



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**DEVELOPMENT OF REAL-TIME FLASH FLOOD ALERT
SYSTEM IN SHOPPING MALL PARKING LOT**

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electrical and Electronic Engineering Technology (Telecommunication) with Honours.

by

SUAIDAH BINTI SHUHAIMI

B071610345

941109146914

**FACULTY OF ELECTRICAL AND ELECTRONIC ENGINEERING
TECHNOLOGY**

2019

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

Tajuk: DEVELOPMENT OF REAL-TIME FLASH FLOOD ALERT SYSTEM IN SHOPPING MALL PARKING LOT

Sesi Pengajian: 2019

Saya **Suaidah Binti Shuhaimi** mengaku membenarkan Laporan PSM ini disimpan di Perpustakaan Universiti Teknikal Malaysia Melaka (UTeM) dengan syarat-syarat kegunaan seperti berikut:

1. Laporan PSM adalah hak milik Universiti Teknikal Malaysia Melaka dan penulis.
2. Perpustakaan Universiti Teknikal Malaysia Melaka dibenarkan membuat salinan untuk tujuan pengajian sahaja dengan izin penulis.
3. Perpustakaan dibenarkan membuat salinan laporan PSM ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. **Sila tandakan (X)

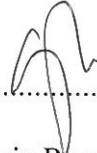
SULIT* Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia sebagaimana yang termaktub dalam AKTA RAHSIA RASMI 1972

TERHAD* Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan.

TIDAK TERHAD

Yang benar,

Disahkan oleh penyelia:



Suaidah Binti Shuhaimi

Ts. Gloria Raymond Tanny

Alamat Tetap:

Cop Rasmi Penyelia

No 31 Jalan Mulia 4/2,

GLORIA RAYMOND TANNY
Jurutera Pengajar
Jabatan Teknologi Kejuruteraan
Elektronik dan Komputer
Fakulti Teknologi Kejuruteraan
Elektrik dan Elektronik
Universiti Teknikal Malaysia Melaka

Taman Mulia Jaya 68000,

Ampang Selangor Darul Ehsan

Tarikh: 13 JANUARI 2020

Tarikh: 13/01/2020

*Jika Laporan PSM ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali sebab dan tempoh laporan PSM ini perlu dikelaskan sebagai SULIT

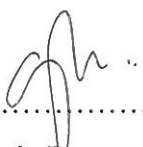
DECLARATION

I hereby, declared this report entitled DEVELOPMENT OF REAL-TIME FLASH FLOOD ALERT SYSTEM IN SHOPPING MALL PARKING LOT is the results of my own research except as cited in references.

Signature:
Author : Suaidah Binti Shuhaimi
Date: 13 JANUARI 2020

APPROVAL

This report is submitted to the Faculty of Electric and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electrical and Electronic Engineering Technology (Telecommunication) with Honours. The member of the supervisory is as follow:

Signature: 

Supervisor: Ts.Gloria Raymond Tanny

Signature:

Co-supervisor: Puan Rosziana Binti Hashim

ABSTRAK

This project entitles Real-Time Flash Flood Alert System in Shopping Mall Parking Lots with IoT. Flash flood is a regular natural disaster which happens during the monsoon season. Flood disasters have a bad effect on all living things. The effect from flood disasters is damage to property, destruction of plants, and the condition of the flood victims. Since this is a hazardous disaster, it requires an efficient warning system to communicate to the public on an early stage so that preparatory measures will face flooding as well as security can be taken to prevent any accidents happened. The frequent area occurrence flash flood such as in Kuala Lumpur is a target for this project. The design goal of this project is to provide an improvement of the safety for users at shopping mall when occurs of flash flooding at parking lots. Next, the real-time system is used in this project are capable of monitoring sudden floods in parking lots, then it also to avoiding water damage inside the vehicle; personal alert to the user through their mobile phone. This project is controlled by Arduino Uno R3 ATmega and PushBullet application to send data measured via Short Message Service (SMS) to the users have registered the phone numbers into the system. Besides, this system is capable to envision the timing before flash flood and detect a maximum water level at 1.5 centimeters height. The Real-Time Flash Flood Alert System in Shopping Mall Parking Lots with IoT is based on Arduino Uno as microcontroller and the measurement of the water level is processed by water level sensor.

ABSTRACT

Projek ini bertajuk Sistem Peringatan Banjir Kilat Masa Nyata di Tempat Letak Kereta di Pusat Beli-belah dengan aplikasi IoT. Banjir adalah bencana alam semula jadi yang berlaku semasa musim tengkujuh dan mempunyai banyak kesan buruk terhadap pelbagai keadaan. Kesan daripada bencana banjir ialah kerosakan harta benda, kemusnahan tumbuh-tumbuhan, dan mangsa banjir. Bencana ini ialah benca yang berbahaya, ia memerlukan sistem amaran yang cekap untuk berkomunikasi dengan orang awam pada peringkat awal supaya langkah-langkah persediaan menghadapi banjir serta keselamatan boleh diambil untuk mengelakkan sebarang kemalangan atau kemusnahan yang berlaku. Kejadian banjir kilat sering berlaku di Pusat Bandaraya Kuala Lumpur oleh kerana itu sasaran projek ini tertumpu kepada kawasan sekitar dan berhampiran dengan Pusat Bandaraya Kuala Lumpur. Matlamat projek ini adalah untuk meningkatkan keselamatan pengguna di pusat membeli-belah ketika terjadinya banjir kilat di tempat parkir kereta. Seterusnya, sistem masa nyata yang digunakan di dalam projek ini mampu mengawasi banjir dan mampu untuk mengelakkan kerosakan kederaan dengan menghantar amaran peribadi kepada pengguna melalui telefon bimbit. Projek ini dikawal oleh Arduino Uno dan aplikasi PushBullet yang di gunakan untuk menghantar data yang diambil melalui Sistem Pesanan Ringkas kepada pengguna. Selain itu, sistem ini memberi peringatan kepada pengguna apabila mengesan paras air pada ketinggian maksima 1.5 sentimeter. Sistem Amaran Banjir Kilat Masa Nyata di Tempat Letak Kereta Pusat Beli-belah dengan aplikasi IoT ialah sebuah projek yang berdasarkan Arduino Uno sebagai mikrokontroler dan pengukuran paras air diproses oleh pengukur automatik paras air.

DEDICATION

I dedicated this project to my beloved parents who have always been my nearest and educated me to reach this level. I am also wanted to say a thank you to my Supervisor who always surrounded me with positive, Co-supervisor, and all my housemates who have encouraged, guided, motivates me to complete this research.

ACKNOWLEDGEMENTS

Syukur and Alhamdulillah to Allah S.W.T because giving me this opportunity to complete my Projek Sarjana Muda (PSM). This report is thankfulness to Universiti Teknikal Malaysia Melaka (UTeM) for giving me this chance to study on Bachelors of Electronics Engineering Technology (Telecommunication) with Honours in Faculty of Electrical Electronic Engineering Technology (FTKKEE). I would like to thank you, my Supervisor, Ts. Gloria Raymond Tanny for the guidance, advice, attention given in the development of my final year project and while writing this report entitled as a Development of Real-Time Flash Flood Alert System in Shopping Mall Parking Lot. My thankfulness goes to my beloved family and my friends that always give courage and support me to achieve the goal of my research. Thanks to their moral support and care they had given to me up until this project are done. Finally, I would also to say thank you to my Co-Supervisor, Puan Rosziana Binti Hashim who also involved directly or indirectly in helping me complete this project.

TABLE OF CONTENTS

	PAGE
ABSTRAK	v
ABSTRAK	vi
DEDICATION	vii
ACKNOWLEDGEMENTS	ix
LIST OF TABLES	xiv
LIST OF FIGURES	xv - xvi
LIST OF APPENDICES	xvii
LIST OF SYMBOLS	xviii
LIST OF ABBREVIATIONS	xix
CHAPTER 1 : INTRODUCTION	
1.1 Background	1 - 2
1.2 Problem Statement	2 - 4
1.3 Objective	4
1.4 Project Scope	4 - 5
CHAPTER 2 : LITERATURE REVIEW	
2.1 Background	6
2.2 Post Related Research	7
2.2.1 Early Flood Alerts Using Short Message Service (SMS)	7 - 8

2.2.2 A Novel Approach for Early Flood Warning Using Android and IoT	8 -10
2.2.3 Shonabondhu: A Cloud Based System to Handle Flash Flood	10 - 11
2.2.4 A Simple Flood Forecasting Scheme Using Wireless Sensor Networks	12 - 13
2.3 Material	13
2.3.1 Microcontroller	13
2.3.1.1 Arduino Uno Micro Controller Unit (MCU)	13
2.3.1.2 Arduino Mega	14
2.3.1.3 PIC18F452	15
2.3.2 Wireless	15
2.3.2.1 Digi XBee	15
2.3.2.2 ZigBee	16
2.3.2.3 ESP8266 Wi-Fi Module	16
2.3.3 Sensor	16 - 17
2.3.3.1 Ultrasonic Sensor	17
2.3.3.2 Milone eTAPE Continuous Fluid Level Sensor PN 12110215TC-12	18 - 19
2.3.4 SIM900A GSM Module	19 - 21
2.3.5 The Internet of Things (IoT)	22 - 23
2.3.5.1 ThingSpeak	23 - 24
2.3.5.2 Blynk Application	24 - 25

CHAPTER 3 : METHODOLOGY

3.1 Introduction	26
3.2 Project Process	26
3.3 Flow of the Project	26 - 27
3.4 Flow of the System	27 - 28
3.5 System Implementation	28 - 29
3.6 Software Implementation	29
3.7 Hardware Implementation	29 - 30
3.8 Hardware Component	30
3.8.1 Arduino Uno R3 ATmega	31
3.8.2 NodeMCU Wi-Fi Module	32 - 33
3.8.3 Arduino Water Level Sensor	34 - 35
3.8.4 Infrared Sensor Module	35 - 36
3.9 Software Development	37
3.9.1 ThingSpeak	37
3.9.2 Arduino IDE Compiler	38 - 39
3.9.3 PushBullet Application	39 - 41

CHAPTER 4 : RESULT AND DISCUSSION

4.1 Introduction	42
4.2 Analysis Data	42 - 49
4.3 Result	50
4.3.1 Software Part	50
4.3.2 Hardware Part	51

CHAPTER 5 : CONCLUSION AND RECOMMANDATION	54
5.1 Introduction	54
5.2 Conclusion	55 - 56
5.3 Recommendation for Future Work	56
REFERENCES	57 - 58
APPENDIX	59
Appendix 1 : Gantt Chart PSM 1	59
Appendix 2 : Gantt Chart PSM II	60

LIST OF TABLES

TABLE	TITLE	PAGE
Table 2.3.1.2	Difference between Arduino Uno and Arduino Mega	14
Table 2.3.3.1	Ultrasonic Sensor Pin Configuration	18
Table 4.2.1	Time taken for water level sensor to detect level of water	43
Table 4.2.2	Distance measure of Car at 1 centimeter and 2 centimeters	45
Table 4.2.3	Real- Time ThingSpeak to generate data through Wi-Fi module at different Level of water	46
Table 4.2.4	LED (Car) at 1 centimeter vs Notification message PushBulltet application	48
Table 4.2.5	Notification message and data generate between ThingSpeak website and PushBullet application	49

LIST OF FIGURES

FIGURE	TITLE	PAGE
Figure 2.2.2	Propose System Block Diagram	10
Figure 2.2.3	Shonabondhu System Architecture	11
Figure 2.2.4	Process Flowchart	12
Figure 2.3.3.1	Comparison specification of Ultrasonic Sensor HC SR04 and Ultrasonic Parallax Ping Sensor 28015	17
Figure 2.3.3.2 (a)	Milone eTape Continuous Fluid Level sensor PN 12110215tc-12	19
Figure 2.3.3.2 (b)	Diagram of Connection and Installation	19
Figure 2.3.4 (a)	SIM900A GSM Module	20
Figure 2.3.4 (b)	SIM900A GSM Module Pinout	21
Figure 2.3.4 (c)	Connection between Arduino and GSM Module	21
Figure 2.3.5	System architecture of the IoT system	23
Figure 2.3.5.1	Flow of IoT system	23
Figure 2.3.5.2	Interface of Blynk App	25
Figure 3.4	Flowchart of the project	28
Figure 3.5	Block diagram of the system	29
Figure 3.8.1 (a)	Physical view of Arduino Uno R3 ATmega	31
Figure 3.8.1 (b)	Pin configuration of the Arduino Uno R3 ATmega	31
Figure 3.8.2 (a)	NodeMCU Wi-Fi Module	32

Figure 3.8.2 (b)	Pinout of NodeMCU Wi-Fi module	33
Figure 3.8.2 (c)	Pin configuration of NodeMCU Wi-Fi module	33
Figure 3.8.3 (a)	Arduino water level sensor	34
Figure 3.8.3 (b)	Diagram of Connection and Installation	35
Figure 3.8.4 (a)	Interface of 3 Pin Infrared Sensor Module	35
Figure 3.8.4 (b)	Connection layout of Infrared Sensor Module with Arduino Uno Microcontroller	36
Figure 3.9.1 (a)	Website interface of www.thingspeak.com	38
Figure 3.9.1 (b)	Example of project using ThingSpeak	38
Figure 3.9.2 (a)	Interface of Arduino IDE	39
Figure 3.9.3 (a)	Website interface with a linked Gmail account	40
Figure 3.9.3 (b)	Mobile interface	41
Figure 4.2.1	Graph Water Level Sensor Vs Time to detect level of water (s)	43
Figure 4.2.3	Real- Time ThingSpeak to generate data through Wi- Fi module at different Level of water	47
Figure 4.3.2 (a)	The combination circuit	52
Figure 4.3.2 (b)	IR sensor detect of car existence within range 1 centimeter	52
Figure 4.3.2 (c)	Water level sensor which is measure the level of water in centimeter, starting with 0 centimeter until 4 centimeters	52
Figure 4.3.2 (d)	Full prototype of the project	53

LIST OF APPENDICES

APPENDIX	TITLE	PAGE
APPENDIX 1	Gantt Chart PSM I	59
APPENDIX 2	Gantt Chart PSM II	60

LIST OF SYMBOLS

V	-	Voltage
cm	-	Centimeter
s	-	Second

LIST OF ABBREVIATIONS

Apps	Application
IoT	Internet of Think
Wi-Fi	Wireless Fidelity
SMS	Short Message Service
MCU	Micro Controller Unit
ROM	Read-Only Memory
RAM	Random Access Memory
EPROM	Erasable Programmable Read-Only Memory
EEPROM	Electrically Erasable Programmable Read-Only Memory
GSM	Global System for Mobile
ADC	Analog Digital Converter
USSD	Unstructured Supplementary Service Data
FAX	Facsimile
CSD	Circuit Switched Data
MIC	Minimum Inhibitory Concentration
TX	Transmitter Channel
RX	Receiver Channel
LED	Light Emitting Diode

CHAPTER 1

INTRODUCTION

1.1 Background

There are some researches about the previous project before starting with this project. Star Publication report that in Malaysia, the flood is a regular natural disaster that happens during the monsoon season. Flood disasters have a bad effect on all living things. The effect of flood disasters is damage to property, destruction of plants, and the condition of the flood victims. Since this is a hazardous disaster, it requires an efficient warning system to communicate to the public on an early stage so that preparatory measures will face flooding, as well as security, that can be taken to prevent any accidents happened.

A Development of Real-Time Flash Flood Alert System in Shopping Mall Parking Lot is a system that will prevent shopping mall user's car traps in flash floods at parking lots. This project offers an efficient solution at a lower cost of a system and easier for future technologies. This project is offered a system that easier to apply, inexpensive maintenance, and long-lasting duration for one system.

This project has several element components which consist of Water Level Sensor, Wi-Fi Module, IoT platform, and User Mobile Phone. The water level sensor used to monitor and regulate water levels within a contained space. Then, it also to obtain the water height. Many methods have been used to get data for water level, the conventional method by flood board. This project is not suitable to use the conventional method, because the conventional method is giving late information to the users. The

method is used in this system is more efficient because is based automatic sensor to measuring the level of water at the affected area. Besides, the wireless system function as a communication medium with the Pushbullet application and the IoT platform. While Arduino UNO board works as a microcontroller which all the collected data from the sensor sent to the IoT platform for monitoring. Next, the hardware component that has been using in this project is the Wi-Fi module. Wi-Fi module will communicate with IoT to generate the data that has been monitored, and triggered the alert notification through short message service (SMS) with the information of the parking area and inform authorities (user) about the flood level when the threshold has been reached the limit.

This paper research about flood warning systems and related issues and proposes an effective flood alert system to overcome the previous project studied systems disadvantages.

1.2 Problem Statement

The geographical location of Malaysia becomes a source for natural disasters of monsoonal floods and flash floods. Malaysia's terrestrial also is simply affected by the Asian Monsoon. During the late half of May or early June to September, prevails the Southwest Monsoon and it causes the intense rainfall. However, the Northeast Monsoon is blowing from November to March, the heavy rain over most of the main cities and towns in Malaysia, such as Kuala Lumpur.

This project aims to improve the flood detector system. In Malaysia, the current flood detector system is late to given the flood information to the road user and due to the late information given, the majority of the road user cannot avoid trapping in the flash

flood. However, by implementing this project, the system will be improved and can give an alert faster and accurate when the flash flood occurs in a place.

Other than that, using the manual flood detector system where it only read the flood level through the flood board at the river. Hence, this project is used Water Level Sensor which this programmable sensor to monitored and obtain the data of the water height from the distance of the water surface.

To get the information regarding flash flood, the previous version of the flood detector system only used the radio or information board location at the side of the road. This project will be more efficient to the user where users will receive the information about the flash flood through the short message service (SMS). In this case, Pushbullet application will be used to send information.

Besides, the aim of the internet and connected devices is to allow people to communicate with each other and to access the online data and for all the processes. While the purpose of IoT is to analyze and create the desired outcomes in real-time data. In this project, using the Wi-Fi module system into a flood alert system make it easier for monitoring the water level in real-time and the input Arduino Uno will communicate with the Wi-Fi module and IoT platform until the data at the sensor reach at the maximum water level measurement four centimeters. The communication process with the mobile phone network is when the data from the IoT platform is reaching the maximum value and triggered then sent to the Pushbullet application.

Lastly, the development of this project is to allow the user (authorities) to monitor the water level easily by using a mobile phone. In other word, to create a user-friendly interface that can be used to monitor the water level.

1.3 Objective

The main objective of this project is:

- i. To develop an alert system that will immediately warn and notify the user about the flash flood that occurs in a shopping mall parking lot.
- ii. To interface the water level sensor and warning alert system via Arduino Uno by using Wi-Fi Module and Pushbullet application.
- iii. To create a user-friendly interface on the mobile phone to monitor the water level at the parking lot in the shopping mall.

1.4 Project Scope

This project is limited to the following that could be focused to achieve the stated objective. To achieve that stated objective, the work scope is listed as below;

- i. Water Level Sensor
Responsible for measuring flood water levels and communicate with Wi-Fi Module and Pushbullet application. It collects and converts the analog data from the Water Level Sensor. This sensor is to observe the water height and measure the distance between the water surfaces.
- ii. Arduino Uno
The main component as a microcontroller. Collected all data from the sensor and sent for processing through the Wi-Fi module.
- iii. Wi-Fi Module
Medium with the IoT platform, ThingSpeak and Mobile Phone.

iv. Pushbullet Application

The application sends a notification through short system service (SMS) with the information of the parking area and informs authorities (user) when the flood level threshold has been reached.