Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT FLASH FLOOD DETECTION BASED ON IOT

MOHAMAD FARHAN ADZRI BIN MAZMAN

Bachelor of Electrical Engineering Technology (Industrial Power) with Honours

2021

DEVELOPMENT FLASH FLOOD DETECTION BASED ON IOT

MOHAMAD FARHAN ADZRI BIN MAZMAN

A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Electronics Engineering Technology with Honours

Faculty of Electrical and Electronic Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2021

UNIVERSITI TEKNIKAL MALAYSIA MELAKA
FAKULTI TEKNOLOGI KEJUTERAAN ELEKTRIK DAN ELEKTRONIK

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek : Development Flash Flood Detection Based on IOT

Sesi Pengajian : 2021/2022

Saya MOHAMAD FARHAN ADZRI mengaku membenarkan laporan Projek Sarjana Muda ini disimpan di Perpustakaan dengan syarat-syarat kegunaan seperti berikut:

1. Laporan adalah hakmilik Universiti Teknikal Malaysia Melaka.
2. Perpustakaan dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan dibenarkan membuat salinan laporan ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. Sila tandakan (✓):

☐	**SULIT***	(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)
☐	**TERHAD***	(Mengandungi maklumat terhad yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)
☑	**TIDAK TERHAD**	

Disahkan oleh:

(TANDATANGAN PENULIS)
Alamat Tetap: N0 11 Jalan Langsat 10 Taman Sri Medan Jaya, 42500 Telok Panglima Garang, Selangor Darul Ehsan

(COP DAN TANDATANGAN PENYELIA)

NURBAHIRAH BINTI NORDDIN
Pensyarah
Jabatan Teknologi Kejuruteraan Elektrik
Fakulti Teknologi Kejuruteraan
Elektrik dan Elektronik
Universiti Teknikal Malaysia Melaka

Tarikh: 9 JANUARI 2022

Tarikh: 9 JANUARI 2022

*CATATAN: Jika laporan ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali tempoh laporan ini perlu dikelaskan sebagai SULIT atau TERHAD.

DECLARATION

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

Signature :

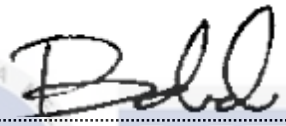
Student Name : MOHAMAD FARHAN ADZRI BIN MAZMAN

Date : 9 JANUARI 2022

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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 Electrical Engineering Technology (Industrial Power) with Honours.

Signature : 

Supervisor Name : NURBAHIRAH BINTI NORDDIN

Date : 9 JANUARI 2022

Signature :

Co-Supervisor :

Name (if any)

Date :

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEDICATION

To my father Mazman Bin Mansor and to my mother Haryani Binti Mat Sahid. Thank you for your trust and support you give to me. All my hardwork and my struggle I do for both of you. Thank you to mu classmate for help me to finish the project and finally for my housemate thank you for your concern, encouragement, knowledge sharing and understanding.

UTeM
اونيۏرسيتي تيکنيکل مليسيا ملاک
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

ABSTRACT

Flood is a natural phenomenon, and it is one of the largest natural disasters often occurring worldwide and can cause a negative impact towards the society. The flood may happen without warning and the after effect can causes significant harm to the surrounding ecosystem and put citizen lives in danger. Therefore. “Flash Flood Detection Based on IOT” is proposed to reduce the damage and risk caused by the flood. The aim for this project is give the users information of current water level in a drain. A warning notification sentto the users indicating three types of water level which are safe, warning and danger. The flood detection based on IOT includes an ultrasonic sensor that detects the current water level while also allowing users to view the duration of the water level from their phone and makingthem more aware of when flooding is likely to occur. This system can provide plenty of time to prepare against predicted flood occurrence and they can be rescued from the aftermath of a flood catastrophe.

.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

ABSTRAK

Banjir adalah fenomena semula jadi dan merupakan salah satu bencana alam terbesar yang sering berlaku di seluruh dunia dan boleh memberi kesan negatif kepada masyarakat. Bencana banjir boleh berlaku tanpa amaran dan akibatnya boleh menyebabkan bahaya besarterhadap ekosistem sekitarnya dan membahayakan nyawa penduduk setempat. Oleh itu. "Pengesanan Banjir Kilat Berdasarkan IOT" diusulkan untuk mengurangi kerosakan dan risiko yang disebabkan oleh banjir. Tujuan projek ini adalah memberi maklumat kepada pengguna mengenai tahap air semasa di longkang. Pemberitahuan amaran akan dikirimkan kepada pengguna yang menunjukkan tiga jenis permukaan air yang aman, amaran dan bahaya. Pengesanan banjir berdasarkan iot merangkumi sensor ultrasonik yang mengesan paras air semasa dan juga membolehkan pengguna melihat jangka masa paras air dari telefon mereka dan membuat mereka lebih mengetahui bila banjir kemungkinan akan berlaku. Sistem ini akan menyediakan banyak masa untuk bersiap sedia menghadapi kejadian banjir yang diramalkan dan mereka dapat diselamatkan dari bencana banjir selepas kejadian

اونيۏرسيتي تيکنيکل مليسيا ملاک
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

ACKNOWLEDGEMENTS

First and foremost, I would like to express my gratitude to my supervisor, Nurbahirah Binti Norddin for their precious guidance, words of wisdom and patient throughout this project.

My highest appreciation goes to my father, Mazman Bin Mansor and my mother, Haryani Binti Mat Sahid for their love, support, encouragement, and prayer during the period of my study.

Throughout my university studies, I am grateful to my friend such Nur Qamarina Binti Sulaini, Nursyafikah binti Kamaruddin my housemate for their help and moral support, knowledge, sharing, and encouragement. Thank you once again for your friendship and memories.

Finally, I would like to thank all who have helped and contributed to our study endeavours in whether way, your generosity means a lot to me and will never be forgotten. Thank you so much for everything.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

TABLE OF CONTENTS

PAGE

DECLARATION

APPROVAL

DEDICATIONS

ABSTRACT **i**

ABSTRAK **ii**

ACKNOWLEDGEMENTS **iii**

TABLE OF CONTENTS **iv**

LIST OF TABLES **vi**

LIST OF FIGURES **vii**

LIST OF SYMBOLS **viii**

LIST OF ABBREVIATIONS **ix**

LIST OF APPENDICES **x**

CHAPTER 1 INTRODUCTION **1**
1.1 Background 1
1.2 Problem Statement 2
1.3 Project Objective 3
1.4 Scope of Project 3

CHAPTER 2 LITERATURE REVIEW **4**
2.1 What is flooding 4
2.2 Type of flooding 5
2.2.1 Flash Flooding 5
2.2.2 River Flooding 6
2.3 Review Paper on IOT Based Flood Prediction Model 7
2.4 Flood Warning and Monitoring System Utilizing Internet of Things Technology 8
2.5 Design of Early Warning Flood Detection System 10
2.6 Real Time WSN Based Early Flood Detection and Control Monitoring System 11
2.7 The Implementation of an IOT-Based Flood Alert System 12
2.8 Smart IOT Flood Monitoring System 13
2.9 Flood Detection and Avoidance Using IOT 14
2.10 Flood Monitoring and Early Warning System Using Ultrasonic Sensor 15

CHAPTER 3 METHODOLOGY **16**
3.1 Introduction 16
3.2 Flowchart for Project Methdology 16

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

3.3 Process Block Diagram 18
3.4 Project Flowchart 19
3.5 Equipment 20
3.6 Arduino Uno (ATMEGA UNO 328) 20
3.7 Sensor 21
3.7.1 Ultrasonic Sensor 21
3.7.2 Temperature Sensor (DHT 11) 22
3.7.3 Water Flow Sensor 23
3.7.4 Rain Sensor 23
3.8 ESP 8266 24
3.9 LCD 25
3.10 Simulation Proteus 26
3.11 Project Design 27
3.12 Coding of The Project 28
3.13 Gant Chart for PSM 1 31
3.14 Gant Chart for PSM 2 32
3.15 Summary 33

CHAPTER 4 RESULTS AND DISCUSSIONS 34
4.1 Introduction 34
4.2 Sensor Testing 34
4.2.1 Measurement of Ultrasonic Sensor 34
4.2.2 Water Level Via Ultrasonic Sensor 35
4.3 Result and Analysis 37
4.3.1 Temperature via Temperature Sensor 39
4.3.2 Result 40
4.3.3 Water Flow Sensor Testing 42
4.4 Summary 43

CHAPTER 5 CONCLUSION AND RECOMMENDATIONS 44
5.1 Conclusion 44
5.2 Future Works 44

REFERENCES 45

APPENDICES 47

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

LIST OF TABLES

TABLE	TITLE	PAGE
Table 3.1	Arduino-Uno Specification	21
Table 4.1	Measurement of ultrasonic sensor	34
Table 4.2	Water level sensor testing for 20cm	36
Table 4.3	Water level sensor testing for 10cm	37
Table 4.4	Temperature testing	40

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

LIST OF FIGURES

FIGURE	TITLE	PAGE
2.1	Flood Effect in Kuala Lumpur, Malaysia	4
2.2	How Flash Flood Occur	5
2.3	How River Flood Occur	6
2.4	Blynk IOT Based Architecture	8
2.5	Schematic Diagram	9
2.6	Block Diagram of System	10
2.7	Block Diagram of System	11
2.8	Flood Alarm System Design	12
2.9	Flowchart Of the System	13
2.10	General architecture flow diagram of the model	15
3.1	Flowchart	17
3.2	Block Diagram	18
3.3	Process Flowchart Project	19
3.4	Arduino Uno	20
3.5	Ultrasonic Sensor	22
3.6	Humidity Sensor	22
3.7	Water Flow Sensor	23
3.8	Rain sensor	24
3.9	ESP 8266	25
3.10	LCD	25
3.11	Simulation in proteus	26
3.12	Project Design Prototype	27
3.13	Gant Chart PSM 1	31
3.14	Gant chart PSM 2	32
4.1	Ultrasonic sensor with water surface	36
4.2	Test on different level of water	36
4.3	Graph analysis for 20 cm	38
4.4	Graph analysis for 10 cm	39
4.5	Weather forecast by google	40
4.6	Graph analysis for temperature	41
4.7	Water flow sensor testing	42
4.8	LCD display water flow result	43

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

LIST OF SYMBOLS

V	-	Voltage
℃	-	Celsius
%	-	Percentage

UTeM
اونيۏرسيتي تيکنيکل مليسيا ملاک
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

LIST OF ABBREVIATIONS

LCD	-	Voltage
IOT	-	Internet of Things
WSN	-	Wireless Sensor Network
V	-	Voltage
HZ	-	Hertz
Wi-Fi	-	Wireless Fidelity

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

LIST OF APPENDICES

APPENDIX	TITLE	PAGE
Appendix A	Gant Chart PSM 1	31
Appendix B	Gant Chart PSM 2	32

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

CHAPTER 1

INTRODUCTION

1.1 Background

In Malaysia flooding is natural disaster that occurs every year. A flood occurs when a water overflows terrain which is usually dry. There are several kinds of floods such as river floods, urban floods, flash floods and pluvial floods.

Flood disasters can be large-scale and strong enough to cause significant damage in specific areas. The loss is important in terms of human lives lost, assets and food supply disruption, and government infrastructure destruction.

There are two types can be classified for monitoring and alerting flood, which are local sensing data and remote sensing data. The flood parameters are measured through the installation of sensor nodes along the river on local sensing data meanwhile for the satellite generally uses remote sensing data to estimate the rain information and capture the cloud image.

Water level inspection in rivers, temperature and water velocity in certain location are extremely crucial to proving whether the flood will occur due the degree of cloud formation will change from time to time simply depending on how powerful the wind is.

This project is design to monitoring system for river that use local sensing data via microcontroller system for monitoring and the system also can measure various flood parameters such as temperature, water level and water velocity. The user receives an alert.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

when the reading of the when one or more parameters reach the threshold values, it indicates a hazardous flood situation.

1.2 Problem Statement

In 1926 the heaviest flood occurred at Perak. This phenomenon known as “Bah Besar”. The flood affecting Sungai Perak, Sungai Kinta, and Sungai Batang Padang. The government has set up a temporary housing and disaster relief movement to help all the victims.

Majority of the flood victims are not fully aware of the upcoming flood calamity because in Perak does not have a flood monitoring and warning system. In certain situation, the authority has warned to the victims, but due the lack of information, the time flood begins and fully flooded, and the victims ignore the information.

In Malaysia, the flood monitoring system uses a telemetry system that continuously monitor water level measurement and uploads them to a specific web page. This procedure needs Internet connection to upload the values and not suitable for Malaysiadue to expensive cost.

Flood monitoring and alert system is an affordable design and able to measure manycharacteristics of the flood such as water velocity, temperature in real time and water level. Furthermore, this project will predict the flood calamity and give an alert to the user.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

1.3 Project Objective

The aim of this research is to propose a systematic and effective methodology of the development research for Flash flood based on iot. The main objectives are as follows:

a) To obtain the flooding data parameters such as water level, temperature, and rainfall

b) To construct flash flood prototype

c) To analyze the performance of the built system

1.4 Scope of Project

The scope of this project are as follows:

a) Accuracy of temperature and water level to detect flood

b) This project is focusing on developing Internet of Things (IOT) by using Blynk and Arduino Uno

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

CHAPTER 2

LITERATURE REVIEW

2.1 What is flooding?

Flooding occurs when water from a river or rain floods a wide area of land. Flood is also known as a temporary rise of the water level as in a lake or river or along seacoast. As a result, it spills over and out of its natural or artificial boundaries onto usually dry land.In Malaysia, flooding is normal phenomena happen every year. It usually happens exposed to the river and in low surface area. It may happen in cities or metropolitan areas such as Kuala Lumpur, Pulau Pinang and Johor Bharu because of the inadequate drainage system that cannot handle the excessive rainwater. Figure 2.1 show floods happened in Kuala Lumpur, Malaysia.

Figure 2.1: Flood Effect in Kuala Lumpur, Malaysia

2.2 Type of Flooding

There are several types of floods that can be occurs in our country Malaysia suchas flash flooding, river flooding, urban flooding, and pluvial flooding. This flood disaster can cause a lot of property destruction which can cause a lot of losses occur.

2.2.1 Flash Flooding

In flash flood can happen in minutes or an hour because of heavy rain, a sudden release of water previously held by ice or a dam or levee failure. A huge debris can be carried by flash flood which can destroy the bridges and building, mud slide, trigger catastrophic and scrape out new channels. Slow-moving thunderstorms, heavy rainfall from hurricanes or thunderstorms repeatedly moving over the same location and other topical are the most common causes of flash flooding. This figure 2.2 show flash flood occur.(R.S.Davis, 2001)

Figure 2.2: How Flash Flood Occurs

.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2.2.2 River Flooding

Flooding is a common occurrence in our world. The usually occurs when the river's catchment receives more water than normal. The river cannot handle the extra waterin its river and causes the river's water level to rise and the water to flow out of streams, resulting in a flood. This flooding could occur anywhere along the river's course and not just where the extra water has entered. (S.A.Bande, 2017)

Furthermore, floods happen when soil becomes saturated and its capacity for infiltration is zero. Runoffs are unable to be contained in stream channels, constructed. reservoirs, natural ponds, and the land surface is submerged, washing away all its content. Periodic floods, resulting during heavy rains, happened naturally mostly river, and forming an area known as flood plain. River floods often cause rivers to overflow their banks, often with tremendous velocity and devastation. (Ezemonve, 2011)

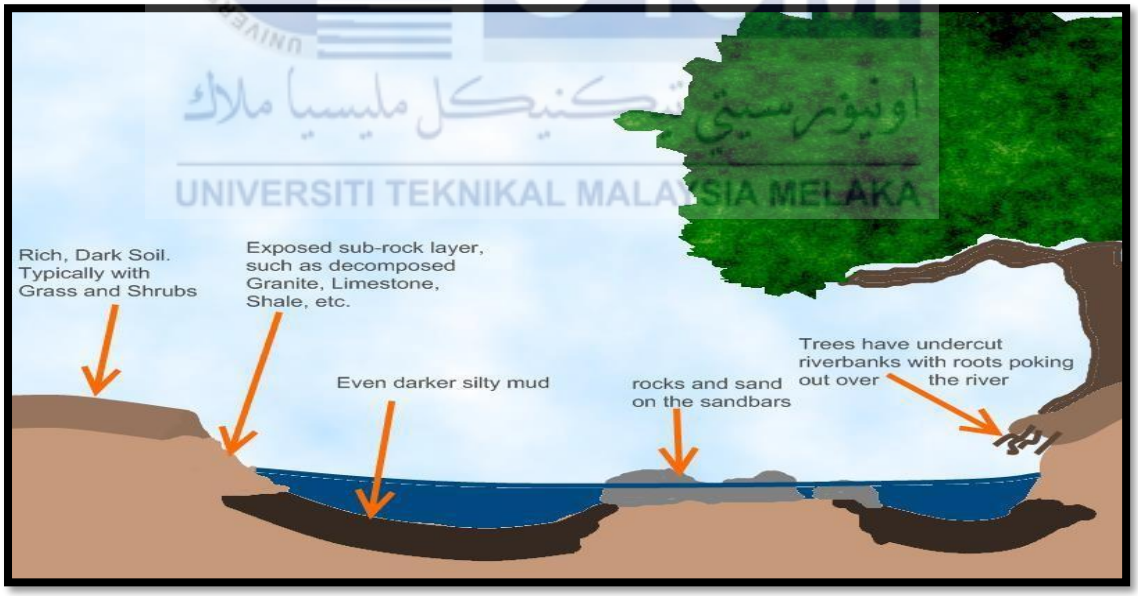


Figure 2.3: How River Flood Occurs

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2.3 Review Paper on IOT Based Flood Prediction Model

A Natural can causes damage of property and even worse can cause loss of life. Floods are one of the most common natural disasters can many significant damages to life such as infrastructure, economy, and agriculture. This project use IOT and machine learning based embedded system is to measure different atmospheric conditions and to predict the weather information such as pressure, temperature, humidity, wind speed and direction and rainfall. Next, they also analyzing the trend of climate change to predict the upcoming natural disaster. The method that has been proposed is use a mesh network linkover ZigBee for the WSN to collect data and a Wi-Fi module to transmit the data over theinternet while using very little power. Using a cloud database, data sets from a variety of sensors are recorded and tracked. To forecast various weather events and predict future disasters, data was processed using an artificial neural network model. Wireless sensor network-based environmental monitoring systems have been found to be cost effective, compact, and extremely dependable, but the weakness of this system it cannot use for the large area because typically, each node is powered by an energy-limited battery. (S.A.Bande, 2017)

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2.4 Flood Warning and Monitoring System Utilizing Internet of Things Technology

This project is to build wireless sensor node at high susceptibility area by developsan early warning and flood monitoring system in real time. Node MCU based technology integrated is the base of the system and they use Blynk application. The function of wireless sensor node is detecting the water level and rain intensity, when there is an inundation or severe rain, an early warning is given. Node MCU as the microcontroller of the system control rain sensor and ultrasonic sensor. Node MCU will put in the flood zone that has been identified. The buzzer and LED will be started to trigger and alert the victimwhen the flood had reached a certain level of danger.

Figure 2.4: Blynk IOT Based Architecture

The sensor will detect the data and transmitted to the Blynk application via wireless connection. Blynk application via IOS or android smartphone can access the interface and receiving a push notification, so the victim knows the current situation with theflood and rain. The flood level data transmitted by email may be useful to a variety of organizations for system development and flood forecasting. (Mohamad Syafiq Mohd Sabre, Shahrum Shah Abdullah, & Amirul Faruq, 2019)