MANIPAL
INTERNATIONAL UNIVERSITY

ECB 4253 FINAL YEAR PROJECT(FYP1)

DEPARTMENT OF COMPUTER ENGINEERING AND COMPUTER SCIENCE

A Flood and Fire Detection System with Corrective Actions

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FYP 1 REPORT

March 2023

MANIPAL
INTERNATIONAL UNIVERSITY

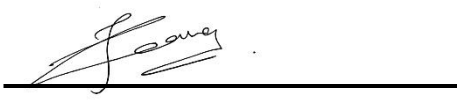
FYP1 (ECB 4253 SCB 3192)

CLEARANCE FORM (*To be filled by students and get signed from examiners & supervisors*)

Title of the FYP1: A Flood and Fire Detection System with Corrective Actions

We hereby declare that above title FYP1 project research is the result of our own investigations, except where otherwise stated. Other sources of information are acknowledged by giving explicit references is appended. This report is submitted to the Department of Computer Engineering and Computer Science, School of Engineering and Computing, Manipal International University as fulfilment of the requirements for the Bachelor of Computer Engineering with Honours/ Bachelor of Computer Science with Hons completions.

Student



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MANIPAL
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ECB 4253/ SCB 3192_FINAL YEAR PROJECT 1

DEPARTMENT OF COMPUTER

ENGINEERING AND COMPUTER

SCIENCE

A Flood and Fire Detection System with Corrective Actions

Final Report

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ABSTRACT

The goal of the project is to create an Arduino based flood and fire detection system using the concept of internet of things (IoT) with corrective action against flood and fire. The system aims to detect floods and fires in the home and alert homeowners even when they are not at home. The proposed system uses sensors to monitor water levels and flames, sending alerts to homeowners' smartphones in an emergency. Additionally, the system takes remedial action against fire and flooding by using water sprinklers and wall blocks to prevent water from entering the home. The system also provided a camera for surveillance purposes for the owner to make sure the alerts are true. The system is Arduino based, cheap yet efficient. The scope of the project includes designing and building the system, testing it in different scenarios, and improving the system if necessary. The limits of sensors used in the system are studied to ensure their effective use. The proposed system aims to provide an affordable and efficient solution for flood and fire detection in smart homes, with the added benefit of taking corrective action itself.

ACKNOWLEDGMENT

I would like to extend my sincerest gratitude to all those who have supported me thus far in the development of the Flood and Fire Detection System project. First and foremost, I want to express my deepest appreciation to my project supervisor, who has provided invaluable guidance and support throughout the process. Their expertise and knowledge in the field have been instrumental in shaping the direction and progress of the project. I am also immensely grateful to the project coordinator, who has been instrumental in keeping me on track and providing valuable feedback and insights. Their organizational skills and feedback have helped me refine and improve the system's design and functionality. Furthermore, I want to acknowledge the head of the department of Computer Engineering and Science and all the lecturers who have contributed to my knowledge and understanding of relevant concepts and technologies. Their teachings have played a crucial role in the development of the Flood and Fire Detection System. I would also like to express my gratitude to the Dean of the School of Engineering for their support and provision of resources. Their assistance has been vital in acquiring the necessary equipment and materials for the project's implementation. Lastly, I want to acknowledge the unwavering support of my family and friends. Their encouragement and motivation have been crucial in keeping me inspired and focused throughout the project's development. To everyone mentioned above and anyone else who has contributed to the progress of the Flood and Fire Detection System, I am deeply thankful. Your support, guidance, and belief in me and the project have been invaluable. I look forward to continuing the development process with your ongoing support and bringing this system to completion.

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CHAPTER 1: INTRODCUTION

1.1 Overview

Experiencing a fire or flood can be a traumatic event that can cause significant mental stress for those affected. The aftermath of such events can be overwhelming, with people having to deal with the loss of property, displacement from their homes, and potential injuries or fatalities. In addition to the immediate impact of the event, people may also experience long-term psychological effects such as anxiety, depression, and post-traumatic stress disorder (PTSD) [1] [2]. Extreme weather events have increased around the world in recent years, increasing the frequency and severity of floods. Additionally, an accidental fire can break out at any time and the consequences can be devastating.

Having effective fire and flood safety systems in place can help reduce the risk of these events occurring and minimize their impact if they do occur. Knowing that one's home is protected by reliable safety systems can provide peace of mind and reduce anxiety related to potential disasters.

Modern early warning systems have come a long way from the primitive warning signals of bonfires and wind instruments. As technology has advanced, so too have the capabilities of early warning systems to warn vulnerable people more quickly and reliably. From the use of mechanical warning devices in the 18th century to this development of the electromechanical siren in the 20th century, early warning systems have become increasingly centralized and sophisticated [5]. Fire protection systems have been in use for centuries, with early examples such as bucket chains and hand pumps. Today's modern fire protection systems are increasingly electronic driven; use a combination of sensors, alarms, and suppression systems to rapidly detect and extinguish fire and rely on faster and more secure data transmission.

Flood safety systems have also been used for centuries, with early examples such as levees and dams. The 20th century saw the development of more sophisticated flood control measures such as reservoirs and drainage systems [4]. Today's modern flood safety systems combine sensors, alarm systems and evacuation plan to protect people from flooding.

Flood and fire alarm systems based on Arduino technology and IoT help homeowners effectively identify and respond to potential hazards in their homes. Some of the hazards that can occur in homes are flooding and fire, which can cause serious property damage and even endanger human life. In the event of flooding, the system can detect rising water levels and turn on the alarm, send real-time alerts to the homeowner's mobile his device and as well as the surveillance for the event. In the event of a home fire, the system can detect the presence of heat and turn on the alarm, send

real-time alerts to the homeowner's mobile his device and as well as the surveillance for the event. The proposed system be using Arduino uno, ESP32 Camera module to enable camera view, flood detection using flood level sensors and fire using fire sensors and upon detection shall alert the user app alert using Cayenne app and trigger the house alarm. Additionally, the system itself can take corrective action such as water sprinkler and wall blocker. One of the main benefits of this system is that it gives homeowners peace of mind by proactive approaches to preventing damage to their homes and property, allowing them to not be burdened by insurances, loss of lives and property damage. This feature is especially important for homes that may be absent in an emergency, allowing the system to act when no one is there.

In summary, his Arduino-based IoT flood and fire alarm system is an essential investment for homeowners looking to protect their homes and property from potential hazards. With real-time notifications and the ability to take self-remedial actions, this system provides homeowners with valuable information and peace of mind. Additionally, the system is highly customizable, cost-effective, and easy to use, making it an ideal solution for a wide variety of homeowners.

1.2 Problem Statement

The problem is that floods and fires can occur unexpectedly and spread rapidly, causing serious damage to homes and endangering the lives of residents. The speed and intensity of these disasters make it difficult for homeowners to take corrective action quickly enough to mitigate the damage. Fires can release toxic gases and cause explosions, further endangering residents. Therefore, an efficient and affordable IoT-based flood and fire alarm system that can detect these disasters in real time, notify homeowners while enabling the surveillance for the event, and take corrective action to mitigate the damage caused is required.

1.3 Objectives

i. To build a fire detection system using IoT which would detect the fire, send an emergency alert, trigger the house alarm as well automatically take corrective actions to prevent fire from spreading by automating water sprinkler system.
ii. To create a flood detection system using IoT which would detect the flood water level and send an emergency alert, trigger the house alarm as well automatically take corrective actions to prevent flood spreading by automating an anti-flood barrier.
iii. To enable a camera view for surveillance purposes for both flood and fire detection.

1.4 Scope of project

This proposed system will be using a microcontroller and external camara to view flood and fire scene upon flood detection using flood level sensor and fire using fire sensor. Upon detection shall alert the user via SMS, App alert using an app and trigger the house alarm with the corrective actions to put off the fire and divert the water away using barrier. The flood will be detected by each water level sensor due to the increase in the water level.

The system can be broken down for 4 units and the scope of the work for each unit follows:

1. Fire Detection System
    a. 3 Flame sensors will be used for fire detection, and each will be placed in a circle.
    b. The alarm goes ON upon fire detection from approximately 3 meters away.
    c. An app alert will be sent to the user's device using the Cayenne app.
    d. The alarm can be turned OFF by a switch.
    e. Water sprinkler turn ON
2. Flood Detection System
    a. 3 water level sensors will be using to detect the increasing water level by 3 levels.
    b. Level 1 (20cm)
        i. The anti-flood barrier motors turn ON and barrier goes up.
        ii. The wall can be turned down by a switch.
    c. Level 2 (40cm)-
        i. An app alert to the user's device will be sent using the Cayenne app.
        ii. When the water is detected, the alarm goes ON.
    d. Level 3 (60cm)-
        i. An app alert to the user's device will be sent using the Cayenne app.
        ii. When the water is detected, the alarm stays ON.
3. ESC 32 Camera
    a. The user can surveillance the area to make sure the app alert is true.
4. Cayenne App
    a. To get the app alert to each flood and fire detection according to the specific condition.
    b. To stream a live video of the area where the system will be installed at home.

1.5 Limitation of the Project

The limitation for the project is followed:

1. This project is limited to flood and fire detection with corrective action and does not include other home automation features such as temperature control, lighting, or security.
2. Flame sensors typically have a range of a few feet so their range can be limited by the strength of the flame and the level of ambient light in the surrounding area.
3. Water level sensors can be limited by factors such as water clarity, sensor placement, and interference from other objects in the water.
4. The ESP32 Wi-Fi module requires a strong network connectivity, otherwise the alert message to the user can get delayed and the live streaming for surveillance of the event by the camara can get disrupted.
5. The system is limited to 2 main corrective actions such as water sprinkler for the fire extinguishing and a wall (anti-flood barrier) turn up to block the water coming more to the system placed room. Any other actions such as ventilation system to act against a fire is not included.
6. Sensors can malfunction when an event occurs.

1.6 Chapter Summary

This chapter included the overview of the project which explained the importance of the project. It explained the necessity of a cost-effective and affordable fire and flood detection systems for homes with able to response for the danger by itself. Furthermore, this chapter comprehensively explained the objectives of the project, scope of project and limitations which will be followed throughout the project.

CHAPTER 2: LITERATURE REVIEW

2.1 Overview

Literature review is an important part of any research project that involves reviewing existing literature, research papers, books, and other relevant sources of information to assess and summarize existing knowledge in a particular area of research. It aims to identify gaps and limitations in current literature and to highlight important findings, concepts, and theories relevant to the research question. In this chapter, 10 study papers have been taken in reviewing to determine basis for research and indicate the state of knowledge and the need for further research in the field and provide a framework for assessing the impact of the research on the existing body of knowledge.

2.2 Theorical Review

2.2.1 Fire Detection

Fire detection refers to the process of identifying the presence of fire or smoke in a given area. It is crucial for early warning and prompt response to minimize property damage, injuries, and loss of life. Fire detection systems use various technologies and sensors to detect signs of fire, including smoke detectors, heat detectors, flame detectors, and gas detectors. These systems can be standalone devices or part of a larger fire alarm system that includes alarms, control panels, and notification devices. Once a fire is detected, the system triggers an alert, such as sounding an alarm or activating sprinklers, and may also notify emergency services for immediate response. Efficient fire detection plays a vital role in ensuring safety and mitigating the impact of fires in residential, commercial, and industrial settings. In general, fire detection involves the use of sensors and technologies to identify the presence of fire or smoke. The primary objective is to detect fires as early as possible to initiate appropriate responses and mitigate the potential risks. Fire detection systems typically include different types of detectors that are strategically placed throughout a building or area. Smoke detectors are the most common type of fire detectors and use optical, ionization, or photoelectric sensors to detect the presence of smoke particles. Heat detectors monitor the temperature and can trigger an alarm when it exceeds a certain threshold. Flame detectors are designed to detect the presence of flames by sensing their optical characteristics. Gas detectors can identify the presence of specific gases associated with fires, such as carbon monoxide or natural gas. Flame detection can be done typically utilize either ultraviolet (UV) or infrared (IR) sensing techniques to detect

the unique light signatures emitted by flames.

2.2.2 Flood Detection

Flood detection refers to the process of identifying the occurrence or likelihood of a flood in a specific area. It involves the use of various methods and technologies to monitor water levels, precipitation, and other relevant parameters to detect and anticipate potential flooding events. Flood detection systems typically utilize sensors, gauges, and monitoring devices strategically positioned in areas prone to flooding, such as rivers, streams, or coastal regions. These sensors continuously measure and collect data on water levels, rainfall intensity, flow rates, and other variables that indicate the potential for flooding. The collected data is analyzed in real-time or periodically to identify abnormal patterns or threshold exceedances that may indicate an imminent or ongoing flood event. Sophisticated algorithms and modeling techniques may be employed to process and interpret the data, providing accurate and timely information about the flood conditions. Flood detection systems can generate alerts, warnings, or alarms when predefined thresholds or criteria are met, triggering appropriate responses from emergency management agencies, local authorities, or residents in the affected areas. These responses may include evacuation procedures, activation of flood control measures, and dissemination of timely information to ensure public safety and minimize damage. The primary goal of flood detection is to provide early warning and actionable information to mitigate the impact of floods. By promptly identifying and communicating flood events, authorities can make informed decisions, implement effective emergency measures, and allocate resources efficiently to protect lives and property. Flood detection is an essential component of flood management and preparedness, complementing other strategies such as flood forecasting, floodplain mapping, and infrastructure development to mitigate the risks associated with flooding and enhance resilience in flood-prone areas.

2.3 Previous Work Review

2.1.1 Prediction and Effective Monitoring of Flood Using Arduino System Controller and ESP8266 Wi-Fi Module

D. Dinesh and I. Anette Regina (2019) [1] designed a cost-effective system focused on flood prediction and effective monitoring using an Arduino system controller and an ESP8266 Wi-Fi module. The proposed system uses Arduino Uno controller works with temperature sensor, rain fall sensor, and humidity sensor to manage, monitor, display and alert the flood forecast

and warnings as and when required using the advantage of cloud service which make the data can be accessed from anywhere through ThingSpeak website with the help of ESP8266 Wi-Fi module. In this paper, an inexpensive miniature prototype radio frame has been proposed for flood warning stations. The system is designed to solve the timeliness problem of SAR data using sensor modules. It was found that the designed system allows pre-programming of the controllers used to monitor the flood system. The main advantage of this model is the reduction of hardware components in this system.

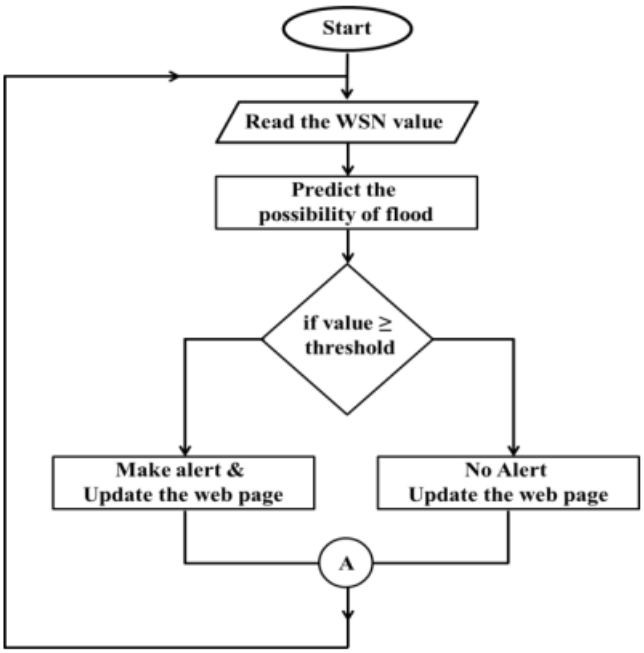

Figure 2.1.1: Flowchart mentioned in D. Dinesh and I. Anette Regina (2019) [1]

2.1.2 Arduino Based Smart Home Warning System

Qusay Idrees Sarhan(2022) [2] has been presented a smart home warning system that uses an Arduino Uno microcontroller and multiple compatible sensors and actuators to efficiently detect fire, gas leak, and intrusion situations. The instruments used in the smart home warning system are Arduino Uno microcontroller, GSM module, MQ2 gas sensor, Flame sensor, PIR motion sensor, DHT22 temperature and humidity sensor, Buzzer, LED bulb, Solenoid valve and Ventilation fan. The system can send notifications to users via GSM radio communication, send SMS messages, emails with photos attached, calls the owner and also warn the owner/residents by sounds a buzzer and flashes a light bulb in an event of a danger. The system also allows homeowners to take proper actions such as stopping fire via water and decreasing

gas concentration in the air via a fan. The system also continuously captures images and saves them in the MicroSD card module to send to the owner. The proposed system is very useful in preventing robbery by detecting movements by thieves. Overall, this study presents a comprehensive solution for smart home security that is affordable, easy to implement, and highly effective.

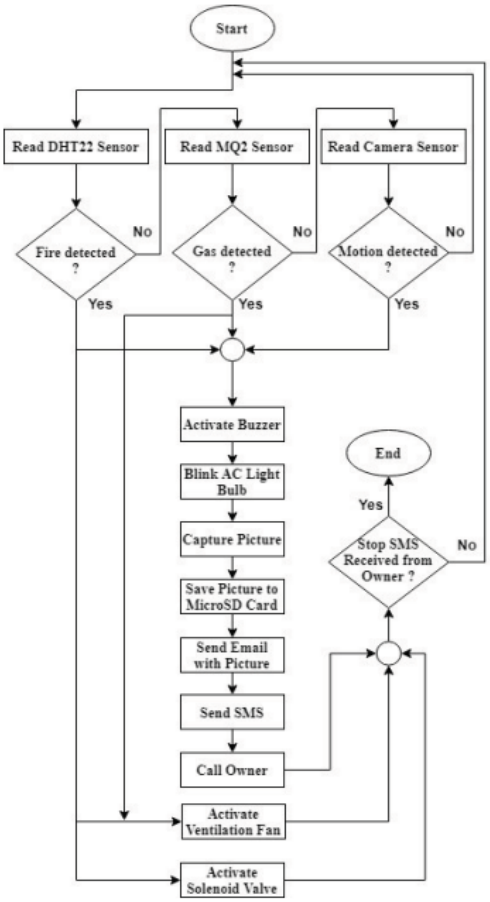

Figure 2.1.2: Flowchart mentioned in Qusay Idrees Sarhan(2022) [2]

2.1.3 Arduino Based Fire Detection and Control System

Muhammad Shazali Dauda and Usman Saleh Toro (2020) [3] has been presented an Arduino-based fire detection and control systems that is inexpensive for safety and accessible to users of all levels. The to automatically detect heat in certain environments, sound an alarm, turn off buildings, and spray water to reduce the intensity of fires. The system uses a DHT 11 sensor, a buzzer, a 5V DC (direct current) motor, a GSM (Global System for Mobile) module sim800l for sending SMS (Short Message Service), and a 16X2 LCD screen and Atmeg328p

microcontroller . The objectives of this project were met and the system worked effectively. The system continuously monitors the presence of large amounts of heat and activates an alarm, simultaneously shutting down the building's electrical network and sending an SMS (Short Message Service) alert to take safety measures to contain the situation. extinguish the fire as The proposed system is unique in that it uses an Arduino microcontroller and various sensors to detect and control fire initiation.

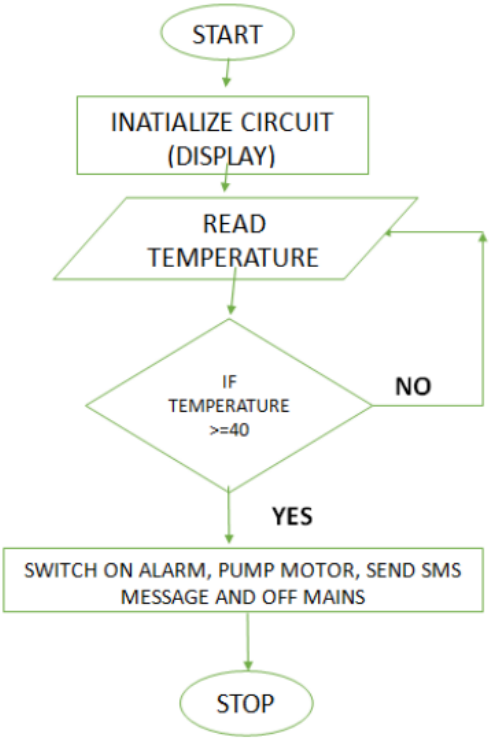

Figure 2.1.3: Flowchart mentioned in Muhammad Shazali Dauda and Usman Saleh Toro (2020) [3]

2.1.4 Arduino Based Smart Home Automation System

Ma Naing and Ni Ni San Hlaing (2019) [4] designed a system to run on both AC and DC power and uses a hybrid power supply. The two Arduino NANO boards are used to obtain values of physical conditions through sensors connected to them. The temperature sensor reads temperature values, the smoke sensor detects smoke by sending SMS alarms and ringing the buzzer, and the Light Dependent Resistor (LDR) controls automatic switching on and off of the light based on daylight intensity. A motion detector is also integrated using Passive Infrared Sensor (PIR) to detect movement for security purposes. Figure 2.1.4 also shows various other

components such as a GSM module, LCD displays, relays, fans, bulbs, and a servo motor that can be controlled by the system.

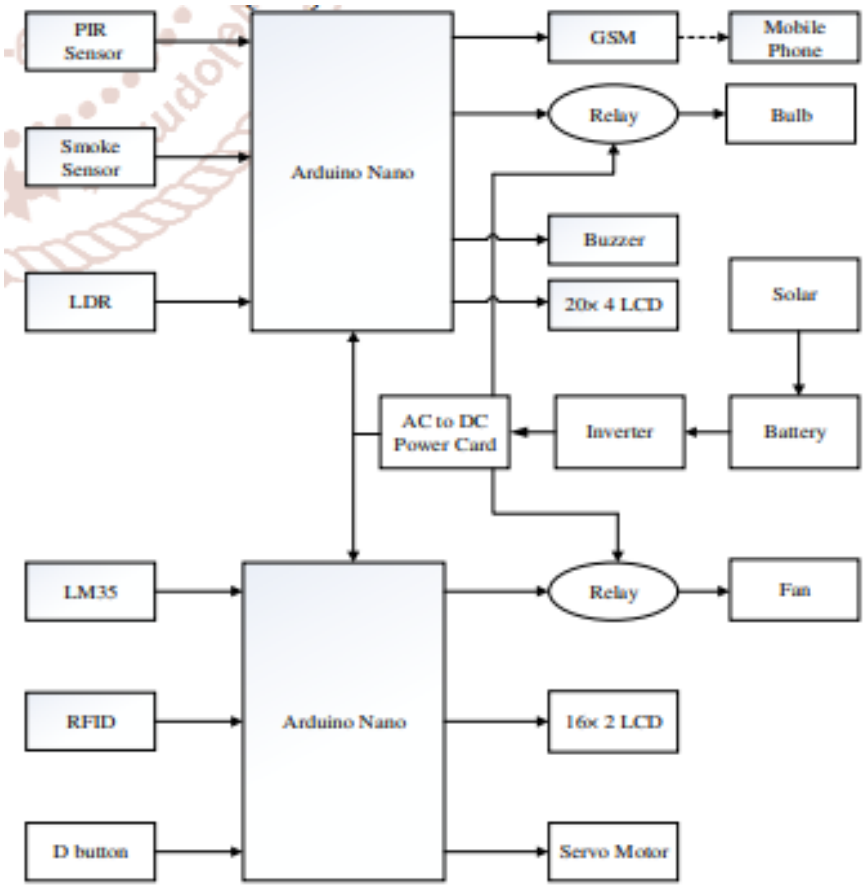

Figure 2.1.4: Flowchart mentioned in Ma Naing and Ni Ni San Hlaing (2019) [4]

2.1.5 Design and Implementation of Security Systems for Smart Home based on GSM technology.

Jayashri Bangali and Arvind Shaligram (2013) [5] design a system consists of a sensor, an Atmega644p microcontroller, a sim548c GSM module, a buzzer, an in-system programmer, and relays to control the device. The sensors of the system detect intrusions and dangerous situations such as gas leaks and fires. The Atmega644p microcontroller collects information from sensors and uses a sim548c GSM module to send SMS notifications to the homeowner's preferred number. A buzzer is used to give an audible alarm in the event of an intrusion. Relays are used to remotely control devices such as lights and fans via SMS commands. In the system, all sensor outputs are connected to an ADC. One IR is connected to Windows and another IR sensor is in front of the door. Entering the room through the window will be treated as

unauthorized entry as well as entry from door is treated as authorized entry. If the access to the house is permitted LED light will be turned on the switch after checking the illuminance of the room, and sound the buzzer will turn on in case of unauthorized entry. If the temperature is high (above 45 degrees), monitor the temperature continuously.

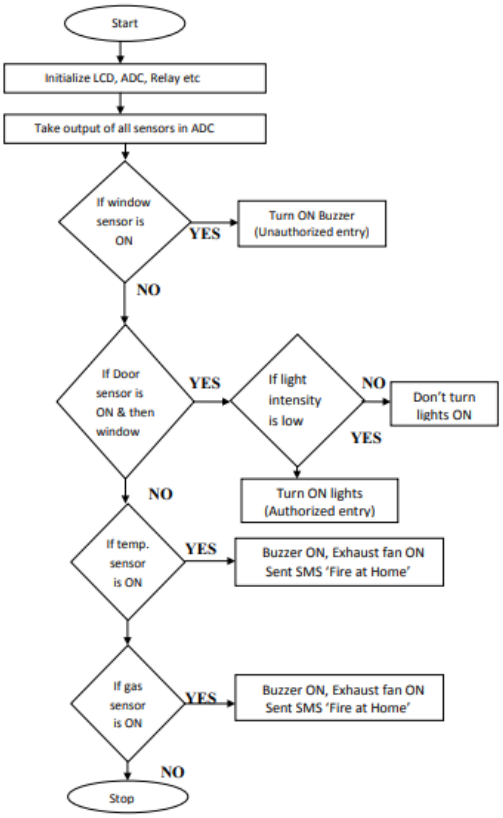

Figure 2.1.5: Flowchart mentioned in Jayashri Bangali and Arvind Shaligram (2013) [5]

2.1.6 Prototype of Google Maps-Based Flood Monitoring System Using Arduino and GSM Module

Dedi Satria, Syaifuddin Yana, Rizal Munadi, and Saumi Syahreza (2017) [6] designed a flood early warning system using Google Maps and Arduino technology. The system uses sensors to detect the water level and send alerts to users via SMS. The study highlights the potential benefits of implementing this system in flood-prone areas, such as faster response times and reduced damage. Overall, this study represents a prototype flood monitoring system that may improve disaster management in flood-prone areas. The flood monitoring system discussed in this study uses 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 water level transmitter and collects flooded information. Coordinate the system station.

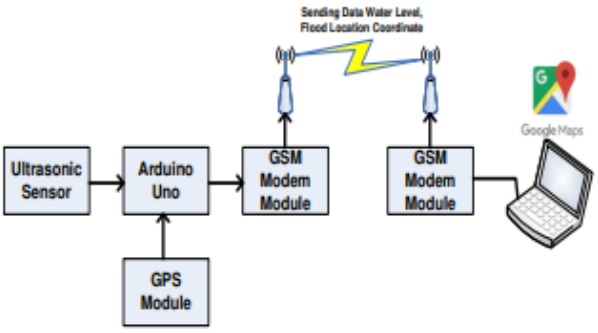

Figure 2.1.6: Flowchart mentioned in Dedi Satria, Syaifuddin Yana, Rizal Munadi, and Saumi Syahreza (2017) [6]

2.1.7 Quick Fire Sensing Model and Extinguishing by Using an Arduino Based Fire Protection Device

Md. Rawshan Habib, Naureen Khan, Koushik Ahmed, Mahbubur Rahman Kiran, Mohaiminul Islam Bhuiyan, and Omar Farrok (2019) [7] proposed an Arduino-based automatic fire alarm system with fire extinguisher for fire prevention. The proposed device uses mathematical models to represent the thermal properties of the house in which it is installed, the external environment and its heating system. A cost function for maintaining the conditioned environment is also considered. The temperature control system set point is 27°C in winter. This study emphasizes the importance of fire protection for safety purposes and proposes this device as a solution to prevent serious accidents due to mishandling of fire sources. The proposed fire protection system uses several functional sensors, such as smoke detectors, temperature sensors and flame sensors. The system also includes a microcontroller and sensor unit, a fire alarm, a motor and water pump for the fire system, a 12V step-down transformer, a bridge rectifier, and filter capacitors for the power system. Also, the system uses a regular push-button phone, which presses the call button three times to call the owner and pressing is done with a servo motor.

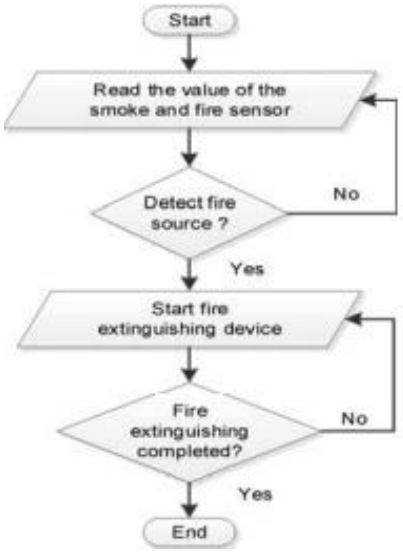

Figure 2.1.7: Flowchart mentioned in Md. Rawshan Habib, Naureen Khan, Koushik Ahmed, Mahbubur Rahman Kiran, Mohaiminul Islam Bhuiyan, and Omar Farrok (2019) [7]

2.1.8 Flood Early Warning Detection System Prototype Based on IoT Network

Joni Welman Simatupang and Faiz Naufal (2019) [8] presents a prototype of a flood early warning system based on IoT networks. The system uses an ultrasonic sensor device to measure the flood in real time, an Arduino UNO to collect the data, and a SIM900 module to send it via SMS to a central server. The system is intended to deliver early warning messages to measurement point managers, who can distribute data to the population. This study compares this system with other similar systems developed by researchers in the past and highlights its strengths and weaknesses. Overall, this research provides insight into how his IoT technology can be used for early flood detection and warning systems. The Flood Early Warning Detection System prototype is built using several components, including Arduino UNO, Ultrasonic sensor, SIM900 GSM/GPRS module, Breadboard and jumper wires, Power supply (9V battery or adapter) and a Cloud server. The ultrasonic sensor is used to measure the water level, while the Arduino UNO collects and processes the data from the sensor and sends it to the cloud server via SMS using a SIM900 GSM/GPRS module. The cloud server stores and processes the data, which can be accessed by users through their smartphones or other devices.

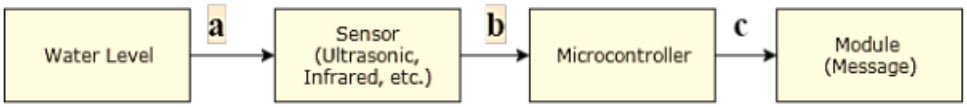

Figure 2.1.8: Flowchart mentioned in Joni Welman Simatupang and Faiz Naufal (2019) [8]

2.1.9 SMS Based Flood Monitoring and Early Warning System

Sheikh Azid, Bibhya Sharma, Krishna Raghuwaiya, Abinendra Chand, Sumeet Prasad, and A Jacquier (2015) [9] describe a study of a design and implement an SMS-based flood monitoring and early warning system. The system uses an Arduino microprocessor connected to a GSM modem and pressure sensor to measure water level. The system will send timely alerts to endangered or threatened population groups and responsible authorities via SMS. The study also discusses the advantages of using SMS-based systems for flood monitoring and early warning compared to other methods. A potential problem identified in the investigation is the inability of the GSM module to upgrade itself when network operators make changes to the network. The components used in the system include Arduino microprocessor, GSM modem, Pressure sensor, Aluminum box to house the circuit components, External support such as a column of a bridge or a dedicated concrete support, Solar battery charging system (to make the system independent), SIM card (for GSM module), Wires and connectors for circuitry, resistors, capacitors, and diodes for circuitry.

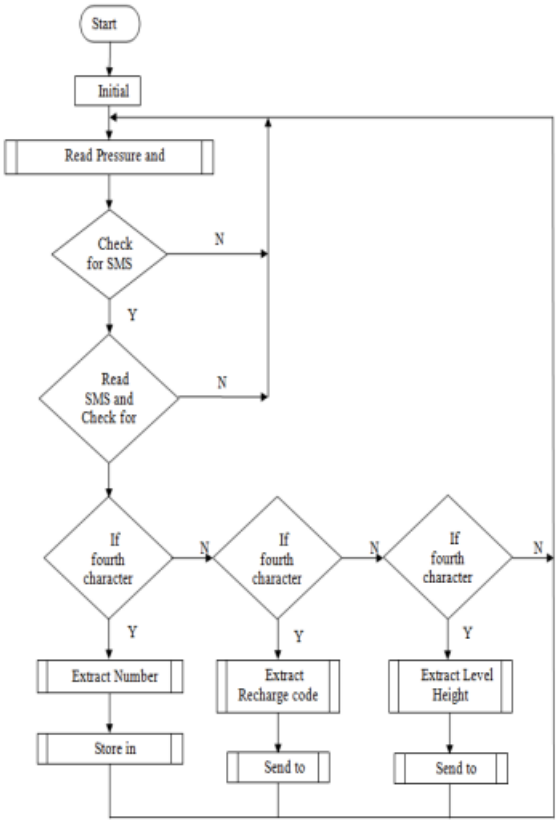

Figure 2.1.9: Flowchart mentioned in Sheikh Azid, Bibhya Sharma, Krishna Raghuwaiya, Abinendra Chand, Sumeet Prasad, and A Jacquier (2015) [9]

2.1.10 Design of a Home Fire Detection System Using Arduino and SMS Gateway SMS

Suwarjono Suwarjono, along with Izak Habel Wayangkau, Teddy Istanto, Rachmat Rachmat, Marsujitullah Marsujitullah, Hariyanto Hariyanto, Wahyu Caesarendra, Stanislaw Legutko, and Adam Glowacz (2021) [10] designed and implemented a fire alarm system using an Arduino Uno microcontroller and an SMS gateway. The flow of the system is divided into four stages: fire detection, data processing, SMS sending and alarm. The authors used a flame sensor to detect fires and a GSM module to send his SMS alerts to the homeowner. The system was tested in a real-world environment, and the results showed that it worked as expected with 10 successful attempts to send SMS and trigger alarms. They have used components such as Arduino Uno R3 Atmega328p microcontroller board, DS18B20 temperature sensor, MQ2 gas sensor, Sim900 GSM module, Active buzzer 5 V–12 V, Adapter 12 V–1 A and Alkaline Battery 9 V in the design.

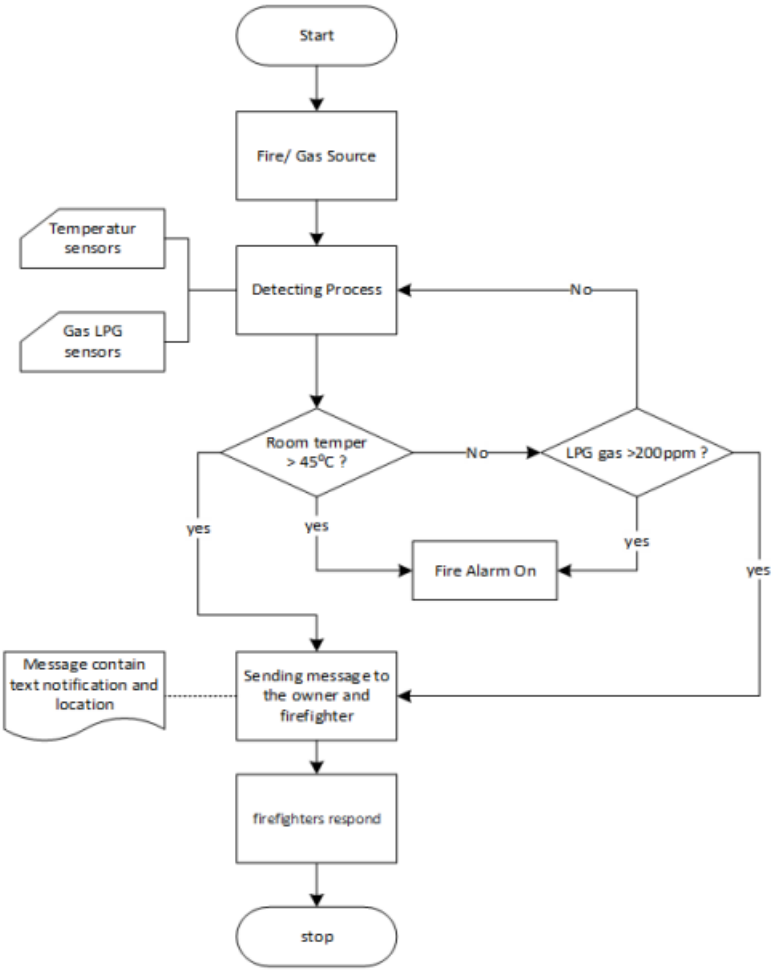

Figure 2.1.10: Flowchart mentioned in Suwarjono Suwarjono, along with Izak Habel Wayangkau, Teddy Istanto, Rachmat Rachmat, Marsujitullah Marsujitullah, Hariyanto Hariyanto, Wahyu Caesarendra, Stanislaw Legutko, and Adam Glowacz (2021) [10]

2.2 Summary of Literature Review.

The summary of the literature review is shown in Table 2.1

Table 2.1 Summary of literature Review.

No.	Author (s) & Year	Title of Research Paper	Variables Studied/ Research Design	Equipment/ Instruments/ Apparatus used for Experiments/ Analysis/ Characterization, etc.	Important Findings	Limitations of Study	ResearchGap/ Novelty of ResearchStudy
[1]	D.Dinesh, I.Anette Regina 2019	Prediction and Effective Monitoring of Flood Using Arduino System Controller and ESP8266 Wi-Fi Module	The sensing unit contains temperature, rainfall, and humidity sensors, and this unit transfers the sensor value to the Arduino and microcontroller unit based on the threshold value. The Arduino and microcontroller send the signal to the communication unit, which updates the information in internet sources using ESP 8266 Wi-Fi module. The system displays and alerts the flood forecast and warnings as and when required using the advantage	1. Power supply 2. Temperature sensor 3. Rainfall sensor 4. Humidity sensor 5. Arduino Uno controller 6. Relay driver 7. LCD display 8. ESP 8266 Wi-Fi module	The system is designed to solve the timeliness problem of SAR data using sensor modules. It was found that the designed system allows pre-programming of the controllers used to monitor the flood system. The main advantage of this model is the reduction of hardware components in this system.	The system is only limited to measure. parameters like Temperature, Rainfall and Humidity.	It uses cloud technology by using ESP 8266 Wi-Fi module to update the information in cloud. Doesn't include with fire detection system with the surveillance of a camara. The system doesn't incorporate a corrective action unit to divert the flood away.

			of cloud service which makes the data can be access from anywhere through ThingSpeak website.				
[2]	Qusay Idrees Sarhan 2022	Arduino Based Smart Home Warning System	The project uses an Arduino Uno microcontroller and various sensors and actuators to create a smart home alarm system that can detect fires, gas leaks, and intrusions. The system has different types of alerts and notifications, such as sending SMS messages, emails with photos, calling owners, playing buzzers, and flashing light bulbs. Only when a fire or gas leak is detected will the fan operate to remove smoke and leaked gas. A solenoid valve operates and stops in the event of a fire. The system continuously captures images and saves them in the MicroSD card module to send to the owner. The system can only be stopped when the homeowner sends an SMS message.	1. Arduino Uno microcontroller 2. GSM module 3. MQ2 gas sensor 4. Flame sensor 5. PIR motion sensor 6. DHT22 temperature and humidity sensor 7. Buzzer 8. LED bulb 9. Solenoid valve 10. Ventilation fan	The system is highly effective in detecting fire, gas leakage, and housebreaking situations using multiple sensors and actuators working together. It also allows homeowners to take proper actions such as stopping fire via water and decreasing gas concentration in the air via a fan.	Other potential threats to home security such as flooding, or carbon monoxide poisoning are not being considered. while the proposed system is designed to be easy to implement, it may still require some technical expertise to set up and maintain. GSM which may not be available or reliable in all areas.	It integrates multiple sensors and actuators to efficiently detect fire, gas leak and intrusion situations. Use SMS messages, emails with attached images, owner calls. A solenoid valve operates and stops in the event of a fire. The system continuously captures images and saves them in the MicroSD card module to send to the owner. It lowers the gas concentration in the air with a fan. It doesn’t integrate with a system to trigger in a flood. . It doesn’t include the surveillance of a camara.

[3]	Muhammad Shazali Dauda, Usman Saleh Toro 2020	Arduino Based Fire Detection and Control System	An Arduino based fire detection and control system designed to automatically detect heat in a given environment, sound an alarm, switch off mains of the building, and spray water to reduce the intensity of fire. The system uses a DHT 11 sensor, a buzzer, 5v DC (Direct Current) motor, a GSM (Global System for Mobile) Module sim800l to send SMS (Short Message Service), and LCD screen 16X2 and Atmeg328p Microcontroller. The system continuously monitors the presence of significant amounts of heat and activates an alarm, simultaneously switches off the mains of the building, sends a Short Message Service (SMS) alert, and extinguishes the fire as a safety measure to contain the situation.	1. DHT 11 sensor 2. Buzzer. 3. 5v DC motor 4. GSM Module sim800l 5. LCD screen 16X2 6. Atmeg328p Microcontroller 7. Power Supply Unit (PSU)	The system was able to quickly detect and alarm a fire outbreak, shut down the building's power grid, send an SMS alert, and extinguish the fire with water from a tank. Overall, it is found that the proposed fire detection and control system effectively achieves the objective of providing a cost-effective solution for detecting and controlling fire outbreaks in buildings.	the system was tested in a controlled environment, and its effectiveness in real-world scenarios may vary depending on various factors such as the size of the building, the intensity of the fire outbreak, and other environmental conditions.	Extinguish fires using water from a tank. The paper also presents a detailed description of the software design of the system, which can be used as a reference for future research in this field. It doesn’t integrate with a system to trigger a flood. It doesn’t include the surveillance of a camara.

[4]	Ma Naing, Ni Ni San Hlaing 2019	Arduino Based Smart Home Automation System	The system is designed to operate on AC and DC power and uses a hybrid power supply. Two Arduino NANO boards are used to obtain physical state values via sensors connected to them. The temperature sensor reads temperature readings, and the smoke sensor detects smoke and sends SMS alerts and sounds a buzzer. A light dependent resistor (LDR) controls the lights to turn on/off automatically based on daylight levels. A passive infrared (PIR) sensor motion detector is also integrated to detect movement for security reasons. The diagram also shows various other components that can be controlled by the system, such as GSM modules, LCD displays, relays, fans, light bulbs, and servo motors.	1.PIR Sensor 2.Smoke Sensor 3.LDR 4.LM35 5.REID 6.D Button 7.Arduino Nano 8.GSM 9.2 Relay 10.Buzzer 11.20 x 4 LCD 12.AC to DC Power Card x 2 13.Inverter Bulb 14.Solar 15.Battery 16.Fan 17.16 x 2 LCD	The system was designed to monitor and control various home appliances such as lights, fans, and temperature based on signals from related sensors. The paper reports that all tasks of the system were done successfully, but there were limitations in time and expenses.	Limitations in time and expenses.	The system also includes SMS alarm functions that can alert users in case of power supply failure or smoke detection. The system can be run by both AC and DC power. It doesn’t integrate with a system to trigger a flood. It doesn’t include the surveillance of a camara. The system doesn’t incorporates a fire extinguishing unit.

[5]	Jayashri Bangali and Arvind Shaligram 2013	Design and Implementation of Security Systems for Smart Home based on GSM technology	One IR is connected to Windows and another IR sensor is in front of the door. Entering the room through the window will be treated as unauthorized entry as well as entry from door is treated as authorized entry. If access to the house is permitted LED light will be turned on the switch after checking the illuminance of the room and sound the buzzer will turn on in case of unauthorized entry. If the temperature is high (above 45 degrees), monitor the temperature continuously. In the case of a fire, an SMS ("Fire at home") will be sent to the homeowner. In case of a gas leak sensed by the gas sensor, the owner will be notified through a SMS ("gas leak").	1.Atmega644p 2.microcontroller 3.ADC 4.IR sensor 5.Gas sensor 6.Temperature sensor 7.Light sensor 8.LEDS & Buzzer 9.GSM module	The paper suggests that GSM-based security systems provide enhanced security as it can quickly send SMS alerts to the homeowner's desired number in case of any intrusion, gas leakage, or fire. The proposed system is controlled by an Atmega644p microcontroller and collects information from sensors to send SMS alerts. The paper also discusses two methods for enhancing home security using GSM-based systems, one using a web camera and the other using a sim548c GSM module.	The effectiveness of the system may depend on various factors such as the quality and placement of sensors, network coverage, and reliability of the GSM module. This system does not use a camara	It uses the concept of smart home with GSM technology. It doesn't integrate with a system to trigger in a flood. It doesn't include the surveillance of a camara. The system doesn't incorporate a fire extinguishing unit.
[6]	Dedi Satria, Syaifuddin Yana, Rizal Munadi, and	Prototype of Google Maps-Based Flood Monitoring System	It begins with an ultrasonic sensor that detects water levels. The GPS module then sends the water level data and flood location coordinates to the Arduino Uno as a data processor.	1. Ultrasonic sensors 2. Arduino Uno 3. U-Blox Neo 6m GPS module as a detector of flood coordinate	A Google Maps-based flood monitoring system developed as expected. The system can detect water level and send alerts to users via SMS to provide real-time	The system is based on GSM technology for sending SMS notifications, which may not be available in some regions. Water level detection	Developing a Google-maps based monitoring system. Used GSM model. It doesn't include with fire detection system with the surveillance of a camara.

	Saumi Syahreza 2017	Using Arduino and GSM Module	Both data are sent in the form of SMS data to the information system station received by the modem. The data is received by a computer and processor to create a water level information system based on Google Maps. This information is displayed as a map with inundation height data via a browser, providing real-time information on inundation height and location.	location 4. GSM SIM900 module 5. Computer and processor for receiving and displaying the data on Google Maps through a browser 6. Jumper Wires	information about flood height and location. It has successfully used an ultrasonic sensor, an Arduino Uno, a U-Blox Neo 6m GPS module and a GSM SIM900 module in the system. The system could improve response time and reduce damage in flood prone areas. The study highlights the potential benefits of installing this system in flood-prone areas, such as improved disaster management and damage reduction.	accuracy may be affected by factors such as debris and other obstacles in the water. Systems may require regular maintenance and calibration to ensure accurate readings. In some areas, the cost of implementing and maintaining systems can be a barrier to adoption. This study was performed as a prototype and further investigation is required to assess the effectiveness of the system in real-life scenarios.	The system doesn't incorporate a corrective action unit to divert the flood away.
[7]	Md. Rawshan Habib, Naureen Khan, Koushik Ahmed, Mahbubur Rahman Kiran, Mohaiminul Islam	Quick Fire Sensing Model and Extinguishing by Using an Arduino Based Fire Protection Device	A flame sensor senses the fire and sends an electrical signal to the microcontroller. A microcontroller receives a signal and sends it to five outputs that activate various components of the system. Solenoid relay switches actuate to turn on servo motors, fire sirens, and fire extinguisher induction	1. Flame sensor 2. Smoke detector 3. Temperature sensor 4. Fire extinguisher 5. Transformer (12V step-down) 6. Servo motor (for mobile phone and call	The proposed fire protection device shows reliability with fewer false alarms. The time delay is 1.5s for activating. alarm. Thus, it can neglect the smoke created from cigarettes,	This is where short range fire detectors are used. As a result, the system does not perform well in crowded areas. It uses a mobile phone to send updates to the right people, which is unreliable. The display is not used here to show status	System incorporates both fire detection and extinguishing systems in a single unit. The system uses multiple functional sensors to avoid the possibilities of malfunction of alarm circuit and decrease of false alarm. All sensors are employed twice in number to make

	Bhuiyan, and Omar Farrok. 2019		motors. Two additional signals are sent to the actuator and the mobile phone's LEDs to alert the concerned parties of the fire incident. Water and powder spray systems are activated by activating a relay switch that helps extinguish the fire.	button) 7. Single-phase induction motor 8. Bridge rectifier 9. Filtering capacitor 10. Fire siren 11. LED 12. Relay (magnetic) 13. Microcontroller (Arduino-based) 14. Wires	burning papers etc. Commercial thermal sensors are expensive. A home-made converter is used in this device. Therefore, the proposed system is economical. Smoke, flame, and temperature sensors have been duplicated to increase system reliability and accuracy.		the system more reliable. The system uses an ordinary button phone to call the owner's number, which is executed by a servo motor that presses the call button three times. The owner is notified of the fire accident via mobile phone network available in that area. It can neglect smoke created from cigarettes and burning paper. It doesn't integrate with a system to trigger in a flood. Doesn't included the surveillance of a camara.
[8]	Joni Welman Simatupang and Faiz Naufal 2019	Flood Early Warning Detection System Prototype Based on IoT Network	An ultrasonic sensor measures the water level and sends the data to the Arduino UNO. The Arduino UNO processes the data and sends it to the cloud server via SMS via the SIM900 GSM/GPRS module. Cloud servers store and process data that users can access from their smartphones and other devices. When the water level reaches a certain	1. Arduino UNO 2. Ultrasonic sensor 3. SIM900 GSM/GPRS module 4. Breadboard and jumper wires 5. Power supply (9V battery or adapter) 6. Cloud server	A prototype flood early warning system has proven useful as one of the solutions that can be implemented to reduce the number of casualties from floods that may occur in the near future. By receiving sensor data from ultrasonic sensors and distributing it through GSM and GPRS	The ultrasonic sensor used in the system had an accuracy of about 20%. This means that the measurements may not be very accurate. The GSM and GPRS modules used in the system were found to be less responsive to some commands, affecting the functionality of the Arduino.	Integration of Arduino UNO, ultrasonic sensor, and GSM/GPRS module to create a low-cost and effective early warning system for floods. Use of cloud server to store and process data, which can be accessed by users through their smartphones or other devices.

			level, an early warning message will be sent to the measurement point management and the data will be distributed to the population.		modules, the system was able to frequently route, record and publish the data on a website. I was also able to ask questions about current water levels and respond directly to messages from people who were interested in knowing if.	The system requires power, either a 9V battery or an adapter, which may not be readily available.	Ability to reply directly to messages from anyone asking about the current water level condition. It doesn't include a fire detection system with the surveillance of a camara. The system doesn't incorporate a corrective action unit to divert the flood away.
[9]	Sheikh Azid, Bibhya Sharma, Krishna Raghuwaiya, Abinendra Chand, Sumeet Prasad, A Jacquier	SMS Based Flood Monitoring and Early Warning System	A pressure sensor measures the water level and sends the data to the Arduino microprocessor. An Arduino microprocessor processes the data and sends his SMS alerts to vulnerable and threatened people as well as relevant authorities via a GSM modem. By incorporating a solar charging system, the system will become self-sufficient by continuously charging batteries in the remote areas where the facility is located. Users can check the battery status through her GSM	1. Arduino microprocessor 2. GSM modem 3. Pressure sensor 4. Aluminum box 5. a column of a bridge or a dedicated concrete support 6. Solar battery charging system 7. SIM card (for GSM module) 8. Wires and connectors for circuitry	This system successfully validates the use of pressure sensors in water level monitoring systems as the relationship between pressure and water level is perfectly linear. The system is self-contained and does not require external power, but recharging the SIM card and saving contacts is done via SMS. The whole system is solar powered, and the rechargeable battery can last for about a week.	GSM network and may not be available in some remote areas. It needs external support like a column of a bridge or special concrete support to hold the pressure sensor in place. These may not be available in all locations. The system is limited by the accuracy of the pressure sensor used and may not be able to detect small changes in water level. The GSM module cannot update itself, so	It uses an SMS based system using GSM module. The incorporation of a pressure sensor to measure water level height, which is a more accurate and reliable method than traditional methods such as visual inspection or manual measurement. The incorporation of a solar battery charging system to make the system independent and self-sustaining, which is particularly useful in remote

			module with the ability to check the battery status at any time. The module should be able to report the battery level to the user via SMS. Remote replenishment and resident number addition are also integrated for complete system efficiency.	9. Resistors, capacitors, and diodes	SMS-based flood monitoring and early warning systems are more efficient than other methods such as radio and television broadcasts. This is because it can reach people in remote areas where other methods are not available. A potential problem identified in this research is the inability of the GSM module to upgrade itself when network operators make changes to the network.	if the network provider makes changes to their network, your system may experience problems. Depending on the local government or region, the introduction cost of this system may be high.	areas where access to electricity may be limited. The inclusion of features such as remote top-up and storing contact numbers via SMS makes the system more user-friendly and accessible. Doesn't include with fire detection system with the surveillance of a camara. The system doesn't incorporate a corrective action unit to divert the flood away.
[10]	SuwarjonoSuwarjono, along with Izak Habel Wayangkau, Teddy Istanto, Rachmat Rachmat, Marsujitullah	Design of a Home Fire Detection System Using Arduino and SMS Gateway	This research involves designing and implementing a fire alarm system using an Arduino Uno microcontroller and an SMS gateway. The system is divided into four stages: fire detection, data processing, SMS sending and alarm. The authors used a flame sensor to detect fires and a GSM module to send his SMS alerts to the	1. Arduino Uno R3 Atmega328p microcontroller board 2. DS18B20 temperature sensor 3. MQ2 gas sensor 4. Sim900 GSM module 5. Active buzzer 5 V–12 V	I have successfully designed and implemented a fire alarm system using an Arduino Uno microcontroller and an SMS gateway. The system was tested in a real-world environment, and the results showed that it worked as expected with 10 successful attempts to	The system is designed to detect flames using a flame sensor, but it cannot detect smoke, which can also be an indicator of a fire. If there is no network coverage or if the network is congested, the system may not be able to send alerts. The range of the GSM module used in the study	Automated SMS alerts using GSM module. Integration of multiple sensors: The authors integrated multiple sensors, including a flame sensor and a gas sensor, to detect fires more accurately. It doesn't include a flood detection system with the surveillance of a camara.

	Marsujitullah, Hariyanto Hariyanto, Wahyu Caesarendra, Stanislaw Legutko, and Adam Glowacz. 2021		homeowner. The system was tested in a real-world environment, and the results showed that it worked as expected with 10 successful attempts to send SMS and trigger alarms.	6. Adapter 12 V–1 A 7. Alkaline Battery 9 V	send SMS and trigger alarms. The authors also explained the limitations of their proposed system, such as the inability to detect smoke and his reliance on the GSM network to send SMS alerts. Overall, this study demonstrates that automatic fire alarm systems can be designed at low cost using off-the-shelf components.	is limited, which means that the system may not be able to send alerts if it is located far away from a cellular tower. The system requires a stable power supply to function properly. If there are power outages or fluctuations, the system may not work as intended. The flame sensor may trigger false alarms if it detects other sources of heat or light, such as sunlight or incandescent bulbs.	The system doesn't incorporate a fire extinguishing unit.
	My project	A Flood and Fire Detection with Corrective Actions	The system be using microcontroller and ESP32 Camara to enable camera view, flood detection using 3 flood level sensor (the increase of water is detected in 3 levels) and fire detection using 3 fire sensor and upon detection shall alert the user App alert using Cayenne app and trigger the house alarm with the corrective actions to bring down the fire by	1.Arduino Uno 2.Flame Sensor x 3 3.Water Level Sensor x 3 4.Jumper Wires male to male sets 5.Breadboard 6.ESP 32 Fi-Wi module with Camara 7.Water Pump 12 V 8.Water	To successfully build a fire detection system using IoT which would detect the fire, send an emergency alert, trigger the house alarm as well automatically take corrective actions to prevent fire from spreading of fire by automating water sprinkler system. To successfully create a flood detection system	This project is limited to flood and fire detection and corrective action and does not include other home automation features such as temperature control, lighting, or security. Flame sensors typically have a range of a few feet so their range can be limited by the strength of the flame and the level of ambient	The system can do both fire and flood detection. All sensors are employed thrice in number to make the system more reliable. The increase of water is detected in 3 levels and response to each level varies making the system not to do unnecessary disturbance in a less important event.

			activating water sprinkler and block the water coming in by a turning up a wall.	Sprinkler 9.Roto Motor 10.Alarm 12V 11.Relay 5V 12.Slide Switch x 2 13.Water tube pipe (hose)	using IoT which would detect the flood water level and send an emergency alert, trigger the house alarm as well automatically take corrective actions to prevent flood spreading by automating a anti flood barrier. To successfully enable the camera view for surveillance purposes for both flood and fire detection. All sensors are employed thrice in number to make the system more reliable.	light in the surrounding area. Water level sensors can be limited by factors such as water clarity, sensor placement, and interference from other objects in the water. The ESP32 Wi-Fi module requires a strong network connectivity, otherwise the alert message to the user can get delayed and the live streaming for surveillance of the event by the camara can get disrupted. The system is limited to 2 main corrective actions such as water sprinkler for the fire extinguishing and a wall turn up to block the water coming more to the system placed room. Any other actions such as ventilation system to act against a fire is not included. Sensors can malfunction when an event occurs	The system incorporates corrective action units for both fire and flood detection; to extinguish the fire and to divert the flood away. The system includes a surveillance unit with a camera. It uses an ESP 32 Wi-Fi module which is built in one module with a camara which minimizes the cost of the unit.

2.3 Chapter Summary

Overall, this chapter is about what past researchers have done and the comparisons of ideas and knowledge that has been published in journals. This chapter details the previous findings conducted by other researchers regarding fire detection systems and flood detection systems. Most of the studies are found done for either a fire detection system or flood detection system as showed most of the studies mentioned above expect for two studies ([2], [4]). These two studies [2] [4] have done for a designing of a smart home system with the capability of multiple detections; fire and gas leak, house intrusion etc. The three systems above mentioned [2] [3] [7] have an automated system provided to combat fire as in one study [2], a solenoid valve operates and stops the fire, second study, [3] extinguish fires using water from a tank and the other [7], the fire extinguisher induction motors ON in an event of a fire. My project incorporates two detections, 'Fire and Flood Detections' as well as incorporates corrective action units for both fire and flood detection as to extinguish the fire and to divert the flood away. The system includes a surveillance unit with a camera as well. If a GSM module is being included in the system, as mentioned in study [9], if the network provider makes changes to their network, the system can experience problems since GSM module cannot update itself. Therefore, I will be using an ESP 32 Wi-Fi module which is built in one module with a camara which also minimizes the cost of the unit. Additionally, all sensors are employed thrice in number to make the system more reliable. The increase of water is detected in 3 levels and response to each level varies making the system not to do unnecessary, too much disturbance to the owner or for the surrounding in less important events like other water leaks.

CHAPTER 3: METHODOLOGY

3.1 Overview

This system be using a microcontroller and ESP32 Camara to enable camera view, flood detection using flood level sensor and fire detection using fire sensor and upon detection shall alert the user app alert using Cayenne app and trigger the house alarm with the corrective actions to bring down the fire and divert the water flow away. The system consists of 2 sub-systems flood detection system and fire detection system. 3 flame sensors are used to detect fire. When one of the sensors senses the fire, the pump starts and pumps the water from the water tank to the water sprinkler and the water sprinkler will sprinkle the water in the room. At the same time the alarm with be activated.

The main parts that will be used in the 2 sub-systems are water sprinkler, ani flood barrier, and ESC 32 Camera. For the Fire Detection System, three flame sensors will be placed in a circle. An alarm will go off when fire is detected, and an app alert will be sent to the user's device using the Cayenne app. Water sprinklers will also turn on automatically to combat the fire.

Similarly, the Flood Detection System will use 3 water level sensors to detect increasing water levels and send app alerts to the user's device accordingly. The Wall Blocker sub-system will consist of motors that will turn on and lift the wall to block open areas that may let in more water during a flood. The flood detection system will consist of three water level sensors to detect increasing water levels at three different levels. When the water reaches level 1 or level 2 or level 3, an app alert will be sent to the user's device using the Cayenne app. For level 2 and 3, the alarm will ring. But only for the level 1, an anti-flood barrier will be activated and divert the water away. The barrier can be turned down by a switch once the water level subsides or the flood is under control. Similarly, for the fire detection system, when the flame sensors detect a fire, an alarm will be ON, the water sprinkler activates, and an app alert will be sent to the user's device using the Cayenne app.

Finally, the ESC 32 Camera will allow users to surveil the area and confirm the app alert is accurate. The Cayenne app will be used to receive alerts for both flood and fire detection, as well as stream live video of the area where the system is installed.

3.2 Block Diagram

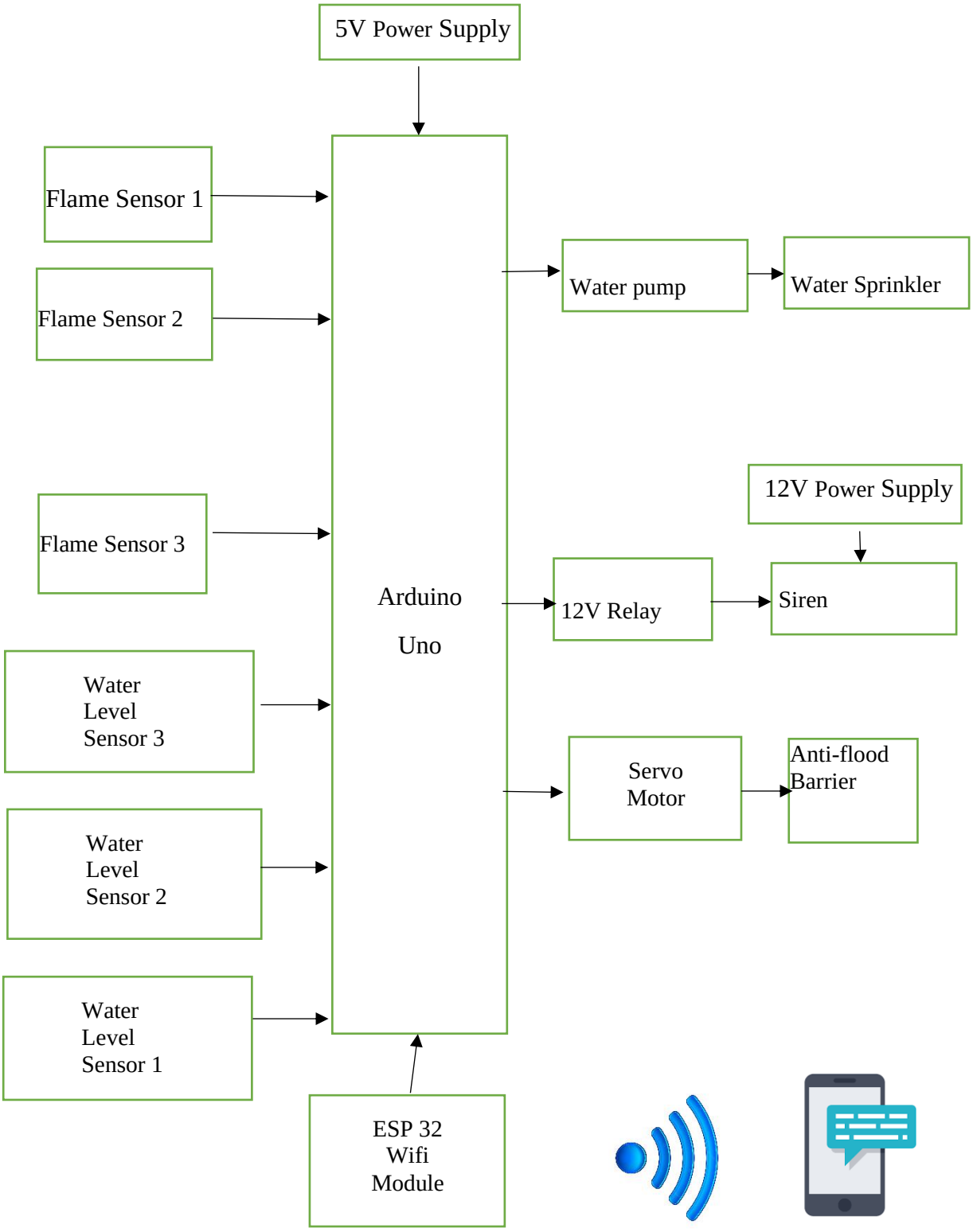

Figure 3.1: Transmitter block diagram.

Above given block diagram shows the components used in the project. It as well shows the overview of the dataflow and connectivity of the system of in total of 12 components. According to the block diagram, there are in total of 7 input takes from 6 sensors which breakdown in to 3 flame sensors and 3 water level sensors and ESP 32 camara module. connected to the Arduino and 3 components directly connected to the Arduino to flow the output signal from it. Outputs signal controls the 3 of the outputs of the system, water sprinkler, siren and water blocking wall/ani-flood barrier. Additionally, Arduino provides another output signal wirelessly to a mobile device.

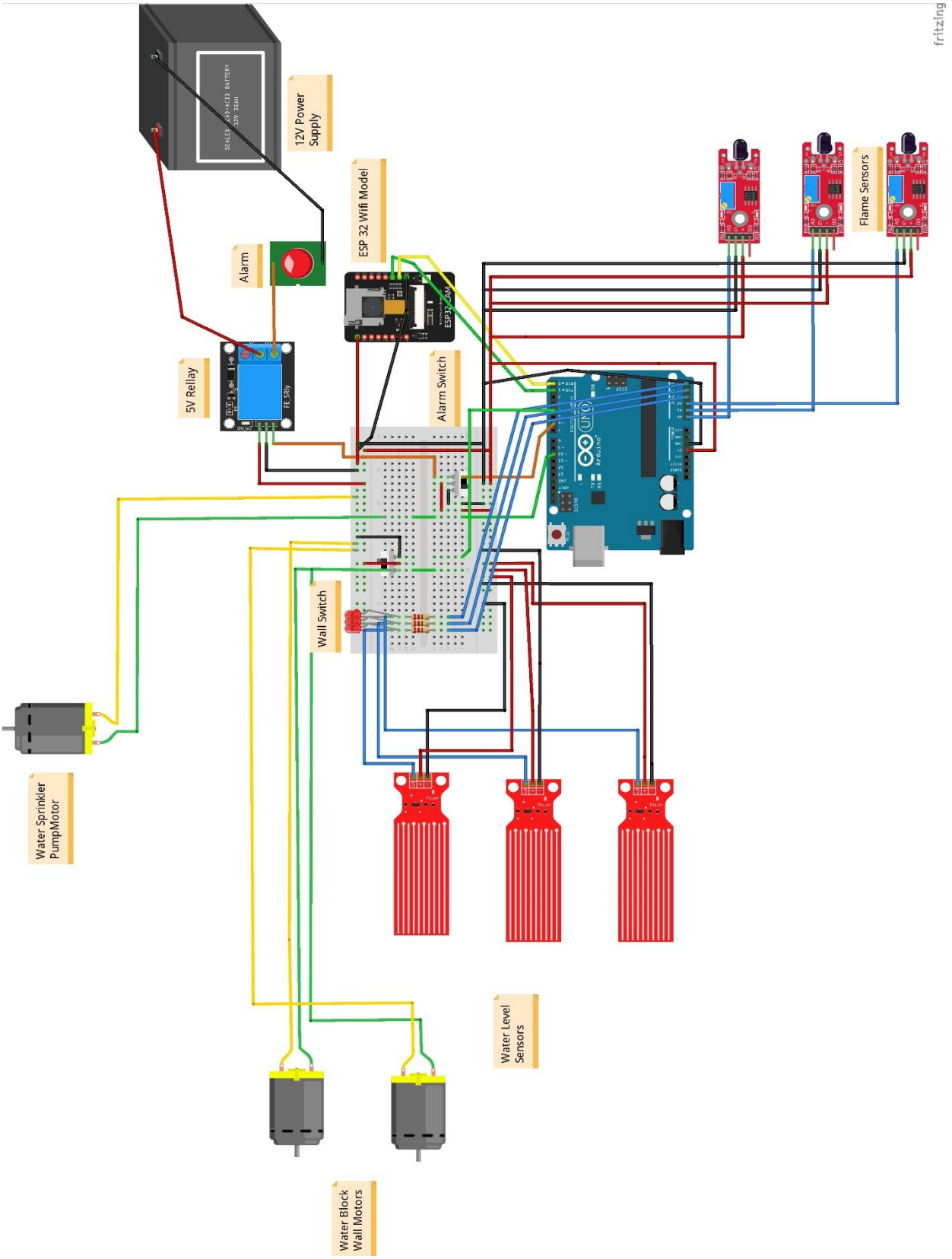

Figure 3.2: The Circuit diagram.

The circuit diagram has been built using Fritzing app. All systems are a integration of fire and flood detection systems. Therefore, The whole circuit is integrated with A Siren system which works for both flood and fire detection systems. The siren is connected to a 12V power supply and go through a 5v relay to Arduino. A switch has been connected to the output of the relay to turn off the siren. The output of each flame sensor is connected to a analog read pin. The output of each water level sensor is connected to 3 digital read pins of the Arduino. The 2 of the anti-flood barrier motors are connected to one digital pin of the Arduino uno. A switch is connected to the same connection to turn off the ani-flood barrier. The water sprinkler water pump in distributed in the circuit using another motor ais connected to another digital pin in the Arduino uno.

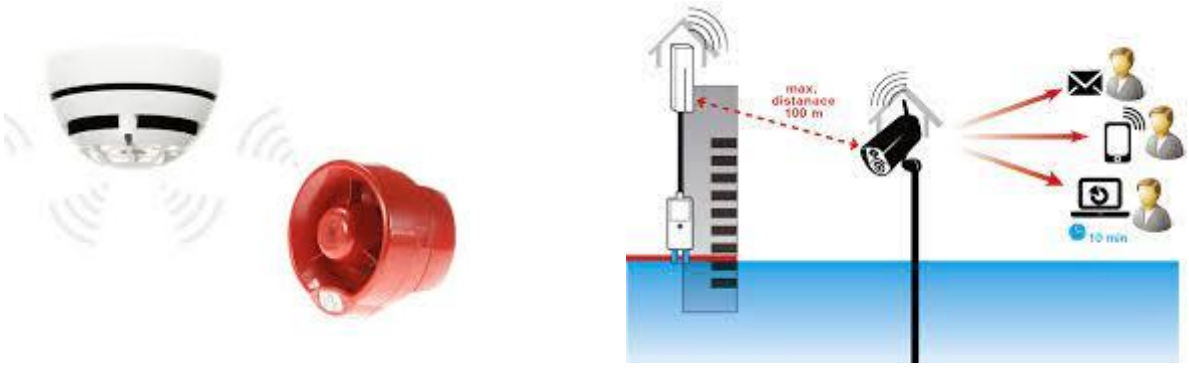

Figure 3.3: Prototype Model (On the left – Fire detection system and on the right –Flood detection system)

As figure 3.3 shows, the flame sensors will be assembled in a curved container and water sensors will be paste in a metal poll which displayed the height measurements in cm. To store a flood and fire detection system in a home space, assessing the layout and identifying fire-prone and flood-prone areas should be done first. Install flame sensor unit near potential ignition sources and water level sensor unit in vulnerable location. Connect these sensors securely to a central control unit, which should be placed within the home and connected to a power source and internet or cellular connection. Additional components like water barriers and sirens to the control unit should be connect after.

3.3 Flowchart

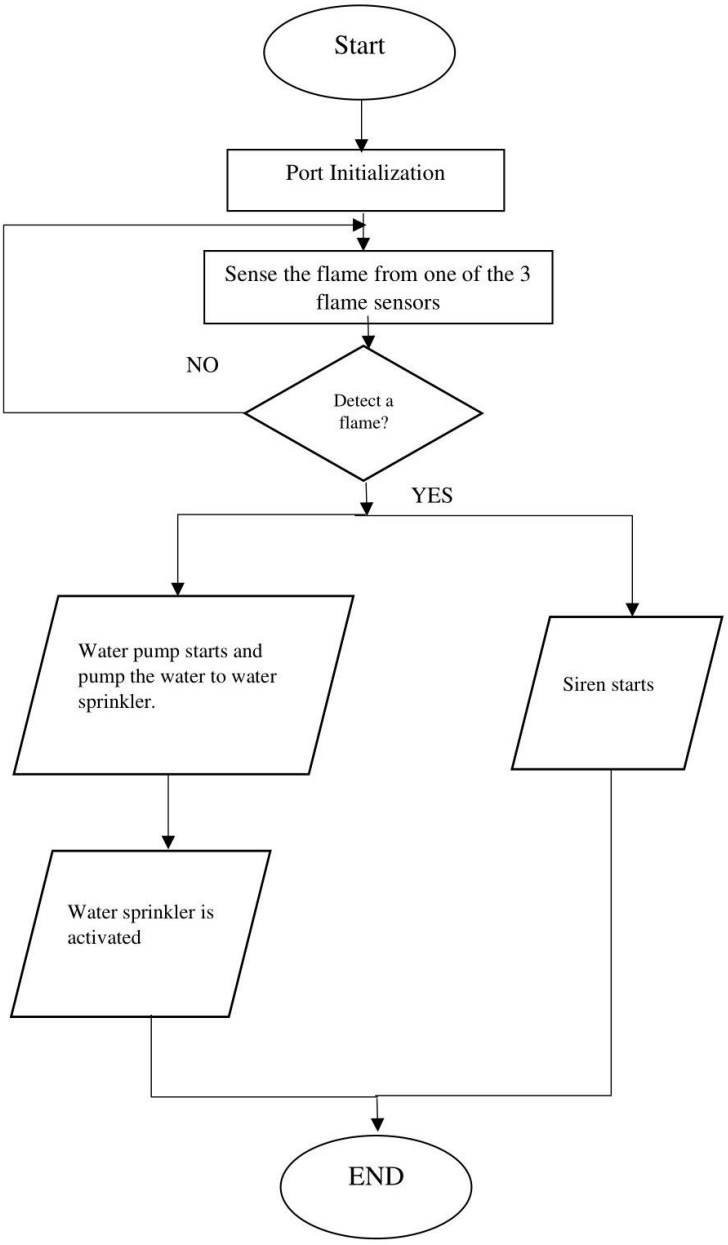

Figure 3.4: The Flowchart of the Fire Detection System

A fire alarm system with 3 flame sensors detects fire and alerts the user. Each sensor can detect the presence of flames and send a signal to the central control unit. When all three sensors detect a fire, the control unit alerts the connected mobile device with a loud siren that provides both visual and audible alarms. The system ensures that multiple sensors are mutually validated, increasing the reliability of fire detection and enabling rapid response to potential

fire hazards.

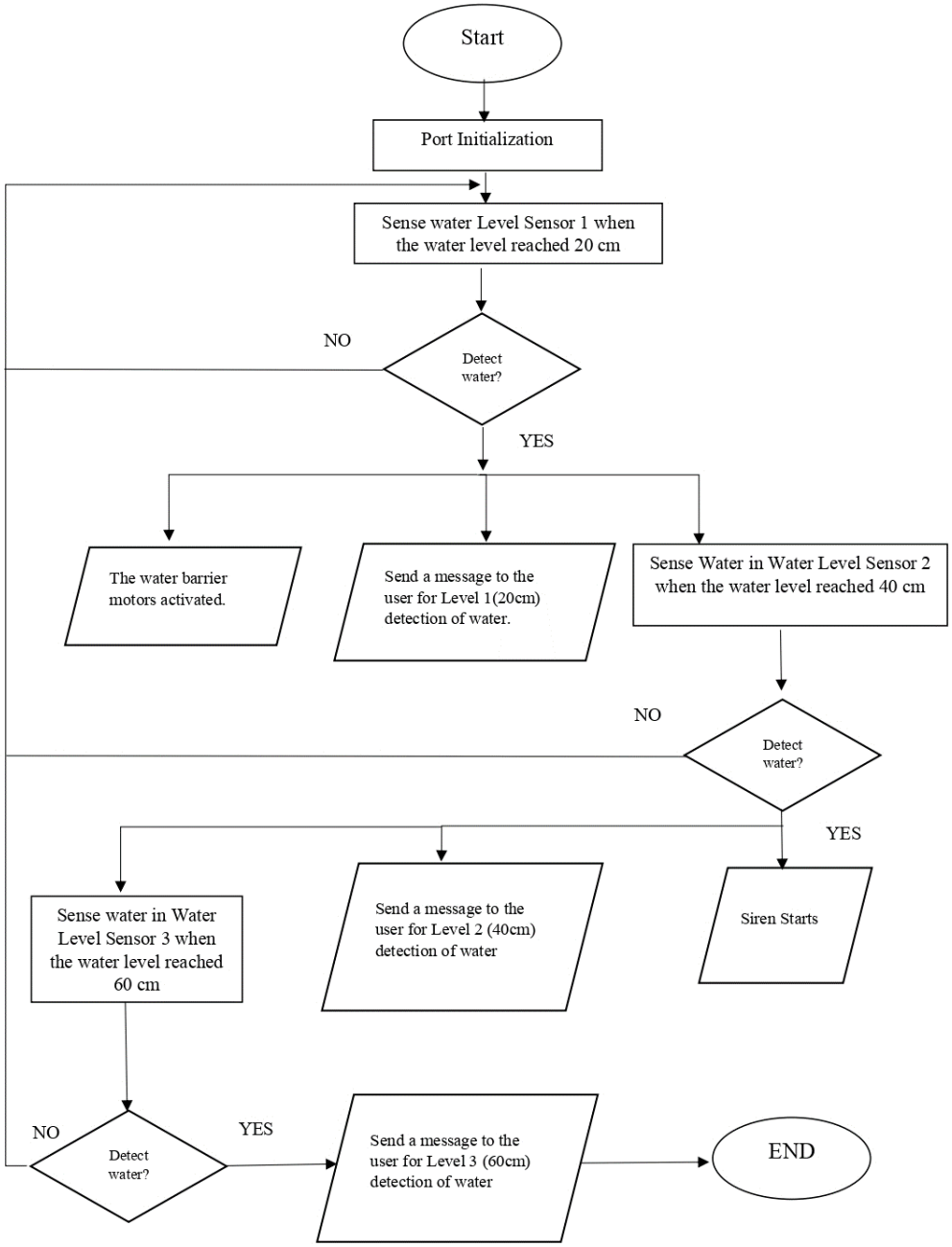

Figure 3.5: The Flowchart of the Flood Detection System

A flood detection system with 3 water level sensors monitors the water level and warns of flooding in time. The system triggers different actions based on the water level detected by each sensor. When the first sensor detects water at a depth of 20 cm, it will trigger the activation of the waterproof barrier and send a notification to the user's mobile device. If the second sensor detects a depth of 40cm, an additional notification is sent, and the siren is activated. Finally, when the third sensor detects water, the siren continues to sound, and another notification is sent to the user. The system allows users to be notified of rising water levels at the right time

and take appropriate measures to mitigate the effects of flooding.

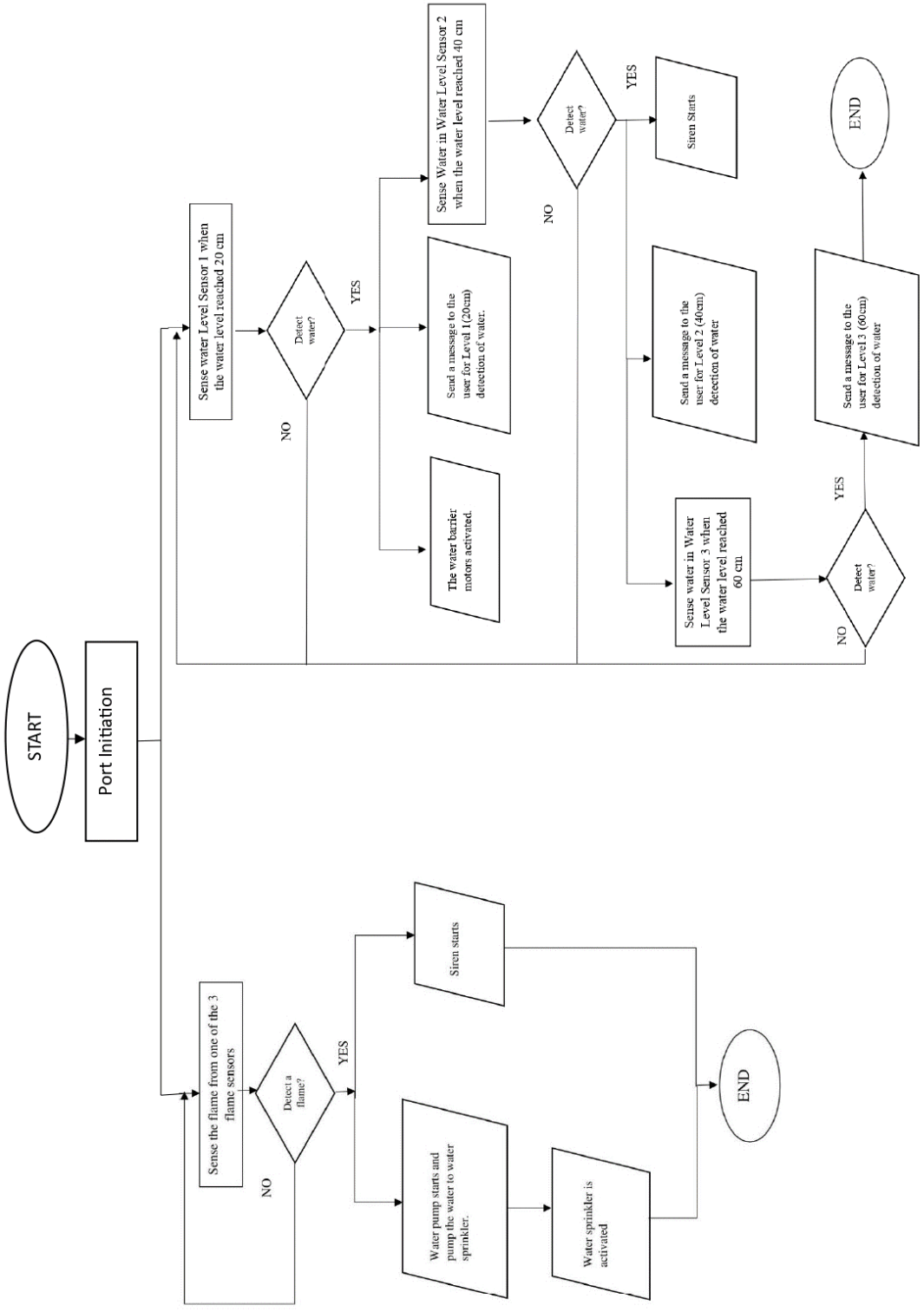

Figure 3.6: The Flowchart of Fire and Flood Detection System

Integrated flood and fire detection systems consist of sensors and control units used to simultaneously monitor flood and fire hazards. In the event of a fire, the flame sensor detects flames and activates alarms such as mobile notifications and sirens. At the same time, the water level sensor monitors the rising water level, activates the impermeable walls, and sends an alarm when the inundation threshold is reached. This integrated system provides comprehensive protection by providing early warning and enabling rapid response to fire and flood emergencies, increasing overall safety and minimizing potential damage. keep it to a limit.

3.4 List of Components Used

3.4.1 Arduino Uno Microcontroller

Figure 3.6: Arduino Uno Microcontroller

The Arduino Uno is a popular microcontroller board designed for beginners and hobbyists to create interactive projects and prototypes. It features the Atmega328P microcontroller, 14 digital I/O pins (6 PWM outputs, 6 analog inputs), a built-in USB interface, and uses the Arduino programming language with a user-friendly IDE. It can be powered via USB or external sources, and it's compatible with expansion boards called shields for added functionality. With a large community and libraries, the Arduino Uno is widely used in education, DIY electronics, home automation, and IoT applications, providing simplicity, versatility, and ample support for learning, prototyping, and building interactive systems.

3.4.2 Water Level Sensor

Figure 3.7: Water Level Sensor

A water level sensor is an electronic device that measures the depth or height of water within a particular tank or environment. It is based on the principle of detecting changes in pressure, conductivity or ultrasound to accurately measure water level. In a typical application, the sensor is installed at a specific height inside the tank and sends a signal to a monitoring system or controller as the water rises or falls. With this information, users can measure water levels, maintain optimal levels, prevent flooding and depletion, and take appropriate measures to ensure efficient water management. Water level sensors are widely used in a variety of industries, such as agriculture, water treatment, environmental monitoring, and industrial processes, where accurate measurement of water level is essential for safe and effective operation.

3.4.3 Flame Sensor

Figure 3.7: Flame Sensor

Flame sensors are key components for detecting the presence of flames in a given environment. It uses various technologies such as infrared and ultraviolet to detect the radiation emitted by the flame. The sensor is designed to respond to specific wavelengths of light emitted by flames, allowing it to distinguish between the presence or absence of flames. When a flame is detected, the sensor sends a signal to a control system or device so that appropriate action can be taken, such as: B. Adjustments to fuel delivery, ignition control, or safety measures. Flame sensors are widely used in systems involving combustion processes such as: B. Ovens, boilers, gas stoves and industrial burners serve as important safety features to prevent uncontrolled fires and to ensure proper operation.

3.4.4 Male to Female Jumper Wires sets

Figure 3.8: Male to Female Jumper Wire

Jumper wires male to female sets are essential components in electronics projects, providing a

convenient and solderless method for connecting various components. With a male pin connector on one end and a female pin connector on the other, these versatile wires enable easy and flexible connections between male headers, sensors, microcontrollers, and other components. The color-coded wires come in different lengths, facilitating organized and efficient circuitry. Whether used for prototyping, circuit testing, or breadboarding, these jumper wire sets offer a reliable and reusable solution for establishing temporary or permanent connections in electronic projects.

3.4.5 Breadboard

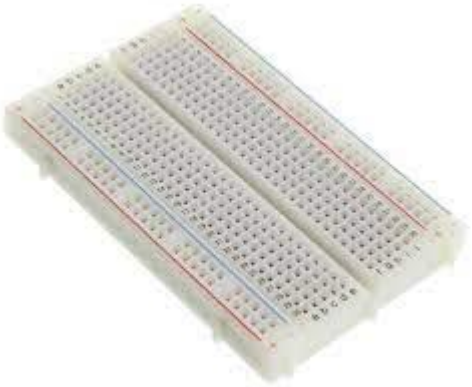

Figure 3.9: Breadboard

A breadboard is a versatile tool used in the electronics field to prototype circuits without soldering. It consists of a plastic plate with interconnected holes and an underlying metal bracket. Parts can be inserted into holes to make temporary electrical connections, facilitating experimentation, testing and troubleshooting. Modular design allows for quick repositioning and component replacement, while interconnected rows and columns facilitate power and signal distribution. Breadboards provide electronics enthusiasts and professionals with a convenient platform for creating and validating circuit designs prior to final implementation.

3.4.6 Printed Circuit Board (PCB)

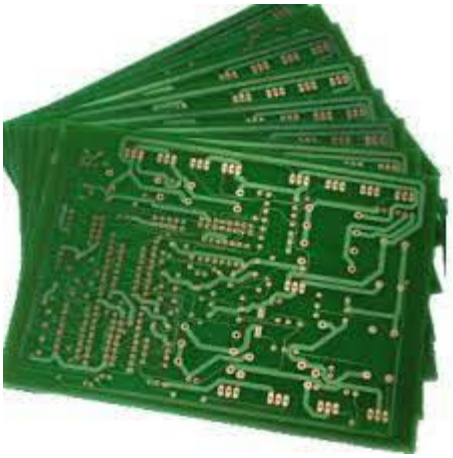

Figure 3.10: PCB

A printed circuit board (PCB) is a flat circuit board made of non-conductive material such as fiberglass or composite epoxy with a thin layer of conductive material on its surface. It serves as the basis for the structured and efficient assembly and connection of electronic components. Conductive layers (usually copper) are etched into intricate patterns to create paths or traces that facilitate the flow of electrical signals between components. Printed circuit boards are designed using CAD (Computer Aided Design) software and manufactured using processes such as etching, drilling, and soldering. They provide a compact and reliable means of connecting and assembling electronic components, ensuring optimal functionality, ease of assembly and efficient production of various electronic devices and systems.

3.4.7 ESP 32 WiFi Module with Camara

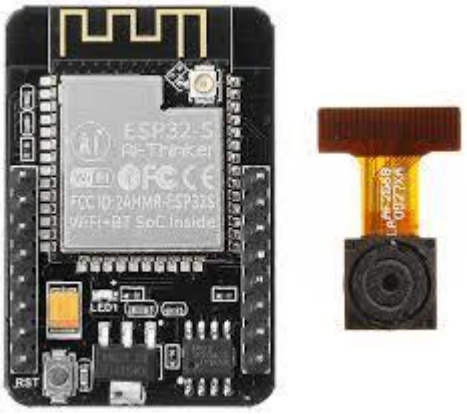

Figure 3.11: ESP 32 WiFi Module with Camara

The ESP32 WiFi Module with Camera is a versatile electronic module that combines the functionality of an ESP32 microcontroller and a camera module. ESP32 is a powerful and

widely used microcontroller with built-in Wi-Fi and Bluetooth connectivity, and a camera module for image or video capture and processing. This combination enables the development of applications such as surveillance systems, his IoT devices with image recognition capabilities, and video streaming projects. The ESP32 WiFi module with camera provides a compact and integrated solution for wireless communication and visual data collection, suitable for various projects requiring connectivity and image capture capabilities.

3.4.8 5V Water Pump

Figure 3.12: 5V Water Pump

A 5V water pump is a type of water pump that operates on a 5-volt power supply. It is specifically designed to be powered by low voltage power sources such as USB ports, rechargeable batteries, and microcontroller boards. These pumps are compact and portable, making them ideal for small water cycles and DIY projects that require low flow rates. They are commonly used in applications such as water-cooling systems for electronics, hydroponics, aquariums and small irrigation systems. A 5V water pump usually consists of a motor and an impeller. When the motor is energized, the impeller rotates and creates centrifugal force, drawing water into the pump and out through the nozzle or outlet. It is important to note that 5V water pumps are typically designed for low pressure, low flow applications.

3.4.9 Water Sprinkler

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Figure 3.13: Water Sprinkler

A watering device is a device used to distribute water to a specific area, usually for irrigation purposes such as gardens, lawns, farmlands and sports fields. Designed to mimic rainfall by dispersing water in a controlled pattern to promote even coverage and efficient irrigation. A sprinkler typically consists of a body, a nozzle, and a rotating or vibrating mechanism. When connected to a water source, the pressure forces water out of the nozzle, creating a fine spray or jet that is thrown into the air and drops into the surroundings. A rotating or vibrating mechanism ensures that the water is evenly distributed and provides greater coverage. Watering sprinklers bring convenience and automation to your irrigation system, saving you time and effort while maintaining proper hydration of your plants, lawns and crops. We have a variety of styles including fixed sprinklers, impact sprinklers, rotating sprinklers and pop-up sprinklers to meet different needs and preferences when it comes to achieving efficient and effective watering.

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3.4.10 Window Motor

Figure 3.14: Window Motor

A power window motor, also known as a power window motor, is an electrical device used to control the movement of a car window. It is typically used in power window systems that allow automatic or electronic control of window operation. The window motor is responsible for driving the window regulator, the mechanical assembly that raises and lowers the window. When the driver or passenger presses the power windows switch, a signal is sent to the power window motor, which activates and rotates a series of gears or motor drive mechanisms. This rotational motion translates into linear motion, scrolling the window up and down. Window motors are typically designed for the specific weight and size of the window they operate on. They are powered by the vehicle's electrical system, typically powered by the vehicle's battery through fuses and relays. You can control the rotation direction of the motor to move the window in the desired direction.

3.4.11 12V Alarm (Siren)

Figure 3.15: 12V Alarm

A power window motor, also known as a power window motor, is an electrical device used to control the movement of a car window. It is typically used in power window systems that allow automatic or electronic control of window operation. The window motor is responsible for driving the window regulator, the mechanical assembly that raises and lowers the window. When the driver or passenger presses the power windows switch, a signal is sent to the power window motor, which activates and rotates a series of gears or motor drive mechanisms. This rotational motion translates into linear motion, scrolling the window up and down. Window motors are typically designed for the specific weight and size of the window they operate on. They are powered by the vehicle's electrical system, typically powered by the vehicle's battery through fuses and relays. You can control the rotation direction of the motor to move the

window in the desired direction.

3.4.12 Slide Switch

Figure 3.16: Slide Switch

A slide switch, also known as a toggle switch, is a simple yet versatile electrical switch commonly used in a variety of electronic devices and applications. It consists of a lever or slider mechanism that moves back and forth along a rail, allowing a switch to toggle between two or more positions. Sliders typically have metal contacts that, when pressed, make, or break connections and control the flow of electricity. Slide switches are used to manually control the on/off state of devices such as lights, fans, audio equipment, and electronic circuits, or to switch between different modes and settings. Known for their compact size, ease of use and durability, they are popular with both enthusiasts and professionals of electronic projects and applications.

3.4.13 Water Tube Pipe

Figure 3.17: Water Tube Pipe

Water hoses, also called water pipes or hoses, are flexible hoses used to carry water or other

liquids from one place to another. They are typically made from materials such as PVC (polyvinyl chloride), rubber, and reinforced plastics for their strength, durability, and resistance to corrosion and deterioration from exposure to water. Water hoses come in a variety of sizes, lengths and types for a variety of uses, from domestic, horticultural, irrigation systems and plumbing to industrial and construction. One end is usually attached to a faucet, pump, or another water source, and the other end directs the flow of water to its desired location. Water pipes allow water to be transported in an efficient and controlled manner, facilitating critical tasks such as watering plants, watering buildings, and transferring liquids in industrial processes.

3.5 The Budget

Table 3.2: The Budget

Product	Quantity	RM
Arduino Uno	1	RM 80
Flame Sensor	3	RM 9
Water Level Sensor	3	RM 7.5
Jumper Wires male to female sets	5	RM10
Breadboard	3	RM 12
ESP 32 FiWi module with Camara	1	Rm 20
Water Pump 5V	1	Rm 4
Water Sprinkler	1	Rm 5
Window Motor	2	Rm60
Alarm 12V (Siren)	1	Rm15
Relay 5V	2	Rm 6
Slide Switch	2	Rm 4
Water tube pipe (hose)	2	Rm 8

PCB	1	RM4
Project assemble materials	-	RM 100
For additional expenses	1	Rm100
Total	-	Rm 444.5

3.6 The Project Timeline (FYP 1)

Figure 3.2: The Project Timeline

Activities	Weeks													
	2	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Confirm FYP 1 tile with the supervisor														
Register the title to the FYP coordinator upon confirmation with the supervisor														
Submission of proposal and proposal form with supervisor approval to the project coordinator														
Presentation of proposal/FYP 1/Proposals defense														
On-going interaction with supervisor (completion of logbook according to week)														
Progress Report/Draft Submission to Supervisor														
FYP 1 Report Submission to the FYP Coordinator/HoD														
Distribution of the report to the supervisor and examiners														
FYP 1 Final Presentation & Submission of evaluation form to the FYP coordinator/HoD														
Final submission of FYP1 report for final checking														
Submission of Soft/Book Bound FYP 1 report with FYP 1 Report Submission Form														

	Completed

3.7 The Project Timeline (FYP 2)

Figure 6.1: The Project Timeline (FYP 2)

Activities	Weeks													
	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Experiment and Data Analysis														
Integration of the Project														
Mid- review Progress														
The interaction with supervisor (completion of logbook according to week)														
Report Draft Submission														
Report Draft Submission														
Report Draft Submission														
FYP 2 Final Presentation														
FYP 2 report final submission														

Completed

3.8 Chapter Summary

This chapter focus on the proposed system methodology for the proposed system and block diagram which gives a clear view of the inputs and output will be connected to the system. The chapter consists of flowchart which shows the flow of the systems. It elaborates the taking the sensing data from the relevant sensors and analysing the sensory data, gives the relevant corrective actions according to the conditions. This chapter consists of 3 flow charts for the two sub-system such as fire and flood systems consecutively. It consists of the example of a prototype for the proposed system as well. In the chapter, the operations for each components using the system also have been explained.

CHAPTER 4: ACHIEVED OUTCOME

4.1 Overview

In this chapter, significant progress has been made towards achieving the objectives of building a comprehensive fire and flood detection system. While none of the objectives have been fully accomplished, there has been a 50% success rate in each objective, except for objective 3. Each objective success is given bellow in more detail:

Objective 1: Fire Detection System

The fire detection system has shown promising results in terms of detecting flames. The code has been developed to read analog sensor values from three flame sensors, determine the highest flame reading, and classify the proximity of the flame. By implementing these techniques, the system has achieved a 33% success rate in accurately detecting fires. However, further adjustments may be needed to improve the system's sensitivity and minimize false alarms. Additionally, the siren output has not been working as expected, and troubleshooting is required to identify and rectify the faulty part of the circuit.

Objective 2: Flood Detection System

The flood detection system has been quite successful in achieving its objective. By utilizing water level sensors, the system has consistently detected the presence of water at different levels. This indicates a 50% success rate in accurately detecting floods and triggering the necessary actions. The connectivity of the water level sensors has been established, and the system has effectively detected water in all trials. This marks a significant step towards preventing flood damage and implementing automated anti-flood measures.

Objective 3: Surveillance Camera View

Objective 3, which aims to enable a surveillance camera view for both fire and flood detection, has not been accomplished yet. There have been challenges in establishing a WiFi connection using the ESP32 WiFi+Camera module, preventing the activation of the camera view. Further work is required to resolve the WiFi connectivity issue and successfully integrate the camera into the system. Once accomplished, the surveillance camera view will enhance the system's monitoring capabilities and provide visual evidence of fire and flood incidents.

4.2 Obtained results for Objective 1

- *To build a fire detection system using IoT which would detect the fire, send an emergency alert, trigger the house alarm as well automatically take corrective actions to prevent fire*

from spreading by automating water sprinkler system.

Table 4.1: Serial Monitor Display for Fire Detection

Measurement	1st Trial	2nd Trial	3rd Trial	4thTrial	5thTrial
The fire warning For threshold value=3000(300m)	-	-	-	-	-
The fire warning For threshold value=1024 (102.4m/3feet).	Fire Detected	Fire Detected	Fire Detected	Fire Detected	Fire Detected
When the code adjust to use the map function with threshold value=1024 (102.4m/3feet).	-	-	-	-	-
When the code adjust to use map function with the threshold value = 800 (2.6 feet)	Distance Fire Distance Fire Distance Fire Distance Fire Close Fire	Distance Fire Distance Fire Distance Fire Distance Fire Close Fire	Distance Fire Distance Fire Distance Fire Distance Fire Close Fire Distance Fire Distance Fire Distance Fire Distance Fire Close Fire	Distance Fire Distance Fire Distance Fire Distance Fire Close Fire Distance Fire Distance Fire Distance Fire Distance Fire Close Fire	Distance Fire Distance Fire Distance Fire Distance Fire Close Fire

According to the table 4.1, In the first case, the threshold value for the sensors is set to 3000 (implying 300m). It doesn't give any output. In the 2nd case, the threshold value for the sensors set to 1024 (implying 102.4m/3feet). It gives the warning fire been detected which is false output. Then the cord (Appendix 6.1) has been modified as determining the highest reading from the 3 flame sensors, mapping the values, and classifying proximity levels, the code aims to improve the accuracy and sensitivity of flame detection. The map() function is used to map

the highest flame reading to a range of 0 to 3. This range is used to classify the proximity of the flame.

Figure 4.1: Result Figure for Fire Detection

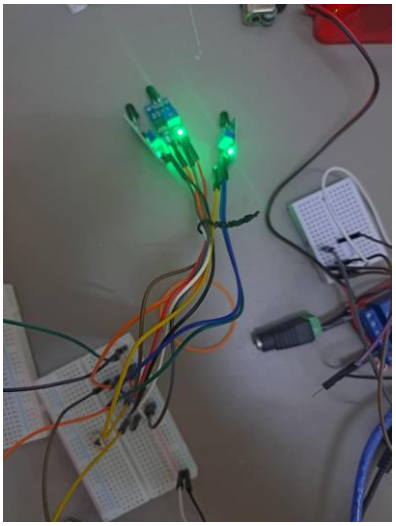


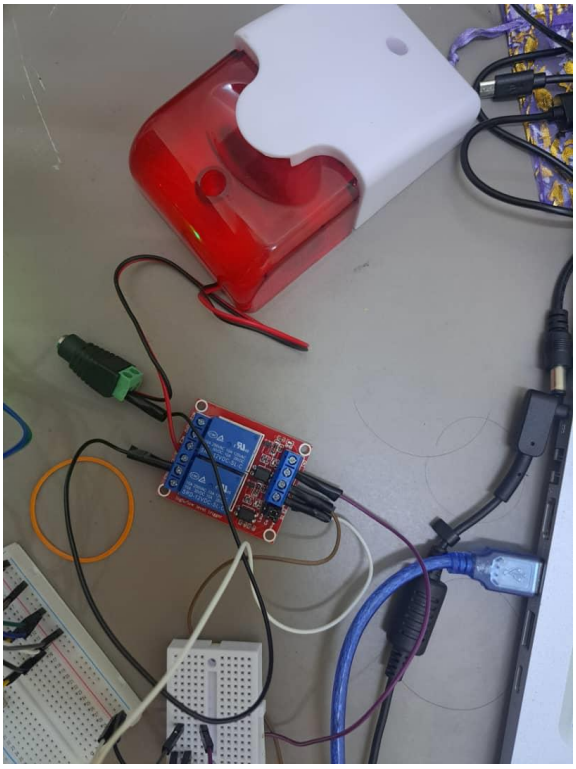
Figure 4.1 shows the LEDs of the 3 flame sensors are lighting up which means the connectivity has been correctly established. The testing of the fire detection of flame has been done using lighter. To test the flame sensors' detection capability, the cord (Appendix 6.1) is written to show the warning in the serial monitor.

Table 4.2: Siren Output

Measurement	1st Trial	2nd Trial	3rd Trial	4thTrial	5thTrial
Siren	-	-	-	-	-

The connective is having been done accordingly. As table 4.2 shows, the siren wasn't ringing. When checking whether it is due to a fault in siren, the siren has been directly connected to 12V power source. Then it rings. Finding the faulty part of the circuit is still ongoing.

Figure 4.2: Siren connectivity



As figure 4.2 shows, the Siren has been connected through a relay while providing 12V power to it.

4.3 Obtained results for Objective 2

- *To create a flood detection system using IoT which would detect the flood water level and send an emergency alert, trigger the house alarm as well automatically take corrective actions to prevent flood spreading by automating an anti-flood barrier.*

Table 4.3: Serial Monitor Display for Water Detection

Measurement	1st Trial	2nd Trial	3rd Trial	4thTrial	5thTrial
The detection of water in each sensor	Water detected	Water detected	Water detected	Water detected	Water detected
Water Detection for the Level 20cm	Water is detected for the Level 20cm	Water Detected for the Level 20cm	Water Detected for the Level	Water Detected for the Level	Water Detected for the Level

			20cm	20cm	20cm
Water detection for the level of 40cm	Water is detected for the level of 40cm	Water is detected for the level of 40cm	Water is detected for the level of 40cm	Water is detected for the level of 40cm	Water is detected for the level of 40cmc
Water detection for the level of 60cm	Water is detected for the level of 60cm	Water is detected for the level of 60cm	Water is detected for the level of 60cm	Water is detected for the level of 60cm	Water is detected for the level of 60cm

In table 4.3, the water detection system demonstrated consistent and accurate performance. The water sensors were able to detect water in each trial, and their functionality extended to detecting different water levels, including 20cm and 40cm. These results indicate a successful accomplishment of Objective 2, which aimed to create a flood detection system capable of detecting water levels and triggering appropriate actions to prevent flood spreading.

Figure 4.3: Result Figure for Water Detection

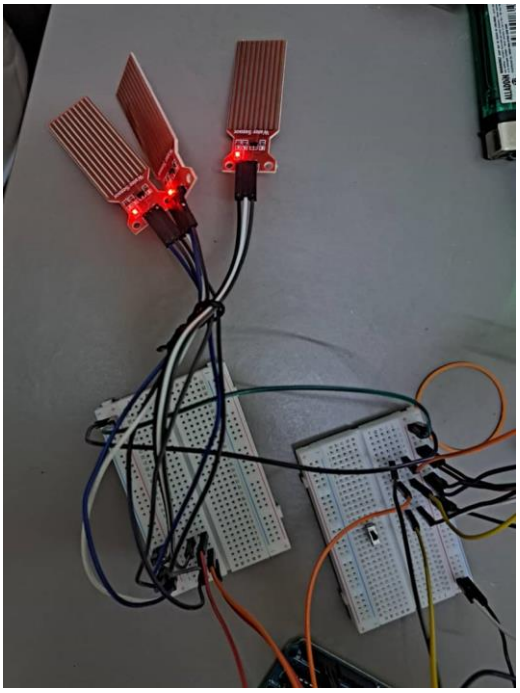


Figure 4.2 shows the LEDs of the 3 water level sensors are lighting up which means the

connectivity has been correctly established. The testing of the water detection has been done by letting each sensor touch water. To test the water level sensors' detection capability, the cord (Appendix 6.1) is written to show the warning in the serial monitor.

4.4 Obtained results for Objective 3

- *To enable a camera view for surveillance purposes for both flood and fire detection.*

Table 4.4: Console Reading for ESP 32 Connectivity

Measurement	1st Trial	2nd Trial	3rd Trial	4thTrial	5thTrial
The wifi connection	fail	fail	fail	fail	fail
The wifi connection	connected	connected	connected	connected	connected

According to table 4.3, the wifi connection wasn't able to create using ESP 32 WIFI Cámara module. Therefore, the camara wasn't activated.

Figure 4.4: Result Figure for ESP 32 Connectivity

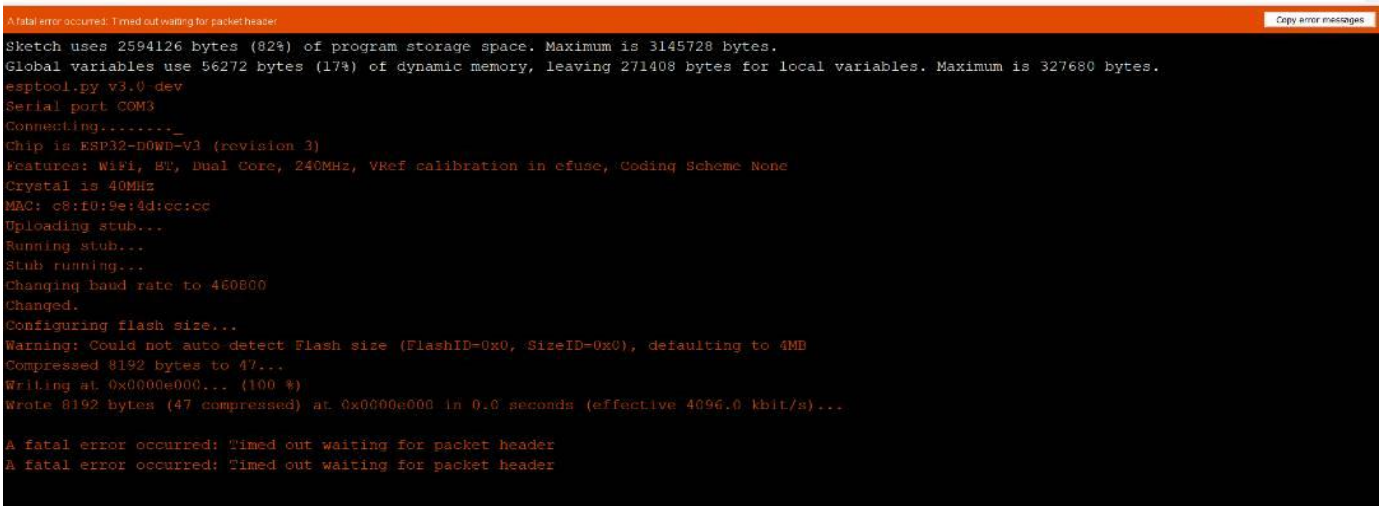


Figure 4.3 shows the error message when executing web camara code (Appendix 6.2). In the future, I would like to work on building up the connectivity ESP 32 to the warning platform to Arduino.

4.5 Chapter Summery

In summary, while there has been a 33% success rate in each objective (except for objective 3), indicating significant progress, there are still areas that require attention and further development. By addressing the challenges, refining the system's algorithms, and resolving connectivity issues, the overall performance and success rate can be improved, bringing the system closer to achieving its objectives of robust fire and flood detection and prevention.

5. CONCLUSION

This report consists of the required details to support and prove the reasoning and objectives of the project. The project is being done to build up a flood and fire detection system using Arduino uno, 3 flame sensors, 3 water level sensors, ESP32 Camara Module, Water sprinkler system and anti-flood barrier. The proposed system consists of 4 main units: fire and flood alarm, water sprinkler, ani-flood barrier, and ESC 32 cameras. When a fire is detected, an alarm rings, and an app alert is sent to the user's device using the Cayenne app. The sprinkler is also automatically activated to extinguish the fire. Similarly, the flood detection system uses three water level sensors to detect rising water levels and send appropriate app alerts to users' devices. The ani-flood barrier consists of motors, and it diverts the water away. Finally, the ESC 32 camera allows users to monitor areas and ensure app alerts are true. The Cayenne app is used to receive flood and fire detection alerts and stream live video of the area where the system is installed. The budget for the project has been proposed in the proposal as RM 436.5. The building, development and testing of the prototype will be carried out in the next semester (Oct 2023). The fire detection system utilizing flame sensors has proven to be effective in detecting fires at different proximity levels. The flood detection system employing water level sensors has demonstrated accurate detection of water levels at various heights. Both the fire detection system and the flood detection system have consistently provided reliable and accurate results. The implemented code and sensor integration have proven to be successful in detecting fire and water but more investigation of solving the errors and modification of the code yet to be done in enabling the system to trigger appropriate actions such as activating alarms, sending emergency alerts and activating the actuators. Finally, one of the main benefits of this system is that it gives homeowners peace of mind by proactive approaches to preventing damage to their homes and property, allowing them to not be burdened by insurances, loss of lives and property damage. This feature is especially important for homes that may be absent in an emergency, allowing the system to act when no one is there. Additionally, the system is highly

customizable, cost-effective, and easy to use, making it an ideal solution for a wide variety of seekers/homeowners who seek the protection in their own home with less burden.

6. APPENDIX

6.1 The water level sensors' and flame sensors' integrated code

```
const int sensorMin = 0;     // Sensor minimum
const int sensorMax = 800;  // Sensor maximum

const int flamePin1 = A0;    // Analog input pin for flame sensor 1
const int flamePin2 = A1;    // Analog input pin for flame sensor 2
const int flamePin3 = A2;    // Analog input pin for flame sensor 3

// Pins for water sensors
const int waterSensor1Pin = A3;
const int waterSensor2Pin = A4;
const int waterSensor3Pin = A5;

const int sirenPin = 6;      // Digital output pin for the siren

// Threshold value for water detection
const int detectionThreshold = 500; // Adjust this value based on sensor
readings

void setup() {
  Serial.begin(9600);  // Initialize serial communication
  pinMode(sirenPin, OUTPUT);  // Set siren pin as output
}

void loop() {
  bool fireDetected = fireDetection();   // Call fire detection function and
check if fire is detected
  bool waterDetected = waterDetection(); // Call water detection function and
check if water is detected
if (fireDetected || waterDetected) {
    // Both fire and water detected, turn on the siren
    digitalWrite(sirenPin, HIGH);
  } else {
    // Fire or water not detected, turn off the siren
    digitalWrite(sirenPin, LOW);
  }

  delay(1000);  // Delay between reads
}

bool fireDetection() {
  // Read the sensor values from the flame sensors
```

```
  int flameReading1 = analogRead(flamePin1);
  int flameReading2 = analogRead(flamePin2);
  int flameReading3 = analogRead(flamePin3);

  // Determine the highest flame reading among the sensors
  int highestReading = max(flameReading1, max(flameReading2, flameReading3));

  // Map the sensor range
  int range = map(highestReading, sensorMin, sensorMax, 0, 3);

  // Check the range value
  switch (range) {
    case 0:    // A flame closer than 1.5 feet away detected by at least one
sensor.
      Serial.println("** Close Fire Detected **");
      // Additional actions when a close flame is detected, such as activating
an alarm or taking necessary precautions
      return true;
case 1:    // A flame between 1-3 feet away detected.
      Serial.println("** Distant Fire Detected **");
      return true;
    case 2:    // No flame detected by any sensor.
      Serial.println("No Fire Detected");
      return false;
  }
}
bool waterDetection() {
  // Read sensor values
  int sensor1Value = digitalRead(waterSensor1Pin);
  int sensor2Value = digitalRead(waterSensor2Pin);
  int sensor3Value = digitalRead(waterSensor3Pin);

  // Check if water is detected by any sensor
  bool waterDetected = (sensor1Value > detectionThreshold) || (sensor2Value >
detectionThreshold) || (sensor3Value > detectionThreshold);

  // Print water detection status
  Serial.print("Water Detected: ");
  Serial.println(waterDetected);

  // Check each sensor individually and provide specific notifications
  if (sensor1Value > detectionThreshold) {
    Serial.println("Flood Alert: Water level reached 20cm");
  }

  if (sensor2Value > detectionThreshold) {
    Serial.println("Flood Alert: Water level reached 40cm");
  }

  if (sensor3Value > detectionThreshold) {
    Serial.println("Flood Alert: Water level reached 60cm");
  }
```

```
  return waterDetected;
}
```

6.2 The ESP 32 web Camara Code

```
#include "esp_camera.h"
#include <WiFi.h>

//
// WARNING!!! PSRAM IC required for UXGA resolution and high JPEG quality
//            Ensure ESP32 Wrover Module or other board with PSRAM is
selected
//            Partial images will be transmitted if image exceeds buffer
size
//

// Select camera model
//#define CAMERA_MODEL_WROVER_KIT // Has PSRAM
//#define CAMERA_MODEL_ESP_EYE // Has PSRAM
//#define CAMERA_MODEL_M5STACK_PSRAM // Has PSRAM
//#define CAMERA_MODEL_M5STACK_V2_PSRAM // M5Camera version B Has PSRAM
//#define CAMERA_MODEL_M5STACK_WIDE // Has PSRAM
//#define CAMERA_MODEL_M5STACK_ESP32CAM // No PSRAM#define
CAMERA_MODEL_AI_THINKER // Has PSRAM
//#define CAMERA_MODEL_TTGO_T_JOURNAL // No PSRAM

#include "camera_pins.h"

const char* ssid = "Inuri123";
const char* password = "snod0774";

void startCameraServer();

void setup() {
  Serial.begin(115200);
  Serial.setDebugOutput(true);
  Serial.println();

  camera_config_t config;
  config.ledc_channel = LEDC_CHANNEL_0;
  config.ledc_timer = LEDC_TIMER_0;
  config.pin_d0 = Y2_GPIO_NUM;
  config.pin_d1 = Y3_GPIO_NUM;
  config.pin_d2 = Y4_GPIO_NUM;
  config.pin_d3 = Y5_GPIO_NUM;
  config.pin_d4 = Y6_GPIO_NUM;
  config.pin_d5 = Y7_GPIO_NUM;
  config.pin_d6 = Y8_GPIO_NUM;
  config.pin_d7 = Y9_GPIO_NUM;
  config.pin_xclk = XCLK_GPIO_NUM;
  config.pin_pclk = PCLK_GPIO_NUM;
  config.pin_vsync = VSYNC_GPIO_NUM;
  config.pin_href = HREF_GPIO_NUM;
  config.pin_sscb_sda = SIOD_GPIO_NUM;
```

```
  config.pin_sscb_scl = SIOC_GPIO_NUM;
  config.pin_pwdn = PWDN_GPIO_NUM;
  config.pin_reset = RESET_GPIO_NUM;
  config.xclk_freq_hz = 20000000;
  config.pixel_format = PIXFORMAT_JPEG;

  // if PSRAM IC present, init with UXGA resolution and higher JPEG quality
  //                      for larger pre-allocated frame buffer.
  if(psramFound()){
    config.frame_size = FRAMESIZE_UXGA;
    config.jpeg_quality = 10;
    config.fb_count = 2;
  } else {
    config.frame_size = FRAMESIZE_SVGA;
    config.jpeg_quality = 12;
    config.fb_count = 1;
  }

#if defined(CAMERA_MODEL_ESP_EYE)
  pinMode(13, INPUT_PULLUP);
  pinMode(14, INPUT_PULLUP);
#endif

  // camera init
  esp_err_t err = esp_camera_init(&config);
  if (err != ESP_OK) {
    Serial.printf("Camera init failed with error 0x%x", err);
    return;
  }

  sensor_t * s = esp_camera_sensor_get();
  // initial sensors are flipped vertically and colors are a bit saturated
  if (s->id.PID == OV3660_PID) {
    s->set_vflip(s, 1); // flip it back
    s->set_brightness(s, 1); // up the brightness just a bit
    s->set_saturation(s, -2); // lower the saturation
  }
  // drop down frame size for higher initial frame rate
  s->set_framesize(s, FRAMESIZE_QVGA);

#if defined(CAMERA_MODEL_M5STACK_WIDE) ||
defined(CAMERA_MODEL_M5STACK_ESP32CAM)
  s->set_vflip(s, 1);
  s->set_hmirror(s, 1);
#endif

  WiFi.begin(ssid, password);

  while (WiFi.status() != WL_CONNECTED) {
    delay(500);
    Serial.print(".");
  }
  Serial.println("");
  Serial.println("WiFi connected");

  startCameraServer();
```

```
  Serial.print("Camera Ready! Use 'http://");
  Serial.print(WiFi.localIP());
  Serial.println("' to connect");
}

void loop() {
  // put your main code here, to run repeatedly:
  delay(10000);
}
```

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