Faculty of Electrical and Electronics Engineering Technology

EARLY DETECTION SYSTEM FOR HOME FLOOD PREVENTION USING ARDUINO AND IOT

EZZAT MUHAMMAD SYAHMY BIN ASRI

Bachelor of Electronics Engineering Technology (Telecommunications) with Honours

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A project report submitted
in partial fulfilment of the requirements for the degree of
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Alamat Tetap: LOT 12073,
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Ir. Dr. Mohd Muzafar bin Ismail
Senior Lecturer
Fakultiy of Engineering Technology
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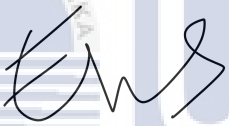
Signature : 

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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 : IR. DR. MOHD MUZAFAR BIN ISMAIL

Date : 11/1/2023

.....

DEDICATION

To my beloved mother, Rohana Binti Zainun, and my father, Asri Bin Redzuan,

Thank you for supporting me when I continue my studies

for bachelor's degree in UTeM.

To my sister, Nur Aiman Ezzaty Binti Asri,

Thank you for providing your creativity expertise and suggestion

for completing this project.

To my brother, Muhammad Eiman Bin Asri,

Thank you for your emotional support.

ABSTRACT

During this of globalization, floods are the major disaster that are always occurs in the country, Malaysia. The country is affected by heavy rainfall largely during the end of the year which are the typical for seasonal monsoon floods. Flood disasters such as flash floods and tidal floods that occurs mostly on houses or residential that are close to the seaside and rivers can be devastating to those who choose to live there. The damage done to the property and even innocent lives that are loss to this natural disaster occurred every year can be potentially avoided with a system. The system that can signal if the water around the residential area is rising rapidly and have a blockade for the flood water to enter the residential place. With that, no to minimal damage will be done to the places. This system could also be used in industrial places with using the same concept, albeit in much bigger scale compared to residential area system. The expected outcome of this system is to have minimal property damages done to homes and safety to resident from floods. An Ultrasonic sensor is chosen in this project because of having high sensing distance while having no moving parts thus making it more reliable compared to other alternative water sensors. This system is main equipped with Arduino UNO connected to water sensors to track water level on simulated water drainage. When specified water level is reach, it will trigger the water gate system. The data from water sensors is also connected to NodeMCU ESP8266. The user will be able to do monitoring for the water level by using the mobile application. This project is aimed at developing and design flood monitoring systems with an automation for water gate, with addition of able to monitor in real-time using mobile phone application through IoT platforms. The project is presented in a small-scale concept of residential houses, simulated water drainage and functioning prototype of the system. This project is suitable for residential and industrial area for safety measure against flood disaster. IoT functionality are efficient for monitoring area from afar. For future works, the system can be implemented and tested in real world residential house and add a reliable uninterrupted power source such as solar powered battery.

ABSTRAK

Dalam era globalisasi ini, banjir merupakan bencana besar yang selalu berlaku di negara, Malaysia. Negara ini terjejas oleh hujan lebat sebahagian besarnya pada akhir tahun yang merupakan tipikal untuk banjir monsun bermusim. Bencana banjir seperti banjir kilat dan banjir pasang yang kebanyakannya berlaku di rumah atau kediaman yang berhampiran dengan tepi laut dan sungai boleh memudaratkan mereka yang memilih untuk tinggal di situ. Kerosakan yang dilakukan kepada harta benda dan juga nyawa yang tidak berdosa yang merupakan kerugian akibat bencana alam ini berlaku setiap tahun berpotensi dapat dielakkan dengan sistem; itu boleh memberi isyarat jika air di sekitar kawasan perumahan itu naik dengan cepat, dan mempunyai sekatan untuk air banjir memasuki kawasan perumahan. Dengan itu, tiada kerosakan yang minimum akan berlaku kepada tempat-tempat tersebut. Sistem ini juga boleh digunakan di kawasan perindustrian dengan konsep yang sama, walaupun dalam skala yang lebih besar berbanding sistem kawasan kediaman. Hasil yang diharapkan daripada sistem ini ialah kerosakan harta benda yang minimum dilakukan kepada rumah dan keselamatan kepada penduduk daripada banjir. Penderia Ultrasonik dipilih dalam projek ini kerana mempunyai jarak penderiaan yang tinggi sementara tidak mempunyai bahagian yang bergerak sehingga menjadikannya lebih dipercayai berbanding dengan penderia air alternatif yang lain. Sistem ini dilengkapi dengan Arduino UNO yang disambungkan kepada penderia air untuk mengesan paras air pada saliran air simulasi. Apabila paras air tertentu dicapai, ia akan mencetuskan sistem pintu air. Data daripada penderia air juga disambungkan ke NodeMCU ESP8266. Pengguna akan dapat melakukan pemantauan paras air dengan menggunakan aplikasi mudah alih. Projek ini bertujuan untuk membangunkan dan mereka bentuk sistem pemantauan banjir dengan automasi untuk pintu air, dengan tambahan boleh memantau dalam masa nyata menggunakan aplikasi telefon mudah alih melalui platform IoT. Projek ini dibentangkan dalam konsep berskala kecil rumah kediaman, simulasi saliran air dan prototaip sistem yang berfungsi. Projek ini sesuai untuk kawasan perumahan dan perindustrian bagi langkah keselamatan terhadap bencana banjir. Fungsi IoT adalah cekap untuk memantau kawasan dari jauh. Untuk hasil kerja akan datang, sistem ini boleh dilaksanakan dan diuji di rumah kediaman dunia sebenar dan menambah sumber kuasa tanpa gangguan yang boleh dipercayai seperti bateri berkuasa solar.

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A	-	Ampere Current
API	-	Application Programming Interface
EEPROM	-	Electrically Erasable Programmable Read-Only Memory
GSM	-	Global System Mobile Communication
GUI	-	Graphic User Interface
IDE	-	Integrated Development Environment
I/O	-	Input / Output
IoT	-	Internet of Thing
SMS	-	Short Message Service
UI	-	User Interface
UPS	-	Uninterruptible Power Supply
USB	-	Universal Serial Bus
V	-	Voltage
W	-	Watt, Unit of Power

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CHAPTER 1

INTRODUCTION

This chapter will discuss about the background of the project, problem statement, objective, scope of the project and the project outline.

1.1 Research Background

Arduino board is a type microcontrollers kits or single board that have been use in variety type of project. Most of prototype and even final product have taken benefit of the flexibility using Arduino board as it is much inexpensive and already comes with and open supply hardware and software with the board design use a variety of microprocessors and controllers. Digital and analogue input/output (I/O) pins on the boards can be used to connect to expansion boards ('shields') or breadboards (for prototyping) and other circuits. The boards have serial communications interfaces, as well as USB ports on some variants, which are used to load programmes. The Arduino programming language, which is based on Processing and comes with a modified version of the Processing IDE, may be used to programme microcontrollers using C and C++ programming languages and a standard API. In addition to standard compiler toolchains, the Arduino project provides an integrated development environment (IDE) and a command line tool built in Go, a compiled programming language developed by Google. [1]

The Harvard architecture is used in the Arduino board's processor, which includes separate memory for programme code and programme data. Programme memory and data memory are the two types of memories available. Data is stored in data memory, whereas code is stored in flash programme memory. With 32kb of flash memory, 2kb of SRAM, and 1kb of EPROM, the Atmega328 microcontroller runs at 16MHz. [2]

The main circuit for the project is tested and developed using SimulIDE. The coding to be written in propriety Arduino IDE software. It will then test in SimulIDE with sensor and other circuits connected to simulated Arduino board loaded with the code written. A Wi-Fi module are implemented to the system for IoT system using Blynk that is used to monitoring via the Internet.

The main objective of this paper is to bring notice that matter to prevent proprietary damage to residential area can be avoided with an efficient system built and implemented properly. In addition, the system can also be implemented in other purpose if the customer demands for other usage. This study may prove study to be useful to those who live in residential area with a high risk of flood within every year.

1.2 Problem Statement

The citizen of our country Malaysia has to face horrible natural disaster which is flood every year during the monsoon season. [3] Although preventive measure such as remove the clogging within the drain system or expand the water flow system in the residential area, the heavy rain that comes overnight have able to flood a portion of the houses that are place in low or sloped land area. Furthermore, this study could introduce a type of IOT device that can be used by user to monitor the water level around the residential area.

1.3 Project Objective

The main aim of this project is to propose a systematic and effective methodology to make system to control the water flow of flood by preventing water entering the residential area. Specifically, the objectives are as follows:

a) To design a monitoring flood system and an automated gated system that can be activated when incoming water flow that exceed the limitation given.
b) To detect the level of the water flood using sensor which will be divided into multiple level.
c) To analyse the effectiveness of the automated system with Internet of Things (IoT) system architecture.

1.4 Scope of Project

The scope of this project is as the follows:

a) Study the which hardware of that are suitable for the project.
b) Determine which type of sensors that are suitable for the water level.
c) Design is functioning hardware component of the project
d) Simulate the prototype by using TinkerCAD, Arduino IDE and Blynk.
e) The project would be finished in at least a small-scale prototype as the original scale would be much costly.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Several writers and report mentioned an inevitable cases of flood natural disaster occur every year. Even its seems that these cases have been addressed through government initiative such as the SMART Tunnel [4], it is still a huge issue in rural area around the country that does not have an efficient proper drainage system that can combat the flood problem. [5]

Prototype developed to solve this issue can be made by using a microcontroller such as Arduino. Arduino is an open-source electronics construction and programming platform. It can receive and send data to most devices, as well as command specific electronic equipment over the internet. The board is programmed using an Arduino Uno circuit board and a software programme (Simplified C++). [6]

In this chapter, I have been comparing others project related with the project. It is related to the function and operation of each component. All the comparison process during the literature review were made to complete the Early Home Flood Prevention System.

2.2.1 Flood disaster indicator of water level monitoring system

With the advancement of technology, early warning systems for flood management have been swiftly developed. These systems use the Short Message Service (SMS) via the Global System for Mobile Communications to inform individuals early (GSM). This paper describes a simple, portable, and low-cost early warning system that employs an Arduino board to manage the system and GSM shields to transmit data. The hardware and software components of the system have been designed and implemented. The device uses float switch sensors to assess the water level, then analyses the data to determine the type of hazard present. [7] An alarm message is issued to the user based on the observed level. The GSM network is utilised to send SMS messages between the various system components.

2.2.2 A Low-Cost Flash Flood Monitoring System

A flash flood is a disaster that necessitates rapid identification in order to avoid fatalities. [8] The concept envisioned a low-cost solution based on an Android smartphone and an Arduino board. The system will use an echolocation approach to assess water level, collect data from its sensors, and communicate data to the server over a mobile network or long-range WIFI. Low-level features, such as colour, are analysed at the phone as a network connection decision trigger in order to save network costs. Other high-level characteristics are extracted at the server to identify whether it is a flash flood.

2.2.3 SMS based flood monitoring and early warning system

This study shows how an SMS-based Flood Monitoring and Early Warning system is designed, implemented, and experimentally verified. [9] SMS will be used for tools like credit top-up and maintaining contact numbers. Users would receive texted updates on the water level's height if they requested it. When the level of water exceeds the user-defined threshold value, the system sends an SMS alert to the at-risk or threatened population as well as necessary authorities. The Global System for Mobile Communications (GSM) module is used to deliver text messages to mobile phones, while the Arduino Uno CPU reads the pressure sensor's input and calculates the water level. This basic yet effective warning system is thought to be one of the most efficient and cost-effective ways to notify the appropriate authorities and the susceptible residence. [3]

2.2.4 Flood Monitoring and Early Warning System Using Ultrasonic Sensor

The goal of this research is to create a real-time flood monitoring and early warning system in Isabela's northern region, particularly in the communities bordering the Cagayan River. Ultrasonic sensing techniques have matured to the point that they are now frequently used in engineering and basic science. Ultrasonic sensing has the unique capacity to probe inside an object without causing damage since ultrasound can travel through any medium, including solids, liquids, and gases. The water level detection and early warning system (through website and/or SMS) that warns concerned agencies and individuals to a potential flood occurrence is the subject of this study. Furthermore, an inquiry system is added in this study to make it more participatory, so that members of the community can use SMS keywords to question about the current water level and status of the desired area or location affected by flood. The study's goal is to help individuals be prepared and informed in the event of a flood. The use of Arduino, ultrasonic sensors, GSM module, web-monitoring, and SMS early warning system in assisting stakeholders in mitigating flood casualties is what makes this effort unique. The paper aims to assist flood-prone areas throughout the country, notably in the province's local villages. It is, without a doubt, significant and important in terms of community safety and wellbeing. [10]

2.2.5 Web Camera Sensor Coupled With Lidar Data Flood Map For Flood Warning System

A Flood Warning System is created in this study using Water Level Data imaged from a simple web camera. The system converts the water level image's output data into tables, then connects to the flood map database to choose the appropriate map for presentation as a flood prediction image using a GIS application. The technology uses real-time data processing to deliver reliable flood area predictions to the public. By using this technique, users may predict where areas will be flooded as the water level rises, allowing residents in the affected region to escape or at the very least prepare for the impending flood. This type of early warning system is projected to save not only the lives of residents in the affected area, but also their possessions from the flood calamity. The flood area is split at 1 m intervals from LiDAR data, and the water level is measured every 10 cm. The resulting area, calculated using elevation data, is used to define the flood's greatest extent. Each map layer corresponds to a specific water level captured by the camera. [11]