POLITEKNIK SULTAN SALAHUDDIN ABDUL AZIZ SHAH

FLOOD SENSOR

JABATAN KEJURUTERAAN AWAM

NOR FARZANA ADILEA BINTI MOHD FARIS`

(08DKA21F1500)

SESI II:2023/2024

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Laporan ini dikemukakan kepada Jabatan Kejuruteraan Awam sebagai memenuhi sebahagian syarat penganugerahan Diploma Kejuruteraan Awam

JABATAN KEJURUTERAAN AWAM

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AKUAN KEASLIAN DAN HAK MILIK

TAJUK PROJEK

1. Saya, Nor Farzana Adilea Bt Mohd Faris (010620-10-1494) adalah pelajar Diploma Kejuruteraan Awam, Politeknik Sultan Salahuddin Abdul Aziz Shah, yang beralamat di Persiaran Usahawan, Seksyen U1, 40150 Shah Alam, Selangor (Selepas ini dirujuk sebagai 'Politeknik tersebut')

2. Saya mengakui bahawa 'Projek tersebut diatas' dan harta intelek yang ada didalamnya adalah hasil karya/ rekacipta asli saya tanpa mengambil atau meniru mana-mana harta intelek daripada pihak-pihak lain.

3. Saya bersetuju melepaskan pemilikan harta intelek 'Projek tersebut' kepada 'Politeknik tersebut' bagi memenuhi keperluan untuk menganugerahkan Diploma Kejuruteraan Awam kepada saya.

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PENGHARGAAN

Bismillahirrahmanirrahim,

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ABSTRAK

Flood Sensor kami ialah teknologi elektronik yang memberi amaran kepada kejiranan sekitar dalam jarak terdekat bahawa hujan lebat yang berterusan telah mencapai tahap yang membimbangkan pada paras flood sensor air kami. Dengan menggabungkan Sistem Arduino Uno, Flood Sensor kami mempunyai buzer yang mengeluarkan bunyi pic yang sangat tinggi apabila paras flood sensor air telah direndam sepenuhnya oleh hujan. Flood Sensor ini dilengkapi dengan perintang, buzzer dan wayar penyambung. Ini sepenuhnya membina langkah berjaga-jaga keselamatan dan perlindungan untuk kereta dan motosikal yang diparkirkan di sekitar kawasan kejiranan. Idea ini berpegang teguh kepada keperluan pengguna kami di kawasan sekitar yang meletakkan kenderaan mereka sepanjang hari berhampiran tapak. Terutamanya di Shah Alam, Flood Sensor kami sangat berguna untuk kawasan sekitar kerana Shah Alam telah mengalami banjir yang sangat teruk pada beberapa tahun lalu yang menjejaskan dan merosakkan kenderaan. Keputusan telah menunjukkan bahawa pensyarah, kakitangan dan pelajar pada sekitar kawasan diberitahu akan kedatangan banjir yang berkemungkinan berlaku. Dengan ini, mereka diberi masa keemasan untuk memindahkan kenderaan mereka sekaligus mengelakkan sebarang kerugian dan kerosakan pada kereta mereka. Hasil idea ini, empat kenderaan terlibat di sekitar perkarangan tempat letak kereta berjaya mengaluhkan kenderaan mereka. Idea ini juga bukan sahaja mengesahkan penyelidikan objektif kami tetapi juga menyerlahkan pelbagai skop untuk aplikasi masa depan dan kemudahan orang lain.

Kata kunci*: sensor banjir, hujan lebat, sensor paras air, Arduino Uno.*

ABSTRACT

To begin, our Flood Censor is an alarming electronic technology that alerts the surrounding neighbourhood within walking distance that an ongoing rainfall has reached a certain alarming level of our water level censor. By incorporating Arduino Uno System, our Flood Censor has an alarming buzzer that makes a very high pitch sound once the water level censor is soaked by the rainfall. This water level censor is equipped with resistors, buzzer and connecting wires. This completely builds a safety precaution and protection of cars and motorcycles parked around the surrounding neighbourhood from damages that will highly occur by the incoming flood. This idea stands strongly of the necessity for our users in the surrounding neighbourhood who parks their vehicles throughout the day near the site. Especially in Shah Alam, our Flood Censor has been very useful for our surrounding compound as Shah Alam has had really bad floods for the past few years affecting and damaging vehicles. The results has shown that lecturers, staffs and walking distance students having classes and lectures around the neighbouring compound are well-informed and cleared the site. By this, they were given the golden time to move their vehicles thus, preventing a great deal of loss and damage to their cars. The outcome of this idea, among four vehicles were involved around the carpark compound. This successful idea has not only validate the research of our research objectives but also highlight the wide variety scopes for future applications and convenience of others.

Keywords: *flood censor, heavy rain, water level censor, Arduino Uno***.**

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PSA	Politeknik Sultan Salahuddin Abdul Aziz Shah

Chapter 1

INTRODUCTION

1.1 INTRODUCTION

Flood Sensor is a simple and cheap innovation that gives early flood warning. This warning system is to help the community in the polytechnic to take safety measures and early prevention before the flood occurs. This warning system is built on a simple water level alarm circuit that gives off a high-pitched sound when the water level reaches a pre-set level. This innovation has been tested for its functionality and durability. Thus, able to install this warning system around a compound of residence especially in areas where floods often occur so that they are better prepared every time a flood occurs whilst able to avoid major property damages and loss of lives.

1.2 BACKGROUND OF PROJECT

Flood Sensor is a warning system that is prepared to detect flood in several areas. The Flood Censor tool that is often used is a siren which provides a high-pitched sound to notify or signal the surrounding community to quickly take action thus avoiding danger by moving to a safer place. Through this idea, a prototype Flood Censor is created which can read the rise in water level and produce warning notification sounds and send a short message, namely SMS.

1.3 PROBLEM STATEMENT

Rainwater in the area of *Jabatan Perdagangan* rises easily when it rains heavily which causes the pool water in front of the Polytechnic Foodcourt to overflow out of the pool causing flooding in the car park area. We have interviewed a student of the Department of Commerce, Afiq and Haiy. They have shared their opinions with us about areas that are often flooded. Through their opinion, we took steps to take that area as a preferred area to use our Flood Sensor project.

1.4 OBJECTIVE

a. Designing a flood sensor to be placed near Jabatan Perdagangan PSA Department.
b. Testing out the Flood Sensor tool to ensure accurate detection of flood conditions.
c. Analyze data of the Flood Sensor tool to enable students, staff and lecturers to be aware incoming rising of potential flood.

1.5 SCOPE OF WORK

Kawasan Jabatan Perdagangan Politeknik

Diagram 1.1 : *Jabatan Perdagangan* PSA

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will be explaining about our research for necessary information before designing the related title of the project that will be carried out. Through this chapter, more focus will be given to projects that have been carried out either directly or through our observations. The purpose of this literature review is to further strengthen the study of the project that will be carried to ensure the whole process to completion runs well and smoothly.

2.2 Field Research

2.2.1 Naveen Ahmad et al {1} presented a comprehensive study on a GIS-BASED Flood Forecasting procedure that uses an Ad hoc remote Sensor Network Architecture.

2.2.2 Victor Seal et al {2} uses a multivariated robust lunear regression that is informal to recognize and simple yet has low implementation. However, it is well-organized eventhough the resource operation is low and provides real-time predictions with reliable accuracy, in addition to having desirable characteristics in any real world algorithms.

2.2.3 J G Natividad et al [3] proposed a system to produce a flood monitoring system that observes river water levels using ultrasonic sensors and to design and develop an early warning system. In this study, form a model system that detects current water levels across the Cagayan River watershed and surrounding areas through ultrasonic sensors.

2.2.4 Dedi Satria et al [4] proposed a flood monitoring framework model that relies on 'Google Maps' structured by combining an ultrasonic sensor as a height detector, an Arduino Uno as a processor, a U-Blox Neo 6m GPS module and a GSM module as a transmitter of water level and direction to a data framework station who was moved.

2.2.5 Edwin De Guzman et al [5] propose a system to improve and design a flood identification framework that will automatically identify floods and send information to Local Government Units and to area residents using Arduino.

2.2.6 Amol Ratho et al[6] designing and implementing a flood detection system using barometric pressure sensors. Effectively designed monitoring systems that send messages to receivers when water crosses the edge level. The framework of the designed monitoring system is cheaper, reliable and fast which is why this monitoring system is useful to prevent property damage and loss of life.

2.2.7 Cloke et al.[7] has conducted a comprehensive study on numerical weather forecasting also known as Ensemble Forecasting System (EPS). The authors have conducted operational and pre-operational flood forecasting systems. The advantage of this study is based on a detailed analysis of the catchment area and the duration of the disaster event when the flood hit the target area. Hydrological models combine rainfall, flow based on deterministic predictions in case of extreme flood events. A key challenge in this study is relying on quantitative and evidence-based case studies for false notifications and uncertainty of future rainfall.

2.2.8 Alfieri et al. [8] has drawn researchers' attention to distributed hydrological modeling for weather forecasting. Hydrological simulations for flash flood forecasting and collective results were performed in Verzasca, Lavertezzo for a period of 4 days ahead of time. Relative Correlated Operating Characteristic (ROC) curves have been used to measure flood forecasting based on probabilistic information. The advantage of this study is based on the use of a 30-year-old meteorological data set known as COSMO to predict the climatology of peak results in flash flood events.

2.2.9 Rozalis et al.[9] have used an uncalibrated hydrological model to simulate flash flood events in the Mediterranean watershed in Israel. Rainfall data was obtained from a C-band Doppler-free radar system installed in the study catchment area at a distance of 80 km. The daily rainfall intensity and its depth can be calculated using the rain gauge bias adjustment method. The proposed model has been used for 20 selected events, especially flood events during storms. Peak flow and flow depth are matched numerically with the help of hydrograms. The main issue in the investigation of this study depends on the temporal and spatial resolution of rainfall from radar satellite images in predicting the water flow process in the specified area.

2.2.10 Biondi et al. [10] evaluate the performance of the Bayesian Flood Forecasting System (BFS) to evaluate the uncertainty in Real Time Flood Forecasting. The authors have proposed stochastic and distributed models in Flood Disaster events. A precipitation uncertainty processor (PUP) was used for numerical mapping in the case of a river flow model. The Hydrological Uncertainty Processor (HUP) is used to evaluate the expected rainfall during a given event period. The advantage of this study is based on the best fit for the predictive distribution (PD) based on the TD scheme (periodic total distribution).

2.2.11 Raha et al. [11] introduced a statistical model to predict floods by using an Ad hoc Wireless Sensor Network (WSN). Multivariable regression techniques were used to calculate the extreme flow of floods across the border. The authors have proposed a distributed Architecture worklist where the cluster head is responsible for calculations and predictions in case of critical flood events. The advantage of this study is based on a sample plot of a uniform sample of water level in the case of two parameters - rainfall data and water release from the dam. The authors have proposed a wireless sensor network deployment scheme responsible for gathering input parameters such as rainfall and temperature for forecasting purposes. The purpose of this study is based on the use of Polynomial adaptation and Roust adaptation function in the design of Mathematical Models. The simulation results are performed in Mat Lab which plots a graph of the predicted values related to the instantaneous water level at different time events taking into account the flood line."

2.2.12 Dawod et al. [12] has focused on research on the occurrence of flash floods in the city of Mecca. The authors have proposed a mathematical model for a series of floods due to the intensity of the 1969 heavy rain storm in the city of Mecca. The authors have designed a Geographic Information System (GIS) Model for flood assessment using the Soil Conservation Service formula, based on hydrological methods used for flood estimation. The authors have also studied the spatial variation of flooding in the city of Makkah which includes the amount of flooding in the past 50 years. The conclusion of the study includes the CN curve number flood estimation methodology which is more accurate than other flood estimation methods. Flood estimation based on GIS also has many advantages that include and process many data sets that include meteorological, geological, soil parameters and land use data. The Digital Elevation Mapping method model has been used by Saudi Arabia's King Abdul Aziz University of Science and Technology for Flood Forecasting. The development method is also based on the integration of various data sets for GIS used for flood modeling scenarios.

2.2.13 Samarasinghe et al. [13] have critically analyzed remote sensing and GIS for flood risk analysis in Kalu Ganga River, Sri Lanka. The authors have focused their study on the vulnerability of floods that often cause damage to forests, residential areas, agricultural land and many other affected areas. The research methodology consists of specimen data collection including data from geographic databases. Then they have done a hazard analysis and a vulnerability analysis of hydrometeorological and satellite data to conduct a risk analysis of possible threats to disaster-affected areas. The strong points of this research are based on hydraulic analysis to obtain the range and depth of the flood. For this purpose, the authors have designed the HEC-RAS Model (Hydrology Engineering Center for River Analysis). A mathematical model for Flood Hazard Mapping provides a Flood Risk Map for a period of 100 years based on a flood simulation study using HH ALOS/PALSAR polarization to detect the range of flood durations."

2.2.14 Saud et al. [14], investigated the occurrence of Flood Hazards at the national and regional levels in Jeddah, Saudi Arabia. For this purpose, researchers have used IKONOS satellite images for location maps to study the areas affected by the disaster. Researchers have used Arc GIS 9.3 software to observe the geographical distribution of flood areas and to identify the direction of the irrigation system. Topographic maps have also been used to track rivers and water lakes with the help of Digital Elevation Models. The authors also identified a watershed map for the city of Jeddah that clearly depicts a schematic diagram of the rock catchment and mountain range in Wadi Fatima located in the city of Jeddah. The advantage of this study is based on the existing hydrological and geomorphological information of the catchment area in the area affected by the disaster. The authors also identified a lack of proper engineering practices with five categories of damage in this area of space. A minor weakness of this study is based on the absence of a mathematical model in this critical real-life scenario.

2.2.15 Hailian et al. [15] have identified flood risk assessment in Hubei Province, China. Flood Risk Assessment is usually based on topographical factors including rainfall, floods, and typhoons. The gradient calculation method using GIS software shows that smaller standard deviation factor values result in more severe flood risk in the case of disaster-affected areas. The spatial distribution of flood-affected areas clearly illustrates the fragility of historical floods that occurred in the defined areas affecting the degree of water flood risk assessment in the GRID map of Hubei Province, China. This research study led to major improvements in GIS technology for flood risk assessment and decision making. Other parameters including soil and hydraulic engineering have also been considered in the flood risk assessment. The proposed research study is lacking on the proposed Model scenario using GIS for flood risk assessment."

2.2.16 Zhang et al. [16] have conducted an analysis and frequency of natural flood disasters and their risk assessment in the Pearl River Valley and Luan River Valley, China. The Authors have focused on ARcGIS-based systems specifically designed for water resources applications. The main objective of this study is to use the comprehensive features of the Arc Hydro tool embedded in Arc GIS to obtain the characteristics of reservoir districts for flood disaster management. The advantage of this study depends on the implementation of the Geo database used in spatial data management using Arc Hydro Model. This study provides detailed information on post-flood disaster assessment in critical situations. The weakness of this study depends on the absence of mathematical models deployed in real-world scenarios.

2.2.17 Chen et al. [17], have proposed a conceptual model for urban flood potential in disaster-affected areas. This study provides in-depth details of the GIS-based Urban Flood Irrigation Model (GUFIM) developed at the University of Memphis. Input parameters for this study rely on rainfall-infiltration and runoff analysis for 2-hour and 100-year storm, historical data. The advantage of this study relies on the Storm-run off Model which depends on input parameters such as storm intensity and duration, soil parameters, initial soil moisture status, and pipeline rate. The results of the Storm-Runoff Model serve as input for the Irrigation Model that produces irrigation depth and flood area under disaster conditions. Adaptive waterfall models will be very helpful in urban planning and emergency preparedness in real-world scenarios, especially for pipe systems that play an important role in the dynamics of the drainage system.

2.2.18 Liu et al. [18], have critically analyzed the losses and impacts of flood disasters in Sindh and Punjab Provinces. Remote Sensing (RS) and Geographical Information Systems (GIS) play an important role in real-time flood monitoring along with submerged conditions of various types of disaster-affected areas. The technical flowchart as designed by the Author provides in-depth details of the Flood Extraction Method using decision trees and supervised classification Methods. The main focus of this study relies on detailed statistical data analysis using satellite remote sensing images for the flood-affected population in the agricultural land areas of Muzaffargarh and Dera Ghazi Khan.

2.2.19 Liu et al. [19], have conducted a detailed analysis of flood risk in the coastal areas of Jiangsu, Shanghai, Zhejiang, Taiwan, and Guangdong. The Authors also identify the risk of flooding and its frequency which results in huge economic losses and lives. The ArcGIS geospatial analysis tool proved to be a powerful platform in disaster risk analysis of China's low-lying coastal areas. This decision can greatly help Disaster Relief Authorities to take necessary precautions in places where vulnerability high flood disaster. The study also provides in-depth details of the economic and life threats in China due to the exposure of large populations along with coastal areas.

2.2.20 Zhuowei et al. [20], explained the framework for an integrative application system for flood disaster response and decision-making in critical emergency situations. Decision support systems for flood scenarios are entirely dependent on remote sensing technology and geographic information systems using software-based methods. The core element of this study relies on OHE (Object Hazard Effects). The OHE module is directly influenced by driving factors such as hazard analysis and flood risk analysis vulnerability. These factors will greatly help researchers in decision-making support analysis. The mathematical model proposed by the Author relies entirely on the Realization and Encapsulation methodology. The Authors have also built the software structure for the prototype system using powerful application development tools such as visual C++ and Python.

2.2.21 Root et al. [21], have analyzed the impact of human activities on the hydrographic structure that causes the main reason for flooding. Pixel-based classification methods and IKONOS satellite images are the most frequently used for soil structure analysis. HEC-RAS 4.0 (Hydrology Engineering Center Analysis System) is a specially designed software application that is also used for flood risk and flood flow rate studies. The required results obtained from the software system are used for hydraulic modeling. The merits of this study depend on the identification of flash floods in the Yeniciftlik valley near Istanbul, Turkey. Geomorphological features play an important role in soil hydrology analysis to reduce the impact of flood disaster parameters such as gradient, drainage aspect, etc. The Authors also suggest the use of HEC-RAS hydraulic software to determine the parameters of the land surface to reduce the risk of flooding in the coming years.

2.2.22 Sulaiman et al. [22], aims to explore and identify flood risk assessment for Urban segments using remote sensing and GIS (Geographic Information System). For this purpose in 2008, a Real Time Three Dimensional Simulation Model for Flood Hazard and risk assessment was designed by Nizam Ghazali and Amiruddin Kamsin et al. [9], at the University of Malaya, Kuala Lumpur, Malaysia. The Author's research methodology relies entirely on LiDAR and ASTER satellite images and topographic maps of the City segment that serve as input for the geometric and quantum GIS simulation tools used to produce the simulation results. These results and parameters are very helpful to the Author in designing a flood risk model and explaining each research study process using flow charts. The main features of this study focus on the integration of GIS and RS technology with appropriate tools without the need for knowledge, experience, and large high-cost features required for this study.

2.2.23 Retna Raj et al. [23], has proposed a Disaster Management System Architecture which is mainly based on three main GIS web services namely Police, Fire, and Hospital. A web application has also been deployed using an AJAX (Asynchronous Java script and XML) approach that can be successfully incorporated into Google maps for the addition of spatial data. The authors also propose a three-tier architecture consisting of an XML Http Request and Response infrastructure between the client browser and the web server. The GIS database has also been integrated with a web server for processing SQL queries for analysis purposes only. The advantage of this study is that it relies on fuzzy sets for ranking quality GIS web services. The proposed system is also successfully integrated into a mobile phone that can provide all three emergency services at a selected point on the map displayed on the Mobile Phone. A small drawback depends on the ability of mobile phones to support AJAX applications and their integration into web-supported maps.

2.2.24 Chan et al. [24], has realized that using Google Earth application software for geographic information system using 3D analysis and Digital Surface Model is an important feature for flood disaster management system. A web-based application has been developed that can easily combine Google Earth Pro v.5 and KML files useful for monitoring disaster-affected areas and produce results based on the required parameters. The success factor for this study revolves around the advancement of ArcGIS hydrology tools that can create files to monitor real-time scenario readings related to river movements that cause flooding and related files can also be downloaded for future reference purposes.

2.2.25 Feng et al. [25], have conducted a fuzzy risk analysis using the probability distribution method. The authors have carried out a detailed mathematical derivation using fuzzy set mathematical theory which has proven to be significant and powerful in flood risk assessment. The fuzzy cut set of the probability distribution method as stated in Figure is a triangular function referred to as the probability level. The advantage of this study depends on the maximum possible risk value α that is located in various categories such as low, high, and acceptable risk areas in a certain geographic area.

2.2.26 Hachmann et al. [26], has focused his study on a structural Health monitoring (SHM) system to detect and localize damage using a wireless sensor network. The authors have proposed a decentralized computing architecture named as Fault Location Assurance Criterion (DLAC). Based on this architecture and a solid literature review, his research turned to fault location algorithms based on Fast Fourier Transform (FFT) and force spectrum analysis of raw vibration readings. Graphical results based on low power detectors represent the correlation of damage between various discrete locations. The authors have carried out a structural configuration using a steel truss structure and highlighted the elements that are the cause of damage in the case of healthy and damaged trusses. The strengths of this study focus on limited power management and reducing latency. A minor factor of weakness of DLAC is that it cannot locally detect small damages and symmetrical structures.

2.2.27 Almedar et al. [27], provides an overview of the wireless sensor network scenario especially for healthcare applications. The author's design considerations depend primarily on the Body Area Network Subsystem. The BAN system consists of RFID Tags that are implanted in children and the elderly in emergency situations. The authors have also designed a modular representation for a comprehensive healthcare monitoring system in the future. The system is responsible for monitoring daily activities, fall and movement detection, location tracking, medication intake, and medical status monitoring. A strong point of the research relies on a low-cost and energy-efficient architecture. The main challenges faced by the authors are security, privacy, ease of tracking, and scalability for ad hoc WSN scenarios.

2.2.28 Johansson et al. [28], presented an Integrated Step Sensor (SIGS) architecture. The proposed system is a low-cost and energy-efficient WBAN (Wireless Body Area Network) system, using radio frequency-based network technology specially designed for patients, the elderly, and people affected by disaster situations. The ANT-based Personal Server experimental device is capable of receiving feedback from wireless pressure sensors to help doctors analyze the treatment of walking problems and fall prevention. The conclusion of the research work supports high transmission rates using GSM/Wi-Fi and Bluetooth communication infrastructure. For increased channel utilization and energy efficiency, GFSK and TDMA modulation schemes. Disadvantages based on expensive wireless network scenarios that are difficult to implement in real-life situations.

2.2.29 Chen et al. [29], have focused on past healthcare efforts including self-configuration and real-time healthcare instruments used by caregivers and physicians to improve healthcare quality. Research work has been carried out at the University of Jonkoping, Sweden mainly for the health care of the elderly. The proposed system based on (DDS data decision system) consists of wireless sensor nodes connected with a smart database gateway. The author has also implemented an Ethernet module to communicate with a remote server in a healthcare center and a GSM/GPRS module is used to send emergency messages to hospitals for medical needs. The main focus of this research is moving towards low-cost and energy-efficient real-time embedded systems and faster response in critical situations. The challenge facing researchers is secure data transmission and communication. Hidden Markov Models can also be used in the future to upgrade Data Decision Systems.

2.2.30 Y.zatout et al. [30], have implemented a three-level wireless sensor network architecture. The authors have proposed a Wireless Sensor Network solution for healthcare monitoring. Low-density heterogeneous sensor nodes are placed evenly in various locations in the home. The Body Sensor Network architecture consists of a Medical Node (MN) that is responsible for transferring information to a Coordinator Node (CN). The coordinator node sends information to the video node (VN) for event detection. The video node periodically sends relevant information to the sink node. The Medical Node is responsible for monitoring the patient's health status including shock, body temperature, Electrocardiogram (EKG), and pulse rate. The success factor of this research depends on a mobility-sensitive and energy-efficient protocol. The lack of this research is the integration of three-level network architecture with secure and reliable data transmission.

2.2.31 Gadallah et al. [31], have adapted the techniques used in MANETS (Mobile Ad Hoc Networks) which are particularly applied in disaster events in crowded buildings, possible fire places, and gas leaks. The main concept behind this study hinges on the need for rescue authorities to search and locate earthquake-affected people under collapsed buildings, fallen lampposts, and trees. The authors have proposed network participant nodes including service provider nodes, service receiver nodes, and command center communication nodes to communicate with each other using wireless infrastructure. The authors' practical work relies on an advanced version of the Dis SERV simulator for simulating wireless sensor networks. The proposed algorithm is also suitable for service discovery and service provider reservation. The weakness of the research centers on the expensive architecture to implement in real-world scenarios.

2.2.32 Aziz et al. [32], have gathered evidence about the occurrence of climate-related disasters with high levels of flooding, landslides, and impending heat waves. In Malaysia, the most common natural disasters occur due to heavy rains, floods, and landslides that pose a threat to millions of people in disaster areas. There are various issues to consider for deterministic and random placement of wireless sensor nodes. Blanket coverage, barrier coverage, and sweep coverage play an important role in maintaining connectivity with remote servers or base stations. Controlled and uncontrolled mobility depends on the movement of the sensor in a narrow or small space. The success factors for this study are early warning flood detection system for landslide monitoring, WSN air pollution monitoring system, WSN for volcanic eruption monitoring, WSN for Earthquake Disaster Correction in urban areas, WSN for Robotic Emergency Search and Rescue System (RESRS). . The weakness of the study is the lack of graphical representation for the research model used in real-life scenarios.

2.3 Integrated Intelligent Research (IIR)

The proposed circuit architecture has the following hardware unit power supply, temperature sensor, rain sensor, humidity sensor, ARDUINO UNO, relay driver and LCD. Figure 1 shows the circuit processing proposed by this study.

In this circuit sensing unit contains temperature, rain, and humidity sensors and this unit transfers the sensor values to the Arduino unit and the microcontroller based on the Arduino threshold value and the microcontroller sends a signal to the communication unit. The communication unit updates the information in the internet resource using Wifi ESP 8266.

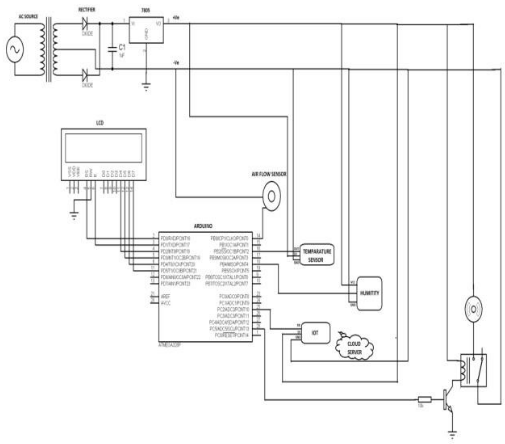

Diagram 2.1 : Design System

2.4 Universiti Tun Hussein Onn Malaysia Publisher's Office

Among the components used in this research project to produce a complete system that can function well are:

i. Arduino ATMEGA328P
ii. Water float sensor switch
iii. Global System for Mobile Communication (GSM) module

Arduino works to receive signals and then produce signals based on the input that has been processed at the beginning. In addition, this water level sensor consists of an electromagnetic switch that causes the switch to open or close. The water flow sensor works to measure the parameters of torrential water. The function of the GSM module is to process data and send SMS to the user.

Diagram 2.2.: Global System for Mobile Communication (GSM) module

2.5 Flood Detector Released by CAREL Company

CAREL's flood prevention system is a device designed to quickly and reliably detect unwanted water leaks, to protect equipment or special environments such as ultrasound rooms, offices, laboratories, industrial facilities, boiler rooms. The advantages of the device include simple operation, no configuration and maintenance required and easy connection. Just connect the power supply, sensors and signal devices. Usually, the detector is installed in the electrical equipment, while the sensor is located in the controlled area. When the sensor is wet with water, the ltras signal is activated. Two types of testers are used to respond to the different needs of the application. A network of sensors connected in parallel series can be created to control a group of points at the same time with the same detector. This system has an unbeatable price or performance ratio and represents a solution for a wide variety of applications.

Diagram 2.3: Flood Detector Released by CAREL Company

2.6 Summary

According to some studies we have obtained, some materials such as ESP8266 Wi-Fi Module and Global System for Mobile Communication (GSM) module have been used as a text messaging system.

CHAPTER 3

METHODOLOGY

RESEARCH

3.1 INTRODUCTION

This chapter will be discussing and explaining in detail some important points in the methodology and strategy used in completing the study. The research methodology makes the research conducted more systematic and the research process more directed in achieving the objectives and goals of the study. We have systematically planned the research methodology and the strategies that will be used to obtain information and data through certain methods.

3.2 FLOW CHART

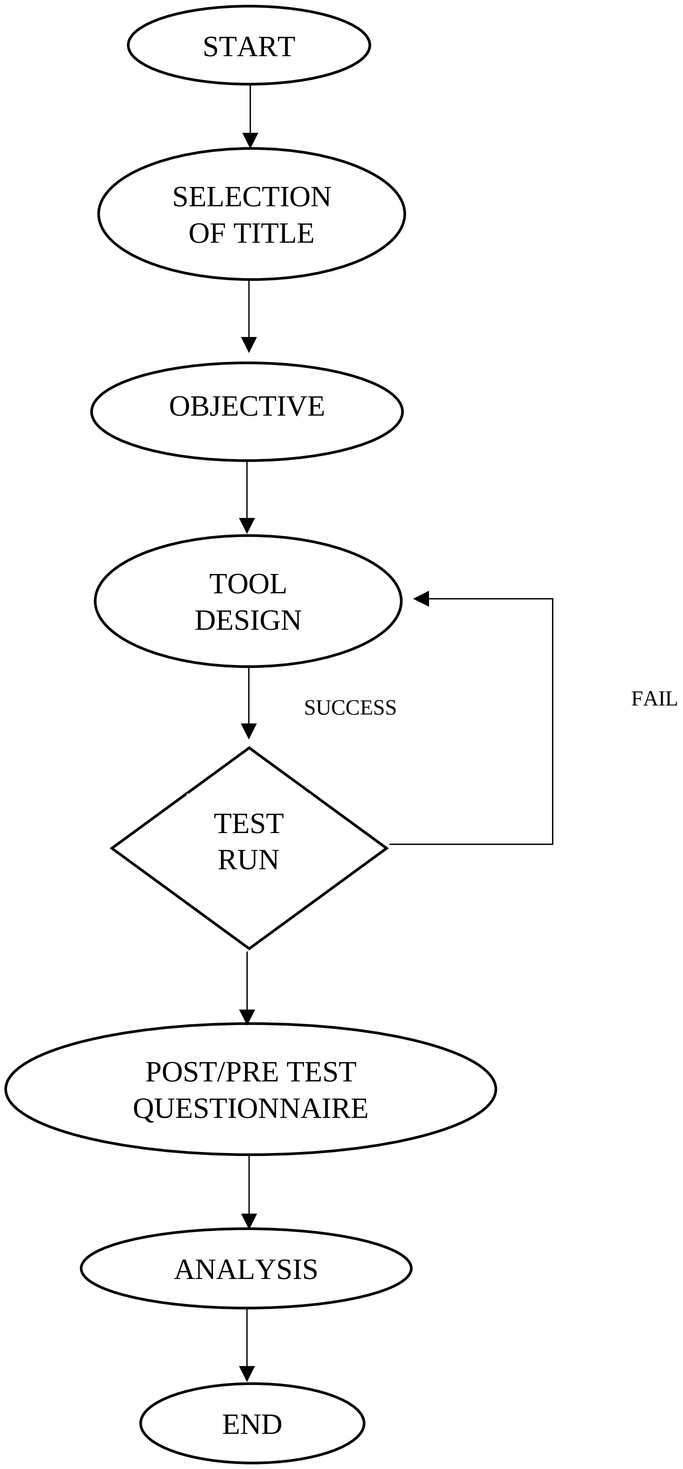

Diagram 3.1 : Flow Chart

3.3 MATERIALS

3.3.1 Arduino Set

Arduino is an open source electronics platform based on easy-to-use hardware and software. It consists of a physical ultrasonic circuit board (often referred to as a microprocessor) and an ultrasonic environment, or Integrated Development Environment (IDE), to write code and upload it to the circuit board. An Arduino board is able to read inputs (such as ultras on a sensor, a finger on a button, or a Twitter message) and convert them into outputs (activating a motor, lighting an LED, publishing something online, etc.). It is often used by hobbyists, artists, and ultrasonic to create interactive projects that range from simple LED indicators to complex robots.

Diagram 3.2 : Arduino Set

3.3.2 Arduino Water Cover

Protects the arduino set from exposure to dust and can certainly prevent water from flowing.

Diagram 3.3 : Arduino Water Cover

3.3.3 Water Level Sensor

Measure the parameters of water hardness and calculate the quantity of water flowing. A water level sensor is a device used to detect and measure the depth of water in a tank, reservoir, or any container containing water. These sensors are important for a variety of applications, including water management systems, flood monitoring, industrial processes, and home automation. Arduino can be used with various types of water level sensors to effectively monitor and control water levelsMengukur parameter kederasan air dan mengira kuantiti air yang mengalir**.**

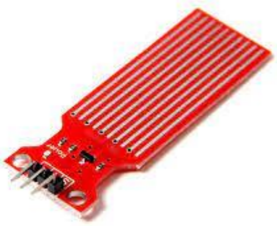

Diagram 3.4 : Water Level Sensor

3.3.4 Ultrasonic Sensor

Measuring distance using ultrasonic waves. Ultrasonic sensors, or ultrasonic distance sensors, are devices that use ultrasonic sound waves to detect the distance of objects or obstacles in front of them. They work by sending ultrasonic pulses and measuring the time it takes for a sound wave to bounce back after colliding with an object. Based on the time it takes for the wave to return, the sensor can calculate the distance to the object.

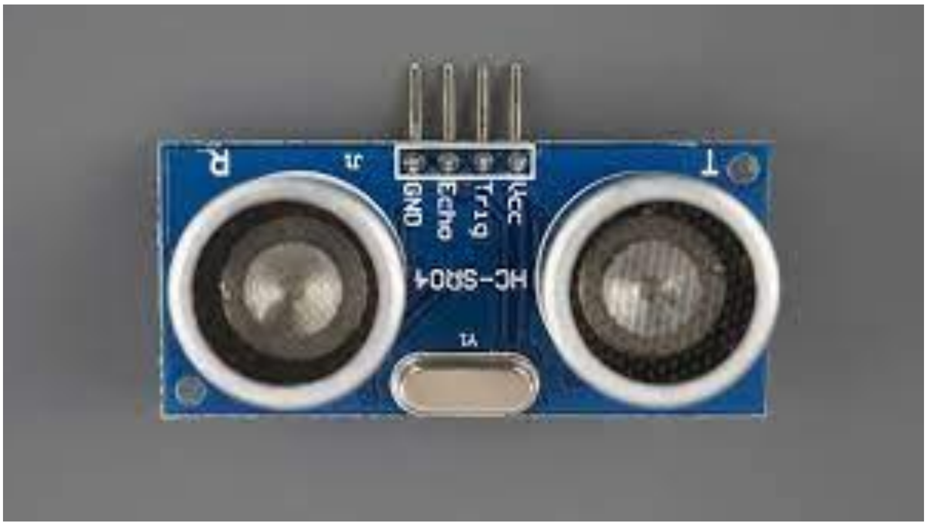

Diagram 3.5 : Ultrasonic Sensor

3.3.5 Mini Buzzer

Used as an alarm to provide input voltage, the electronic buzzer will produce a sound like a sound wave that can be heard by humans.

Diagram 3.6: Mini Buzzer

3.3.6 Stick

Used as a stabilizer and holder for Arduino tools that will be installed at the scope of the study

Diagram 3.7 : Stick

3.4 Estimated Cost

Bil	Material	Quantity	Cost per Unit	Total
1	Arduino UNO Set	1	RM 59	RM 59
2	Arduino Water Cover	1	RM 5	RM 5
3	Water Level Sensor	1	RM 10	RM 10
4	Ultrasonic Sensor	1	RM 15	RM 15
5	Mini Buzzer	1	RM 20	RM20
6	Stick	1	RM 0	RM 0
			TOTAL COST	RM 109.90

Table 3.7: Estimated Cost

3.5 Gantt Chart (M1-M14) FYP 1

MINGGU/ AKTIVITI PROJEK	R/L	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14
Taklimat FYP 1 & Implementation of Design Thinking	R														
	L														
Penghantaran Video A & Perjumpaan Pelajar bersama Penyelia Projek	R														
	L														
Perjumpaan pelajar bersama penyelia projek	R														
	L														
Penghantaran Video B & Design Thinking Bootcamp	R														
	L														
Pembentangan Kemajuan Aktiviti Projek	R														
	L														
Penghantaran draf keseluruhan pelaporan projek 1 & Perjumpaan pelajar bersama Penyelia Projek	R														
	L														
Pembentangan Akhir Projek & Penghantaran Logbook	R														
	L														
Penghantaran Pelaporan Projek	R														
	L														

Table 3.8: Gantt Chart

3.5 Gantt Chart (M1-M14) FYP 2

Table 3.9: Gantt Chart

3.6 Grouping Timeline

Project Task	Person in Charge (PIC)	Date	Catatan
Video A	Lea	4/9	• Editor: Lea • Assitance from Ian • Presented by: Ian, Lea, Sofea
Video B	Lea	21/10	• Editor: Lea • Assitance from Ian • Presented by: Ian, Lea, Sofea
Progress Presentation Project Activities	Ian	23/10	• Editor: Lea, Ian • Assitance from Sofea • Presented by: Ian
Purchase of Materials	Lea	4/11	• Purchased by: Lea • Paid by: Lea, Ian, Sofea
Basic Design of Tools	Ian	20/11	-
Draf Report 1	Lea	25/11	• Done and printed correctly by Lea
Draf Final Presentation Slide Project	Lea	26/11	• Edited by Ian
Final Project Presentation	Ian	27/11	• Presented by Lea, Ian, Sofea
Final Draf Report 1	Lea	5/12	• Reported by Lea • Assitance from Ian

Table 3.10 : Grouping Timeline

CHAPTER 4

FINDINGS

& DISCUSSION

4.1 INTRODUCTION

Floods are natural disasters that often cause great losses to human life, property and the environment. Every year, thousands of people lose their homes and millions of properties are destroyed by floods. Therefore, our flood sensor will provide a good warning when there is a risk of flooding which is very important to protect their property. One of the main challenges in flood control is the lack of effective ltras to detect and provide early warning of potential floods. Traditional methods such as weather monitoring and visual observation are often not quick or accurate enough to provide an adequate warning to ultrasonics. In this project, we will use ultrasonic sensors for changes in water surface height, such as pressure sensors or ultrasonic sensors. These sensors will be installed in the location that we have chosen as the scope of the study area. The data collected by the sensors will be processed using certain algorithms to identify patterns that indicate potential flooding.

4.2 Study Findings

4.2.1 Questionnaire

Questionnaires have been distributed in the form of google forms that are included with a QR code for students and staffs within the study area to provide feedback on the Flood Sensor Tool for any improvement. An interview session has also been conducted with 2 students of *Jabatan Perdagangan* to gather information about areas that often occur in the department and the problems they experience when the water rises in their area. The 'Google form' that has been distributed contains several items and students are asked to fill in background questions before answering the questions about the Flood Sensor tool. Amongst them are as in the following diagram:-

Section A

- Name
- Email
- Department

Section B

- Question 1
- Question 2
- Question 3
- Question 4

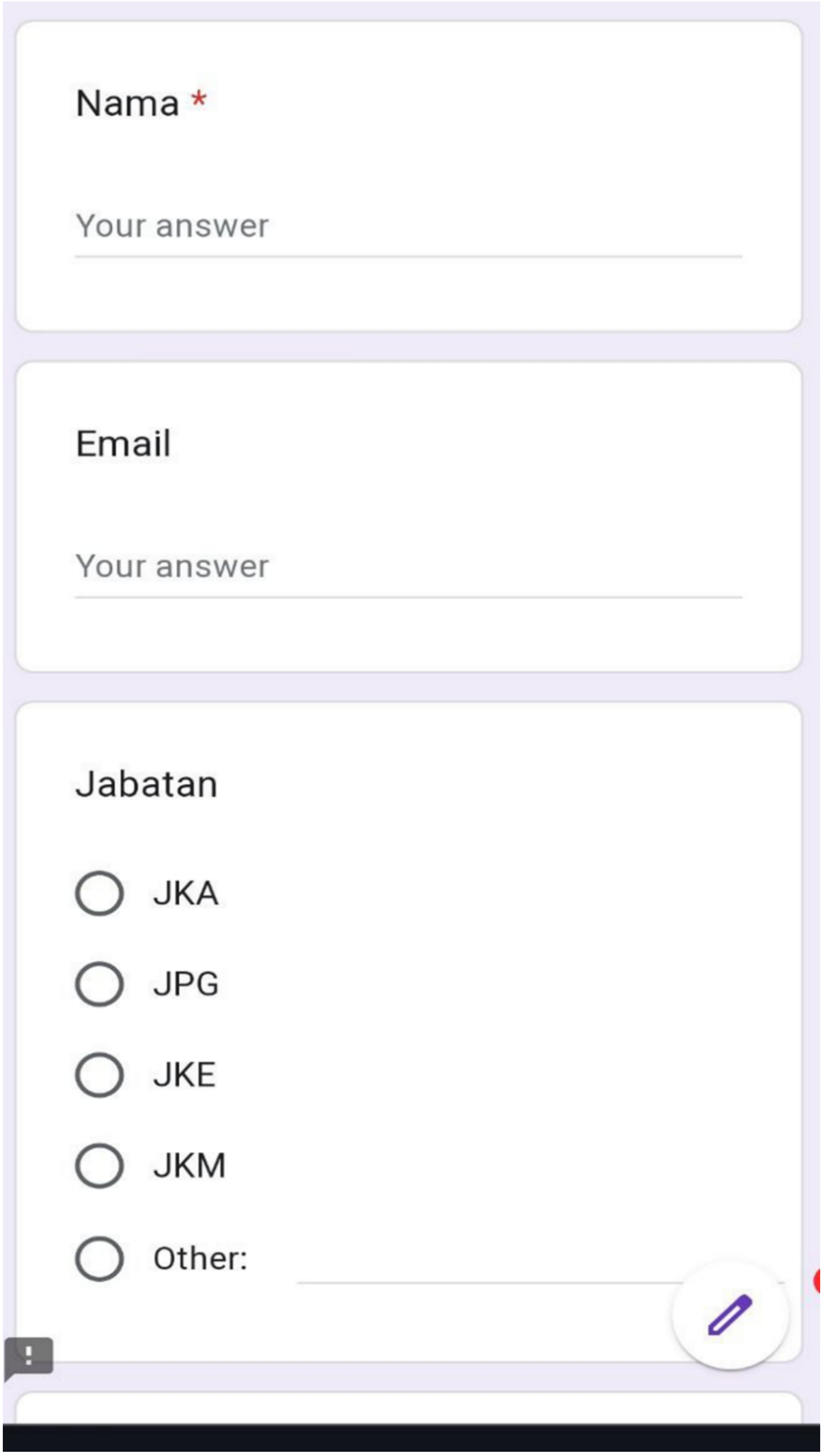

Diagram 4.1 Background Question

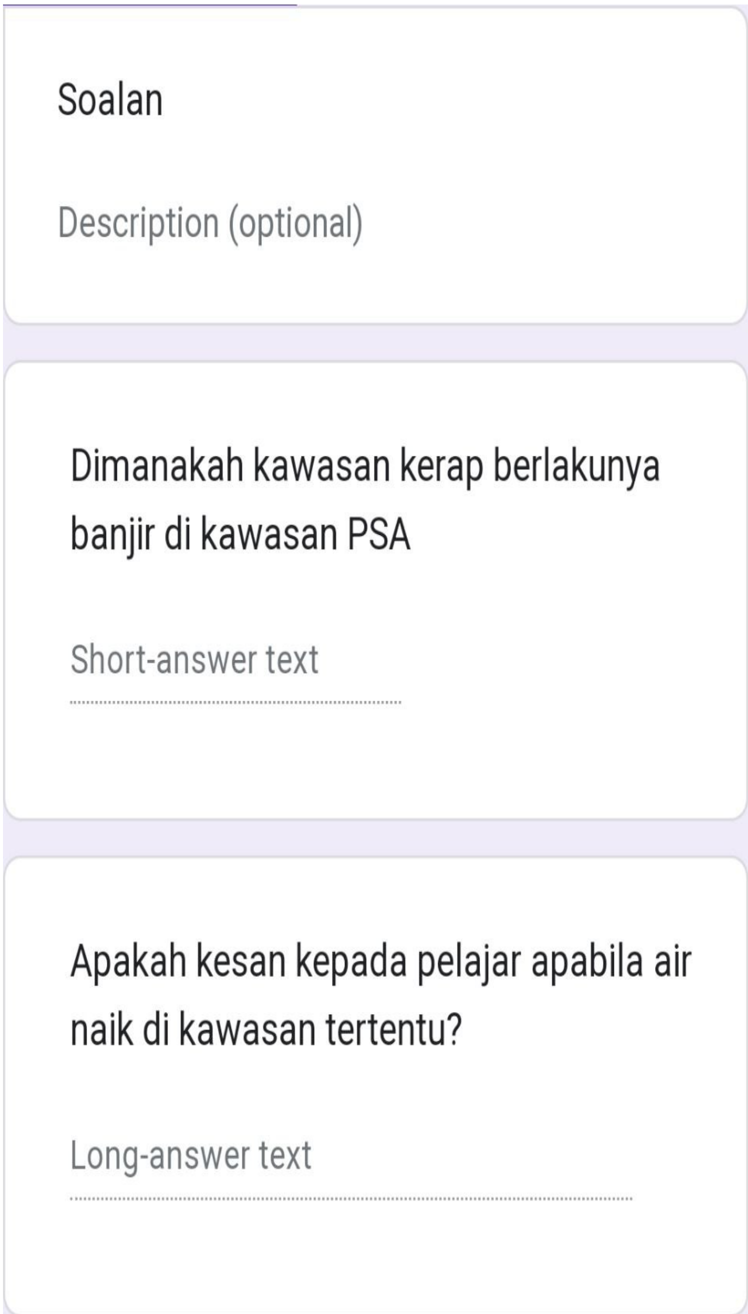

Diagram 4.2 Google Form Question (i)

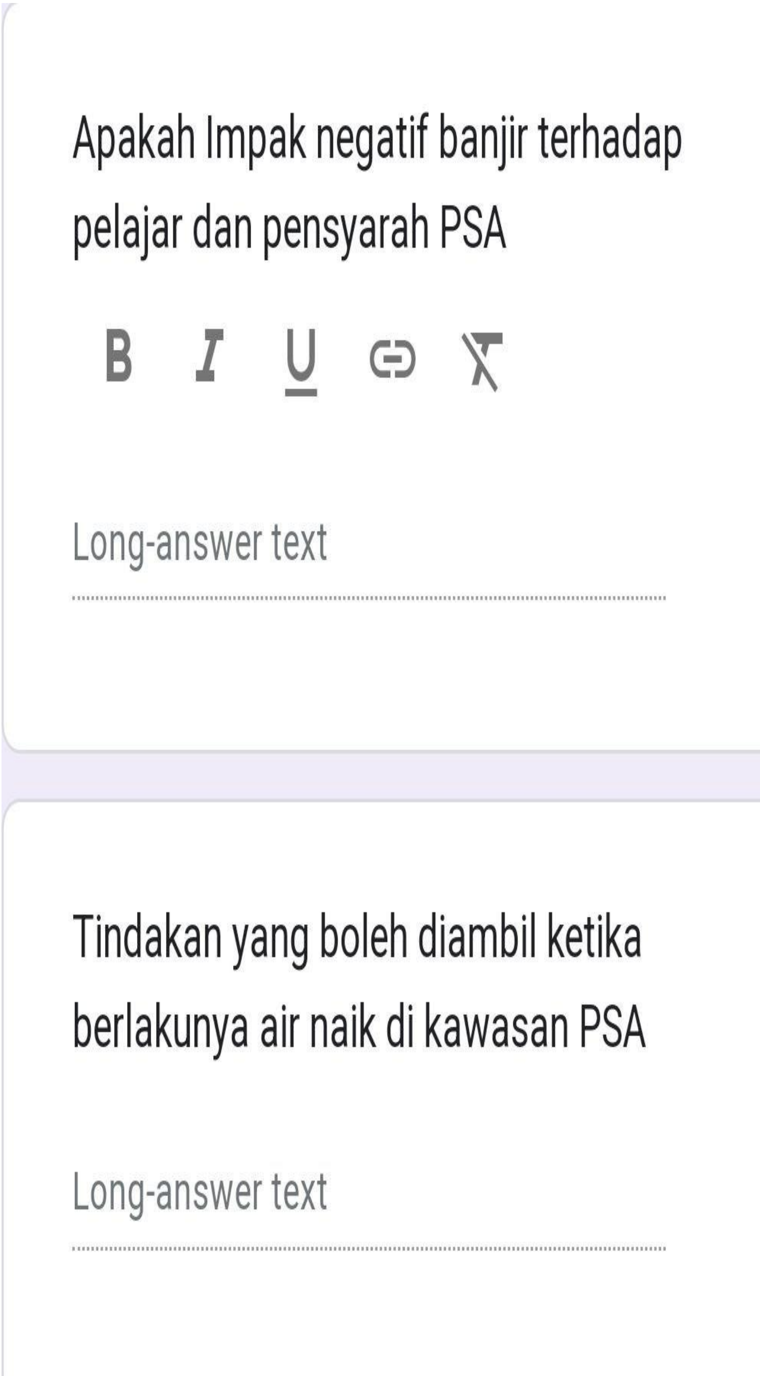

Diagram 4.2 Google Form Question (ii)

4.2.2 Response to Questionnaire

Posters and google forms were distributed in the area of *Jabatan Perdagangan* when the Flood Sensor Device was installed in the scope of the study to obtain information or feedback as to whether the Flood Sensor Device can be heard or not. The pie chart below shows how many people can hear and cannot hear the Flood Sensor Tool.

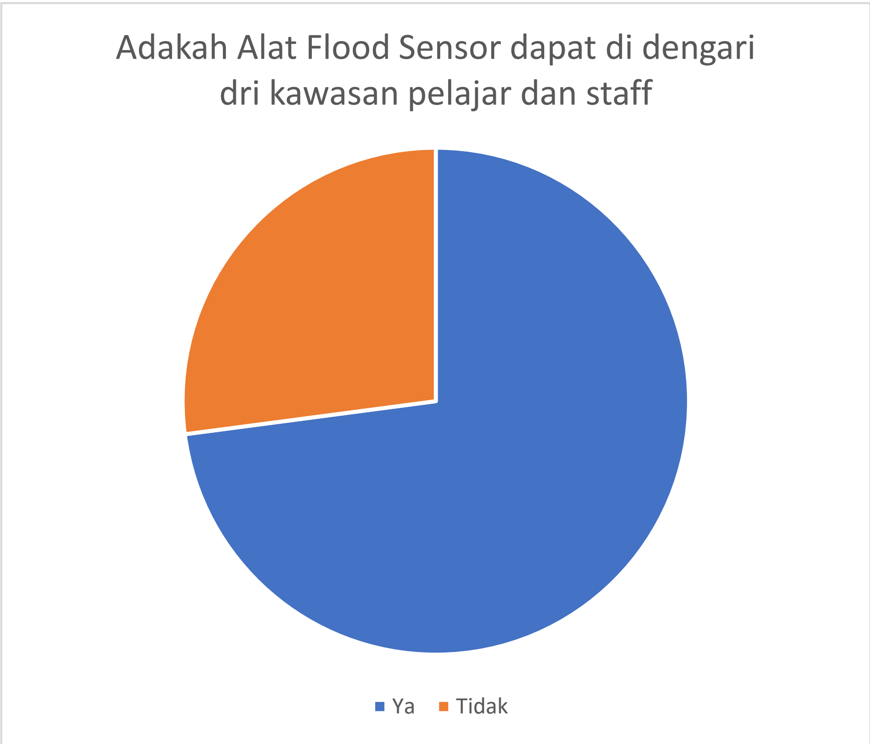

Diagram 4.3: Google Form Response

4.3 Data Collection

Distance	10m	20m	30m
Sound	Clear	Clear	Unclear

Table 4.1 : The Hearing Distance of the Flood Sensor Device

Depth of Water	20cm	30cm	40cm
GSM Alert - Sound	• Safe • Soundless	• Warning • Loud sound	• Dangerous • Loud noises (sirens attached)

Table 4.2 : Flood Sensor Warning Sound

4.4 Discussion

4.4.1 Buzzer Improvement

Based on the answers and feedback from the students of the *Jabatan Perdagangan*, we propose to replace the 5v buzzer with a 12v buzzer to enable students and staff in the study area to hear the warning alarm blaring from the Flood Sensor Device.

Diagram 4.4 : 12v Buzzer

4.4.2 Battery Improvement

After placing the flood sensor device in the study area, the device only lasted for three days when using batteries. We proposed to replace the battery with a Mini Solar for long-term use.

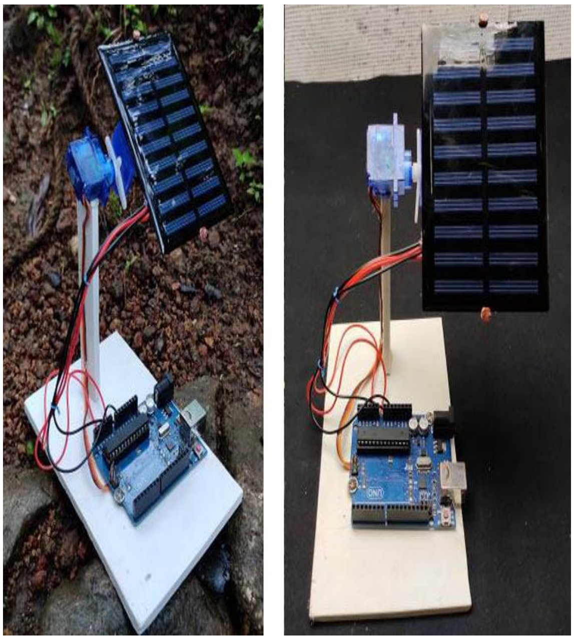

Diagram 4.5 : Mini Solar

4.4.3 Siren Installation

The installation of this siren aims to give a more audible signal to students and staff when they are in the confinements of a bulidng. This is because, when it rains heavily, the sound of the buzzer can be vaguely heard and through the installation of this siren, it can warn students and staff by the loud sound of the sirens.

Diagram 4.6: Siren

4.5 Arduino

Arduino is a popular open-source platform for the development of microcontroller-based hardware prototypes. Arduino data refers to information or signals received, processed or sent by the Arduino microcontroller.

4.6 Main Components of Arduino Data

Arduino data often comes from sensors connected to the Arduino board. These sensors can be diverse, such as temperature sensors, humidity sensors, motion sensors, distance sensors, light sensors, and many more. Sensors measure certain environments or conditions, and the data produced is then taken by the Arduino board for further processing.

4.6.1 Microcontroller Processing

The Arduino board is equipped with a microcontroller (usually from the AVR or ARM family) that processes the data received from the sensors and makes decisions based on the program that has been programmed in it. The microcontroller converts the analog data from the sensor into a digital format that can be understood and processed.

4.6.2 Output

Once processed, the data that has been processed by the Arduino microcontroller can be used to control various output actions. This can include moving a motor, turning a light on or off, turning a device on or off, sending a signal or data through wireless or wired communication, and more.

4.6.3 Serial Communication

Arduino is often used to send and receive data through serial communication. This can involve simple serial communication between Arduino and other devices or more complex serial communication such as serial communication via USB with a computer.

4.7 Examples of Arduino Data Usage

There are various ways to get data through Arduino as described:

4.7.1 Environmental Monitor

An Arduino project can use temperature and humidity sensors to monitor the environmental conditions in the room. This data can then be displayed on an LCD screen or sent to a computer for further analysis.

4.7.2 Self Handling

A plant irrigation system itself can use a soil moisture sensor to detect soil moisture and based on the data, the Arduino can control the water pump to water the plants when needed.

4.7.3 Security System

Arduino can be used in home security systems to detect motion using a PIR motion sensor and if motion is detected, Arduino can send a notification via SMS or email.

4.8 Summary

Flood sensor is an important technology that aims to detect early changes in the water level by anticipating the threat of flooding. By utilizing sensors that are sensitive to changes in the height of the water surface, this system is able to measure and monitor the water level in rivers and waterways. The data collected by the sensor is then processed by an Arduino microcontroller or similar system to identify patterns that indicate potential flooding. As soon as the flood threat is detected, the system will indirectly send a warning to the community and related parties through various communication channels such as SMS, email or smart applications. Thus, flood sensors not only help improve preparedness and response to flood but also minimize property and human losses caused by flood disasters by providing accurate early warning.

CHAPTER 5

CONCLUSION

& SUGGESTION

5.1 Introduction

In conclusion, the flood sensor has great potential in improving preparedness and response to the threat of flooding. With its ability to detect changes in the height of the water level and provide warnings to the community and related parties, flood sensors can minimize losses caused by floods, both in terms of property and human losses. The application of flood sensors can also help in optimizing the use of resources in flood control, by enabling a more efficient allocation of time and energy. In addition, flood sensors can be integrated with existing flood monitoring systems, thus enabling a more efficient exchange of data and information in flood risk mitigation efforts. In this context, flood sensor is not only a technological tool, but also part of a larger solution in flood disaster management. By continuing to develop and improve this technology, it is hoped that a safer and more responsive environment will be created against the threat of flooding in the future.

5.2 Suggestion

Here are some suggestions for improving the Flood Sensor Tool:

1. Changing the 5v buzzer to a 12v buzzer to enable students and staff in the study area to hear warnings from the Flood Sensor Device.
2. Replace the battery with a Mini Solar for long-term use.
3. The installation of this siren aims to give a more visible signal to students and staff when in the confinements of a wall. This is because, when it rains heavily, the sound of the buzzer can be heard clearly and through the installation of this siren, it can warn students and staff by hearing the sirens.

5.3 Summary

In conclusion, our Flood Sensor project has a high potential to be marketed to the public when improvements such as a high-pitched buzzer and mini solar are added to the Flood Sensor.

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Appendix A

Diagram A: QR Code