cm. - Water level = High - Blynk send notification and email to users.

Situation 4: The water quality in the river is 0 to 45 turbidity.	
	- Turbidity of water = 26 - Water quality = Clear - Blynk send notification and email to users.
Situation 5: The water quality in the river is above 55 turbidities.	
	- Turbidity of water = 63 - Water quality = Cloudy - Blynk send notification and email to users.

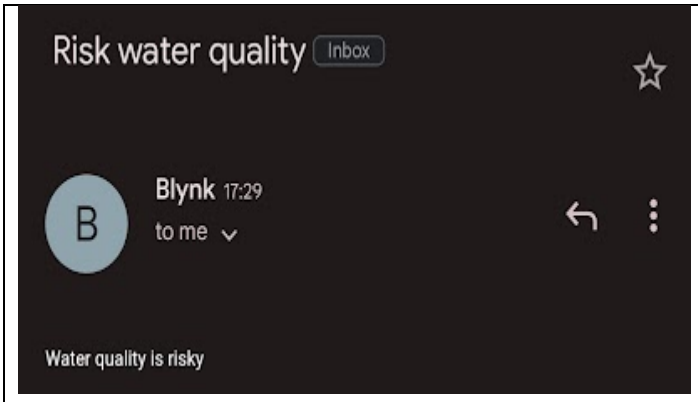
	

Table 5: Data and Analysis of Flood and Water Quality Monitoring System

4.6 Discussion

The results of using an ultrasonic sensor to measure water level and a turbidity sensor to measure water quality were analysed and discussed in this chapter. The ultrasonic sensor was able to detect three different levels of water: low, medium, and high. On the other hand, the turbidity sensor was able to detect three different levels of water quality: clear, moderate, and cloudy. In terms of water level, the ultrasonic sensor was able to accurately detect changes in the water level: low, medium, and high. The turbidity sensor, on the other hand, was able to accurately detect changes in water quality: clear, moderate, and cloudy. Both sensor data were sent to Blynk for monitoring and give notification to the user.

Overall, the use of an ultrasonic sensor and a turbidity sensor for monitoring water level and quality was found to be effective and accurate. The ability to remotely monitor the water level and quality using Blynk is also a convenient feature that can aid in the early detection of potential issues.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

In conclusion, this project was developed to monitor the flood and water quality in rivers. The Flood Monitoring component of the system utilizes an ultrasonic sensor to measure the level of water in the river, with the sensor able to detect three different levels: low, medium, and high. This information can be used to provide early warning of potential flooding events and help mitigate their impact.

The Water Quality Monitoring component of the system uses a turbidity sensor to measure the clarity of the water in the river. Turbidity, or the number of suspended particles in the water, is an important indicator of water quality, as high levels of turbidity can indicate the presence of pollution or other contaminants. The sensor in this system measures the level of turbidity and sends this data back to a central monitoring system.

The NodeMCU ESP8266 is used as the microcontroller for the system. This microcontroller is responsible for collecting data from the ultrasonic and turbidity sensors and then sending this data to the Blynk via an internet connection. Blynk is a platform that allows for easy monitoring of sensor data and sending of messages. The project is developed for monitoring and sending messages about floods and water quality to inform people so that necessary measures can be taken in time.

5.2 Recommendation

A flood monitoring and water quality monitoring project that utilizes ultrasonic and turbidity sensors have the potential to provide valuable insights into the health of local water systems. To ensure that the project is as effective as possible, several steps can be taken. One key step is to consider incorporating other types of sensors, such as pH sensors, to gather a

more comprehensive set of data about water quality. Additionally, incorporating machine learning algorithms to analyse sensor data and make predictions about water levels and quality can help with early warning systems for floods and alerts when water quality falls below a certain threshold. To make the data easily accessible to stakeholders, it's important to develop a user-friendly interface such as a mobile app or web portal. It's also a good idea to look into integrating the system with existing flood monitoring and warning systems used by local government agencies. Before deploying the system in the field, it's essential to validate its performance with on-field testing and comparison with other standard methods.

A secure and reliable communication infrastructure connecting the data from the sensors to a central server, or the cloud is another important step. In this way, the data can be easily shared and accessed by stakeholders and decision-makers. To improve the accuracy of the system, integrating other sources of data such as weather forecasts, is also worth considering. Security and safety of the data and the system should be kept in mind, such as encryption and access control. Moreover, considering the system's potential for use in other applications beyond flood monitoring and water quality monitoring is also a good approach. Finally, it is always important to think about the maintenance of the system and how to ensure that it can continue to operate effectively over time.

REFERENCES

1. Richard Davies Richard Davies is the founder of floodlist.com and reports on flooding news, "Richard Davies," FloodList, 28-Feb-1970. [Online]. Available: https://floodlist.com/asia/malaysia-thailand-floods-february-2022. [Accessed: 05-Apr-2022].
2. Y. C. Ching, Y. H. Lee, M. E. Toriman, M. Abdullah, and B. B. Yatim, "Effect of the big flood events on the water quality of the Muar River, Malaysia," Sustainable Water Resources Management, vol. 1, no. 2, pp. 97–110, 2015.
3. Sinarharian, "Penduduk Kecewa Siren Amaran banjir Tidak Berfungsi," Sinarharian, 02-Jan-2022. [Online]. Available: https://www.sinarharian.com.my/article/181031/BERITA/Semasa/Penduduk-kecewa-siren-amaran-banjir-tidak-berfungsi. [Accessed: 13-Apr-2022].
4. "The importance and challenges of monitoring water quality," Yahara in situ, 23-Sep-2015. [Online]. Available: https://yaharawsc.wordpress.com/2015/09/23/the-importance-and-challenges-of-monitoring-water-quality/. [Accessed: 29-May-2022].
5. H. Auto, "Malaysia floods caused nearly $2 billion in losses," The Straits Times, 28-Jan-2022. [Online]. Available: https://www.straitstimes.com/asia/se-asia/malaysia-floods-caused-nearly-2-billion-in-losses. [Accessed: 21-May-2022].
6. National Geographic Society, "The many effects of flooding," National Geographic Society, 04-Aug-2020. [Online]. Available: https://www.nationalgeographic.org/article/many-effects-flooding. [Accessed: 21-May-2022].
7. N. N, L. N, and K. V, "Flood monitoring and alerting system using Arduino in IOT," SSRN Electronic Journal, 2021.

8. Priya, S. J., Akshaya, S., Aruna, E., Julie, J. A. M., & Ranjani, V. (2017). Flood monitoring and alerting system. International Journal of Computer Engineering & Technology (IJCET), 8(2), 01-05.
9. M. Chitra, D. Sadhihskumar, R. Aravindh, M. Murali, R. Vaittilingame, "IoT based Water Flood Detection and Early Warning System," International Journal of Scientific Research in Computer Science and Engineering, Vol.8, Issue.5, pp.47-53, 2020
10. V. Lakshmikantha, A. Hiriyannagowda, A. Manjunath, A. Patted, J. Basavaiah, and A. A. Anthony, "IOT based Smart Water Quality Monitoring System," Global Transitions Proceedings, 12-Aug-2021. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S2666285X2100090X. [Accessed: 22-May-2022].
11. V. Madhavireddy and B. Koteswarrao, "Smart Water Quality Monitoring System using IOT technology," International Journal of Engineering & Technology, vol. 7, no. 4.36, p. 636, 2018.
12. S. Binti Zahir, P. Ehkan, T. Sabapathy, M. Jusoh, M. Nasrun Osman, M. Najib Yasin, Y. Abdul Wahab, N. A. M. Hambali, N. Ali, A. S. Bakhit, F. Husin, M. K. M. Kamil, and R. Jamaludin, "Smart Iot Flood Monitoring System," Journal of Physics: Conference Series, vol. 1339, no. 1, p. 012043, 2019.
13. A. H. Almawgani, M. A. Alshorman, M. A. Alyami, H. M. Alhmammi, D. S. Almahri, M. A. Alkhuraym, and A. H. Alwasel, "Smart Monitoring System of najran dam," International Journal of Electrical and Computer Engineering (IJECE), vol. 10, no. 4, p. 3999, 2020.
14. S. Pasika and S. T. Gandla, "Smart water quality monitoring system with cost-effective using IOT," Heliyon, vol. 6, no. 7, 2020.

15. D. Satria, S. Yana, R. Munadi, S. Syahreza, and Munawir, “Implementation of GSM based flood data communication in the Flood Disaster Location Information System,” IOP Conference Series: Materials Science and Engineering, vol. 506, p. 012046, 2019.
16. N. Muhd Zain, L. S. Elias, Z. Paidi, and M. Othman, “Flood warning and Monitoring System (FWMS) using GSM technology,” Journal of Computing Research and Innovation, vol. 5, no. 1, pp. 7–18, 2020.
17. E. Šarak, M. Dobrojević, and S. Sedmak, “IOT based early warning system for torrential floods,” FME Transactions, vol. 48, no. 3, pp. 511–515, 2020.
18. M. Roy, P. Pradhan, J. George, and N. Pradhan, “Flood detection and water monitoring system using IOT,” International Journal of Engineering and Computer Science, vol. 9, no. 07, pp. 25113–25115, 2020.
19. M. I. Hadi, F. Yakub, A. Fakhrurradzi, C. X. Hui, A. Najiha, N. A. Fakharulrazi, A. N. Harun, Z. A. Rahim, and A. Azizan, “Designing early warning flood detection and monitoring system via IOT,” IOP Conference Series: Earth and Environmental Science, vol. 479, no. 1, p. 012016, 2020.
20. W. H. Wan Hassan, A. Z. Jidin, S. A. Aziz, and N. Rahim, “Flood disaster indicator of Water Level Monitoring System,” International Journal of Electrical and Computer Engineering (IJECE), vol. 9, no. 3, p. 1694, 2019.
21. S. Gokulanathan, P. Manivasagam, N. Prabu, and T. Venkatesh, “GSM based water quality monitoring system using Arduino,” Shanlax International Journal of Arts, Science and Humanities, vol. 6, no. 4, pp. 22–26, 2019.
22. S. Geetha and S. Gouthami, “Internet of things enabled Real Time Water Quality Monitoring System,” Smart Water, vol. 2, no. 1, 2016.
23. N. Azlan Othman, N. Salwa Damanhuri, M. A. Syafiq Mazalan, S. Addayani Shamsuddin, M. Hussaini Abbas, and B. C. Chiew Meng, “Automated Water Quality

Monitoring System development via labview for aquaculture industry (tilapia) in Malaysia," Indonesian Journal of Electrical Engineering and Computer Science, vol. 20, no. 2, p. 805, 2020.

24. S. Pokhrel, A. Pant, R. Gautam, and D. B. Kshatri, "Water Quality Monitoring System using IOT," Journal of Innovations in Engineering Education, vol. 3, no. 1, pp. 155–164, 2020.
25. Y. Adityas, M. Ahmad, M. Khamim, K. Sofi, and S. R. Riady, "Water quality monitoring system with parameter of ph, temperature, turbidity, and salinity based on internet of things," JISA(Jurnal Informatika dan Sains), vol. 4, no. 2, pp. 138–143, 2021.
26. E. A. Chouwanto, R. Wongso, and V. Yesmaya, "Smart Monitoring System and early warning water level —SMOORTY| using Raspberry Pi Technology," International Journal of Emerging Technology and Advanced Engineering, vol. 11, no. 12, pp. 171–176, 2021.
27. P. author B. C. Interest, Mannaiasays: C. Interestsays: G. Careysays: N. Gsays: Lerkerosays: S. McNeilsays: Is sparkling water bad for your teeth? Dentists weigh in #FitFamsays: How Do Plant Roots Grow? The Answer Might Rely On A Chemical Dye - Eco Save Earthsays: Making a Red Cabbage pH Indicator The Method and the Chemistry | SciTech Connectsays: S. W. and T. Erosion, and S. W. – 20/20 Dentistrysays: "Acids, alkalis, and the ph scale," Compound Interest, 18-Oct-2015. [Online]. Available: https://www.compoundchem.com/2015/07/09/ph-scale/. [Accessed: 09-Jun-2022].

APPENDIX I

A Coding of Smart Water Quality & Flood Monitoring System Using Microcontroller and Cloud Server

```
#define BLYNK_TEMPLATE_ID "TMPLaHmZGEjl"
#define BLYNK_DEVICE_NAME "FLOOD AND WATER QUALITY MONITORING"
#define BLYNK_AUTH_TOKEN "D5f7kx6MxUPHTY4n-RL6gnRGJ2ntiVxr"

 #define BLYNK_PRINT Serial

 #include <Wire.h>
 #include <ESP8266WiFi.h>
 #include <BlynkSimpleEsp8266.h>

 #define TRIGGERPIN D6
 #define ECHOPIN  D7
 #define turbiditysensor A0

int sensorValue = 0;

 char auth[] = "D5f7kx6MxUPHTY4n-RL6gnRGJ2ntiVxr";
 char ssid[] = "AstraZeneca_5G";
 char pass[] = "asampaighurufbesar";

 void setup()
 {
  Serial.begin(9600);
  pinMode(TRIGGERPIN, OUTPUT);
  pinMode(ECHOPIN, INPUT);
  pinMode(turbiditysensor,OUTPUT);
  Blynk.begin(auth, ssid, pass);

 }
 void loop()
{
 ultrasonic();
 turbidity();
 Blynk.run();
}

 void ultrasonic()
 {
  long duration, distance, height;
  digitalWrite(TRIGGERPIN, LOW);
  delayMicroseconds(3);
  digitalWrite(TRIGGERPIN, HIGH);
  delayMicroseconds(12);
  digitalWrite(TRIGGERPIN, LOW);
  duration = pulseIn(ECHOPIN, HIGH);
```

```
 distance = (duration/2) / 29.1;
 height = 27 - distance;
 Serial.print(height);
 Serial.println("Cm");
 Blynk.virtualWrite(V5, height);

 if (height <= 10)
 {
 Blynk.virtualWrite(V0,0); //high
 Blynk.virtualWrite(V1,0); //medium
 Blynk.virtualWrite(V2,255); //low
 Blynk.logEvent("waterlow","Water level is LOW");
 }
 else if (height <= 20 && height > 10 )
{
 Blynk.virtualWrite(V0,0); //high
 Blynk.virtualWrite(V1,255); //medium
 Blynk.virtualWrite(V2,0); //low
 Blynk.logEvent("watermedium","Water level is MEDIUM");
 }
 else
 {
 Blynk.virtualWrite(V0,255); //high
 Blynk.virtualWrite(V1,0); //medium
 Blynk.virtualWrite(V2,0); //low
 Blynk.logEvent("waterhigh","Water level is HIGH");
 delay(1000);
}
}
void turbidity()
{
 sensorValue = analogRead(turbiditysensor);
 int turbidity = map(sensorValue, 0, 750, 100, 0);
 delay(100);
 Serial.println(turbidity);
 Blynk.virtualWrite(V6, turbidity);

 if (turbidity <= 45)
 {
 Blynk.virtualWrite(V9,0); //Risk
 Blynk.virtualWrite(V8,0); //Moderate
 Blynk.virtualWrite(V7,255); //Safe
 Blynk.logEvent("clear_water_quality","Water quality is CLEAR");
 }
 else if (turbidity <= 55 && turbidity > 45 )
{
 Blynk.virtualWrite(V9,0); //Risk
 Blynk.virtualWrite(V8,255); //Moderate
 Blynk.virtualWrite(V7,0); //Safe
 Blynk.logEvent("moderate_water_quality","Water quality is MODERATE");
 }
```

```
  else
  {
  Blynk.virtualWrite(V9,255); //Risk
  Blynk.virtualWrite(V8,0); //Moderate
  Blynk.virtualWrite(V7,0); //Safe
  Blynk.logEvent("cloudy_water_quality","Water quality is CLOUDY");
  delay(500);
}
}
```

APPENDIX II

A Gantt Chart of PSM 2

27/01/2023

	week 1	week 2	week 3	week 4	week 5	week 6	week 7	week 8	week 9	week 10	week 11	week 12	week 13	week 14
Buying component														
Writing Logbook														
Research coding for Ultrasonic Sensor and Turbidity Sensor														
Writing coding of Ultrasonic Sensor														
Writing coding for Turbidity sensor														
Troubleshoot circuit														
Building prototype														
Writing the report for Chapter 3														
Writing the report for Chapter 4														
Writing the report for Chapter 5														
Sending Draft Report														
PSM 2 Presentation														