Water Level Sensor at Parking Lot Using IoTNotification System

[1,2] Norsuzila Ya'acob, [1] Nor Nadia Azwa Jefridin, [1] Noraisyah Tajudin, [1,2] Azita Laily Yusof and [1,2]Darmawaty Mohd Ali

[1] School of Electrical Engineering, College of Engineering, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia,

[2] Wireless Communication Technology (WiCoT), School of Electrical Engineering, College of Engineering, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia

[1]norsuzila@uitm.edu.my,[2]nadyaazwa01@gmail.com, [3]tnoraisyah@gmail.com, [4]azita968@uitm.edu.my, [5]darma504@uitm.edu.my

Article Info
Page Number: 1163-1171
Publication Issue:
Vol. 71 No. 3s (2022)

Abstract— The capital city of Malaysia experiencing flash floods more frequently and they do not always confine to the monsoon season. Kuala Lumpur had to face two kinds of flash flood around the year such as fluvial flash floods and drainage systems and it remains one of the most serious environmental problems. These phenomena have some unique characteristics such as they are sudden, unexpected and most of the time violent in nature. It shows that the roads and highways, houses, and vehicles are directly affected, damaged, and disrupted by flash floods. The problem is this situation really gives a lot of worries to netizens who live in the city. They need to always be alert about their cars leaving at the parking lot when the flood suddenly hits the parking lot and ruins their vehicles so this water level sensor at the parking lot is a really suitable warning system that will be provided to people when facing the flash flood. The method is the two major components consisting of the water level sensor and for the data, the transmission will use Bluetooth shield through the smartphone application. It will be integrated with a local webserver through which users can monitor the data from any device connected to the same Wi-Fi. Direct notification from smartphones can help the owner of the vehicles to always be alert when a flash flood occurs. This project is expected to solve problems faced by flash flood victims by implementing an early water level sensor mechanism at the parking lot so they will be able to save their vehicles. The objective of this research is to reduce the damages of the vehicles due to flooding at the parking lot and develop an early warning system for a flash flood at the parking lot using an IoT system.

Index Terms— water level sensor, Bluetooth shield, flash flood, WIFI.

Article History
Article Received: 22 April 2022
Revised: 10 May 2022
Accepted: 15 June 2022
Publication: 19 July 2022

I. INTRODUCTION

Malaysia is a country that has always experienced natural disasters. Flash floods are characterized by high-velocity flows and short warning times.[1] Flash floods are being among the dangerous disaster that keeps on happening especially in the big city which is Kuala Lumpur. The main river of the city is Klang River and Gombak River located in the middle of the valley. Flash floods occur in a split of seconds because of excessive rainfall from hurricanes and tropical storms, thunderstorms repeatedly moving over the same area, and also from a dam or levee failure.[2] When extreme rainfall exceeds the design rainfall of the drainage system in an urban area, some part of flooded water intruded into spaces such as parking lot. There are many cases of flooded which involve parking lot. There can be a secondary impact due to vehicles being affected. It can be easily guessed that, as a secondary impact, people will have to repair their cars due to any damage caused to their vehicles by damage and ruin all the vehicles at the parking lot. With this application, the owner will be easier to protect their

flash floods. This may have a psychological impact as being caught in a flash flood while in the car may cause fear of death, damage to the car.[3]

Based on this situation, the water level sensor at the parking lot had been created with a smart notification through the smartphone. The users can apply this application using their smartphone and they will be more alert with the condition at the parking lot where they put their vehicles. Flash floods that always happen without a trace will definitely cause huge belongings from being crashed by the flash flood. This project uses IoT as a communication platform to transmit information. The Internet of Things (IoT) is a global infrastructure for society communication, an advanced service by connecting things either physical or virtual things based on existing and evolving information technology.[4]

The water level sensor is designed with two specific points of the water level. The minimum point level will be about 0.1m from the ground while the maximum point will be about 0.2 m. there will be a sensor at both of the points to detect the water approaching. When the water level reaches the minimum point it will turn on the green LED while when at the maximum point it will turn on the red LED and trigger the buzzer. The buzzer will function as an alarm to alert the authority. The owner of the car will be notified through the smartphone application and all the reading will also be provided in the application.

This project applied both, hardware and software programming. For hardware, it can be divided into three (3) main parts which are the water level sensor as the input system, Arduino Mega 2560, and Arduino Bluetooth Shield as an interface with the output and connection to the website respectively and lastly, LED, Buzzer, LCD as the output system. Meanwhile, for the software programming, Arduino software IDE is used for hardware coding.

The objectives of this project are to reduce the number of damages of vehicles at parking lots due to flash floods, especially at the parking lot. Other than that, this project will help to develop an early warning system for a flash flood at a parking lot using Arduino and IoT and warn people about the safety of their belonging during disasters happen. In addition, it will also be helping in preventing the loss of lives in the event of flooding occurring at the car parks and upgrade new system of water level at the parking lot by using an IoT system.

II. METHODOLOGY

A. Material

1) Study Area

Fig. 1 below shows the study area is specific at big cities especially at Kuala Lumpur, Shah Alam or Klang also located near the river. Kuala Lumpur city experiences two kinds of flash floods around the year such as fluvial flash floods and drainage system-induced flash floods. Each of these types of flash floods really gave enormous trouble to people in Malaysia throughout the years. For both types of flash floods, rainfall is playing a major role. However, clogged drains, narrowing water channeling ways littering behaviors of the people, and urbanization are also contributing to the flash flood hazard occurrences.

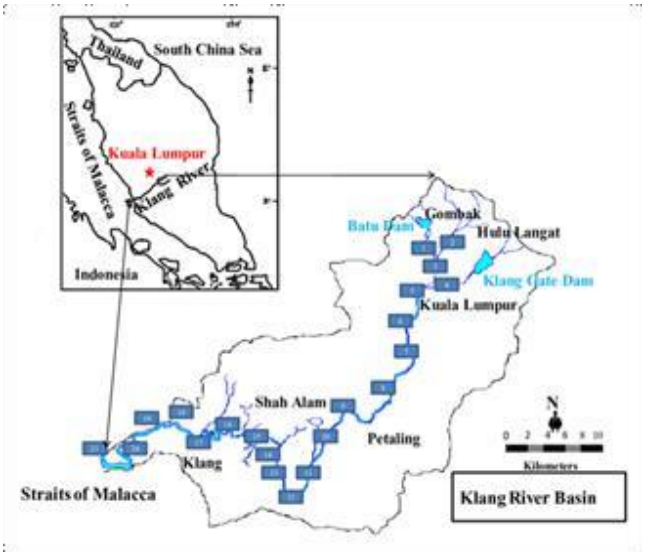

Fig. 1 The map for the study area

2) Software

For the software application, the smart monitoring water level system had used the proteus software. This software can be used for the simulation of the microcontroller and it can easily generate schemas. This software also can easily create an electrical drawing by placing different logic gates and switches. The design of the schematic drawing a produced by connecting all the components that had been set up. [5]

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions, and a series of menus. It connects to the Arduino to upload programs and communicate with them.[6]

Blynk application is one of the new platforms that is provided to help in build interfaces faster in controlling and monitoring the hardware projects from the smartphone devices. After downloading the Blynk application. It will create a project dashboard and arrange buttons, sliders, graphs, and other widgets onto the screen. It can turn pins on and off or display data from sensors by using the widgets [7].

B. Method

1) Framework

Fig. 2 below shows the water level monitoring at the parking lot that consists of several important tools in order to successfully create this project and run smoothly. The project is basically using IoT as a communication platform to transfer the data inform people in easier ways and quickly alert people as this project needs to warn people directly. The blynk

application will help to control the project through smartphones.

Other than that, there are many components that are needed especially the sensing device which for this project isthe ultrasonic sensor. The LED and the buzzer will be automatically turned on when the water level reaches the specific level that had been set up. The proteus software willbe used to design the circuit before doing it using hardware. The programming code is created by using the Arduino ide will connect to the real hardware Arduino so it will run the circuit smoothly according to the code.

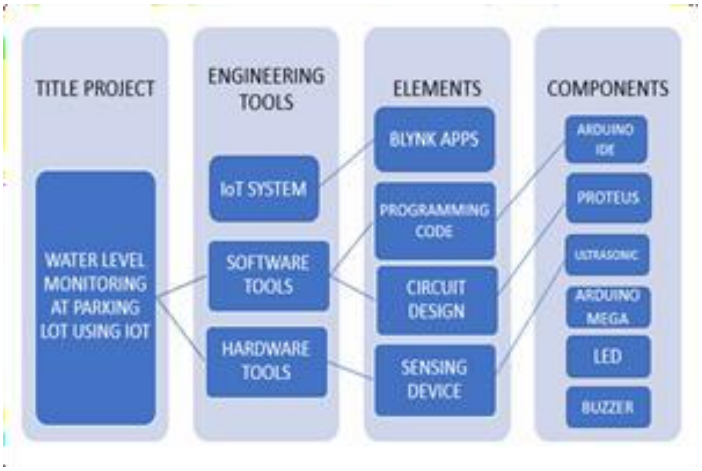

Fig. 2 Block Diagram for Water Level System

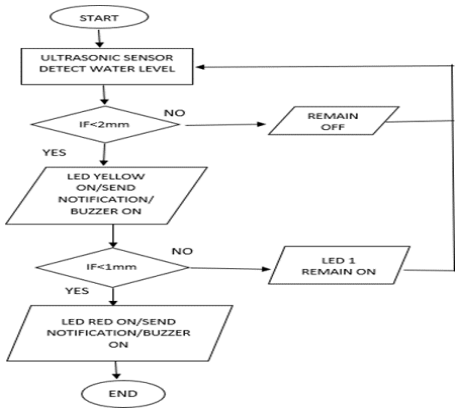

Fig. 3 Flowchart Hardware Design for Water level System about the water level and give notification so they canquickly move their vehicles to the safe zone.

a) Flowchart for Hardware

The flowchart in Fig. 3 below shows the flow of water level monitoring level at parking lot using IoT working process that starting with the water level sensor. The sensor will track the water level reading. The sensor will be put in two-level the first level is about 1mm from the ground while the next level point is about 2mm from the ground. If the distance detected is higher than 1mm the green LED will be on, the buzzer will be a trigger and it will send the first notification. When the water level is detected higher than 2mm, the red LED will turn on, the buzzer will be triggered, and will also give a notification to the owner.

b) 2.2.1.2 Flowchart for Software

Fig. 4 below shows the proteus software is used to create schematic circuit design, to do simulation for the design, and also as the design phase of a PCB layout before assembling them on actual hardware connection. Next for the Arduino software or Arduino Integrated Development Environment (IDE) is application software used to write code, compile the code to check if any errors occur, and upload the code to the Arduino. The Wi-Fi module will allow data transfer using Wi-Fi protocol and lastly the blynk application to help connect with smartphone device that will help control the project through it

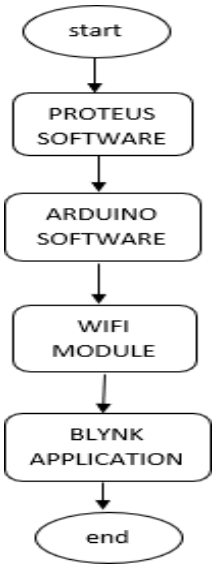

Fig. 4 Flowchart for Software System

2) Data acquisition

The smart monitoring water level based on IoT system starts with the sensor device that will detect the water level at the parking lot. It will provide data to be sent through smartphones for users. Firstly, the sensor will detect the water level at a specific level which is about 2m away from the sensor. The LED will be turned on automatically when the sensor detects the level. After that, when the water level keeps on rising until the sensor detects about 1 m away from the sensor the RED LED will be turned on, and also the buzzer will be triggered. Both of the water levels detected by the sensor will appear on the user's smartphone through the IoT system using blynk application. It will give the reading

Factor selection

Smart monitoring water level system consists of several components that can help to monitor the water level during the flood. The flood detection and monitoring system use sensing devices, modeling software, the Internet, and mobile technology in order to get the users to get accurate information during the disaster.

The Ultrasonic sensor will help to detect the water level when it reaches to the vehicles. It can measure distance and identify the existence of an object without making physical contact. It generates and tracks an ultrasonic echo. The effective range in air varies depending on the sensor and object qualities. It might range from a few centimeters to several meters. It will collect data from the sensor and convert it into a signal to be transferred to the smartphone.

After that, the Internet of Things (IoT) allows for connection, management, and control of a

wide range of devices and objects that were previously impossible to connect. They can communicate with one another within a network environment. These devices can perform a wide range of tasks, including collecting data from sensors or RFID, and sending control instructions to actuators. Sensors and actuators are scattered across a large area in many application scenarios and in certain situations, they are located in remote places that are not served by terrestrial access networks, making the IoT system extremely important in communication and research.

III. RESULT AND DISCUSSION

A. Result for output

1) Table Water Condition Level

Table 1 below shows several conditions of water level that will be detected by the ultrasonic sensor. It will also result in output in which the LED will turn on and also the buzzer will also be triggered. The water level that equals 2mm means that the water level is still far away from the sensor so the yellow LED will turn on. It will also be the same LED color turn on when the water level is between 2mm and 1mm but when the sensor detects the water level change equal to 1mm or maybe low than the value it will cause the red LED to turn on. The buzzer will also trigger when the level show at 2mm or 1mm from the sensor.

Table 1: Conditions of Water Level

NO	Conditions of Water level	LED	BUZZER
1.	Water level equal to 2mm	YELLOW ON	ON
2.	Water level equal to 1mm	RED ON	OFF
3.	1mm< water level <2mm	YELLOW ON	ON

B. Result For Software

1) Blynk Diagram for Water Level

The figure below shows figures that appear on smartphone users when the sensor detects the water level through the
blynk application. Fig. 5 shows that the water level is really high so the water level maybe be equal to or low than 1mm from the sensor. Meanwhile, Fig. 6 shows the medium level from the bottom so the water level will be equal to 2mm or between 2mm and 1mm from the ultrasonic sensor.

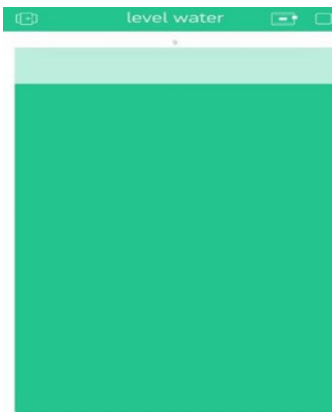

Fig. 5 Water Level using Blynk

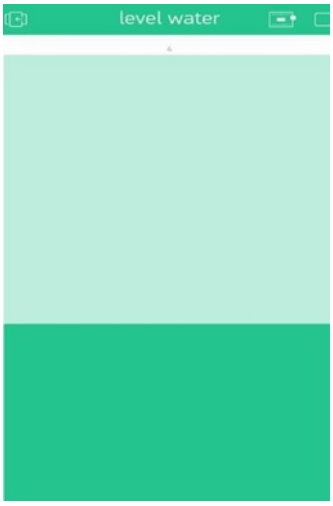

Fig. 6 Water Level using Blynk

2) Notification diagram

The blynk application will help the users to get notifications through their smartphones. All the data and water level readings will appear on the application. It will alert the users about the condition of the water level at the parking lot when the water reaches their vehicles. It will ring their smartphone so it will be much easier for people to gain information using IoT that applied in this smart monitoring water level system at a parking lot

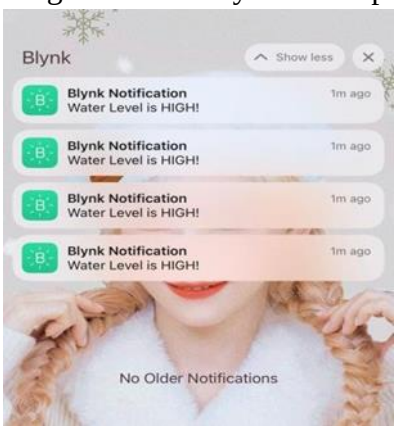

Fig. 7 Notification using Blynk application

C. Result for Hardware

Fig. 8 below shows the components circuit connection that had been used in this smart monitoring water level system at the parking lot. The ultrasonic will be connected to the ESP8266 WIFI module that is placed on the breadboard. The Led also will be connected to the same ESP8266 which is one for the red LED and one for the yellow LED.

The coding will be run using the Arduino application that is already being installed in the laptop and connect the circuit with the laptop then the coding will be uploaded so the sensor will detect the motion of water level and turn on the LED.

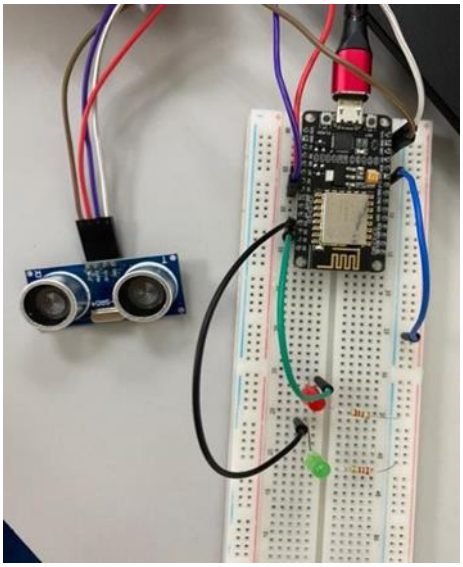

Fig. 8 Circuit Connection of Components

CONCLUSION

In a conclusion, the objective for this smart monitoring water level using IoT has been achieved such as to develop an early warning system for a flash flood at parking lot using Arduino and IoT and reduce the damages of the vehicles due to flooding at the parking IoT. Other than that, the notification had successfully been transferred from the sensorto the user's smartphone through the IoT application. The users can directly see all the information collect from the sensor and discover the warning notification quickly. Furthermore, the investigation and analyzation existing floodmonitoring approaches, focusing on their structure and sensing methodologies had been done. Then able to categorize and compare their benefits and drawbacks, and then recommend new solutions and enhancements based on the emerging Internet of Things technologies. This paper presents a detailed mini-review of sensing technologies in existing flood systems.

Many people rely on flood alert systems to avoid flood dangers. These devices provide real-time information on growing water levels and when water levels in certain locations reach dangerous levels. Flood notifications can alarm people before they go out, at home, or at work.

ACKNOWLEDGEMENT

The authors would like to thank the School of Electrical Engineering, College of Engineering, Universiti Teknologi MARA, Shah Alam, Selangor for their valuable support.

REFERENCES

1. Ashley, S.T. & Ashley W.A. (2008). Fatalities in the United States. Journal of Applied Meteorology and Climatology 47: 805-818
1. Abdullah, K. (2004) Kuala Lumpur reengineering a flood conference. In 14th Professor Chin Fung Kee Memorial Lecture, Kuala Lumpur.
2. Pepsi M, B. B. ., V. . S, and A. . A. "Tree Based Boosting Algorithm to Tackle the Overfitting in Healthcare Data". International Journal on Recent and Innovation Trends in Computing and Communication, vol. 10, no. 5, May 2022, pp. 41-47, doi:10.17762/ijritcc.v10i5.5552.
3. Shu, C. et al. (2011) Incipient velocity for partially submerged vehicles in floodwaters. Journal of

Hydraulic Research, 49(6),pp. 709-717. doi: 10.1080/00221686.2011.616318.
4. F.S Buslima Rohayu, Che Omar, Tajul Anuar Jamaluddin, Hairin Tahar (2018),"Flash and Flood Geo-Hazards in Malaysia",7(4),pp 760-764. DOI:10.14419.
5. Getu Gabisa, Mengesha Mamo (January 2020)" Teaching the Implementation of Digital Control using Proteus VSM Software".
6. Mohamed Fezari, Ali Al Dahoud(October 2018) " Integrated development Environment (IDE) For Arduino".
7. Mohd Hakimi Zohari (August 2020) "Weather Monitoring System using Blynk Application".
8. S. Doocy,A.Daniels, T.Kirsh (2013)" The Human Impact of Floods".
9. R.S. Sunmonu, Sodunke Mobolaji Aduramo, Enitan Agboola (2018) "Development of an Ultrasonic Sensor Based Water Level Indicator".
10. Shahirah binti Zahir (2019) "Smart IoT Flood Monitoring System".
11. Bilal Arshad, Robert Ogie, Johan Barthelemy (2019) "Computer Vision and IoT-Based Sensors in Flood Monitoring and Mapping".
12. Harshali S. Mali, Ashwini R.Marathe, Priyanka K. Patil (2017) " Flood Monitoring and Alerting System based on IoT". vol. 8,no. 2, p. 15.
13. Sheikh Azid, Bibhya Sharma, Krishna Raghuwaiya (2015) "SMS Based Flood Monitoring and Early Warning System", vol 10, no 15.
14. Z. M. Taib, N. S. Jaharuddin, and Z. D. Mansor (2016), "A review of flood disaster and disaster management in Malaysia,"vol. 4, no. 3.
15. Yogendra Singh Parihar (2019), "Internet of Things and Nodemcu: A review of use of Nodemcu ESP8266 in IoT products".
16. Arellano-Zubiate, J. ., J. . Izquierdo-Calongos, A. . Delgado, and E. L. . Huamaní. "Vehicle Anti-Theft Back-Up System Using RFID Implant Technology". International Journal on Recent and Innovation Trends in Computing and Communication, vol. 10, no. 5, May 2022, pp. 36-40, doi:10.17762/ijritcc.v10i5.5551.