IOT EARLY FLOOD DETECTION SYSTEM USING ARDUINO

BY

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(18/ENG02/041)

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IN PARTIAL FULFILLMENT OF REQUIREMENTS FOR THE

AWARD OF BACHELOR OF ENGINEERING (B. ENG) DEGREE IN ENGINEERING.

MAY 2023.

DECLARATION

I, Geoffrey Chima Emeka David, hereby declare that this project titled "**IOT EARLY FLOOD DETECTION SYSTEM USING ARDUINO**" has been carried out by me under the supervision of Dr. E Monday, Department of electrical electronics/computer engineering department. It is presented for the award of the Degree of Bachelor of Engineering (B.Eng.) in Computer Engineering. All the sources of information that are externally obtained are acknowledged by means of reference.

_____ _____

Signature Date

CERTIFICATION

This is to certify that this project was undertaken by Geoffrey Chima Emeka David (18/ENG02/041) supervised by Dr. E Monday, with the report presented to the College of Engineering, Afe Babalola University, Ado-Ekiti, Nigeria.

Dr. Monday _____

Lead Supervisor **Signature and Date**

Dr. Femi Onibonoje _____

Co-Supervisor **Signature and Date**

DEDICATION

This report is dedicated to firstly of all God almighty whose name is above all, through him guidance, strength and support to be able to complete this project, to my amazing parent Dr.GID Chima and Mrs.Josphine Chinyere Geoffrey Chima and my lovely siblings firstly my beautiful twin sister Nneka Grace Geoffrey Chima and Chidinma Susanna Geoffrey Chima along with my stylish Amarachi Miriam Geoffrey Chima , my little princess Amanda Lois Geoffrey Chima my man Echezonam Geoffrey Chima and lastly Simba the dog.

As well to Dr. E Monday for being an amazing guidance enabling me to complete my final year project.

ACKNOWLEDGMENT

I would like to thank God Almighty the king of king for giving me this opportunity, the strength, Provision, the patience to increase my level of wisdom, knowledge, understanding, and experience in my chosen field and I pray for his grace to be a different in my generation.

A distinctive gratitude to my amazing parent, Dr.GID Chima the wisest man I know, a role model to me, who proved no matter what life throws I will never quit, a pillar and most importantly my Daddy who has guided me from day one and I pray for the grace to bend down to listen to him. My power woman Mrs.Josphine Chinyere Geoffrey Chima who is very driven, passionate at what she does, a loving personality as well as an unforgettable character who taught me how to be independent and handy.

Along with my lovely, supportive and amazing twin sister Nneka Grace Geoffrey Chima and Chidinma Susanna Geoffrey for always been by myside since day one love you guys.As well with my wonderful younger siblings , my stylish Amarachi Miriam Geoffrey Chima , my little princess Amanda Lois Geoffrey Chima my man Echezonam Geoffrey Chima for radiating their amazing individuality lastly Simba the dog for always playing.

My profound gratitude goes to my amazing friends and my roomaates Terrible T (Ahamuefule Terence Koisisochukwu,) Concept Jo (Akinde Joel Akintayo), Mentality advance MI (Okokpo Emine-Imo Imowo) and Stan (Ginigeme Stanley Chukuma).

Special appreciation goes to my supervisor Dr E Monday, level adviser, Dr. Akuwumi Joseph and Engr.Ibitoye Oladapo Tolulope for dedicating their time to my development as an Engineer and their suggestions, ideas, and comments, which helped me complete this project.

I want to acknowledge a fallen brother, Engr.Ayomide Oluwagbohumi Oduntan, an amazing person who past on the 1-june-2023 may your soul rest in peace.

Final appreciation goes to my colleagues in the computer engineering department for completing this 5 years journey together.

ABSTRACT

IOT Early Flood Detection System Using Arduino is an intelligent system that maintains a careful eye on many natural characteristics to predict a flood, so we may embrace caution and prevent the damage caused by the flood. Natural disasters, such as flooding, may cause extensive property damage and loss of life. The method uses several natural elements to detect floods in order to prevent or mitigate their effects. Because the system includes a Wi-Fi connection, its discovered data may be retrieved from anywhere pretty easily via IOT.

To detect a flood the system observes various natural factors, which includes humidity, temperature, and water level and flow level. To collect data of mentioned natural factors the system consists of different sensors which collects data for individual parameters, for detecting water level using water level sensor.

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NOMENCLATURE

IOT - Internet of Things

SMS – Short Message Service

WI-FI - Wireless Fidelity

WPAN – Wireless Personal Area Network

GSM- Global System for Mobile

LCD- Liquid Crystal Display

GPRS- General Packet Radio Service

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Study

IOT Early Flood Detection System Using Arduino is an intelligent system that maintains a careful eye on many natural characteristics to predict a flood, so we may embrace caution and prevent the damage caused by the flood. Natural disasters, such as flooding, may cause extensive property damage and loss of life. The method uses several natural elements to detect floods in order to prevent or mitigate their effects. Because the system includes a Wi-Fi connection, its discovered data may be retrieved from anywhere pretty easily via IOT.

The method analyses various environmental components, including humidity, temperature, water level, and flow level, to determine a flood. The system includes multiple sensors that gather data for certain characteristics, such as detecting changes in water level using a water level sensor, to capture data on specific natural variables.(Keoduangsine, 2015)

Floods are terrible natural disasters that affect many nations throughout the globe each year, particularly in flood-prone areas. Floods may not only destroy structures and endanger the lives of people and animals, but they may also result in the spread of illnesses such as cholera and malaria. Flooding is often caused by heavy rains on flat terrain, reservoir failure, volcanoes, melting snow and perhaps glaciers, and other factors. Flood hazard is determined by a variety of elements, including rainfall, river flow and tidal surge statistics, geography, flood control systems, and changes caused by building and development in flood plain zones.

Flooding is caused by a variety of factors and is often preceded by heavy rainfall. Other sources of flooding include moderate to severe winds over water, unusually high tides, tsunamis caused by underwater earthquakes, and the collapse or failure of dams, levees, retention ponds or lakes, and other water-retaining infrastructure. Flooding may be exacerbated by impermeable surfaces or other natural and man-made dangers that devastate soil and plants that absorb rainwater. Although flooding is a natural occurrence, man-made changes to the soil may also have an impact. Floods are not caused by development, although it may exacerbate them. Pavement and roofs in cities and suburbs prevent some rainwater from being absorbed by the soil, which may increase the amount of runoff pouring into low lying regions or storm drain systems.(Gomathy et al., 2021a).

1.2 Problem Statement

Flooding is a constant issue with no permanent solution, caused by rising sea levels and catastrophic weather events that unleash uncontrolled rapids that consume everything in their path. Flooding is a concern because it harms both persons and communities and has social, economic, and environmental impacts. Floods have direct implications such as loss of life, property destruction, agricultural disaster, animal loss, and deterioration of health problems due to waterborne infections. In addition to communication linkages and infrastructure such as power plants, highways, and bridges being destroyed or shut down, some economic operations may be halted, people may be forced to leave their homes, and daily life is affected.

Similarly, interruption to industry may result in fatalities. Infrastructure damage has long-term effects, such as interruptions in the supply of clean water, wastewater treatment, energy,

transportation, communication, education, and health care. Residents in flood plains may face economic instability as a result of loss of livelihood, reduction in buying power, and loss of land value. Floods may also cause long-term stress to victims and their families. The death of a loved one has far-reaching consequences, particularly for children. Displacement from one's home, loss of possessions, and interruption to one's career and social interests may all lead to long-term stress. Some persons may suffer long-term psychological consequences.

Floods may also cause long-term stress to victims and their families. The death of a loved one has far-reaching consequences, particularly for children. Displacement from one's home, loss of possessions, and interruption to one's career and social interests may all lead to long-term stress. Some persons may suffer long-term psychological consequences.

Floods and flash floods were observed in Yobe state (north-eastern Nigeria) , resulting in deaths. According to reports, four people were murdered and many more were injured. A total of 100 families have been relocated over 11 villages in Gulani and one hamlet in Gujba. Several communities, including Gulani, Bara, Gagure, and Njibulwa, are now inaccessible due to the destruction of an essential bridge connecting these locations.

Flood prevention requires careful urban planning, suitable sea-wall construction, and proper home-building methods. Even with all of the security features built into today's infrastructure, there are times when prevention just isn't enough.

An IOT Early Flood Detection System" is an intelligent system that maintains careful watch on many natural aspects to foresee a flood, so we may embrace caution and reduce the harm caused by the flood. Flood detection and avoidance technologies have been developed to help

people prepare for and be aware of a looming hazard. The gadgets may help to reduce flood-related damage and loss, as well as maybe save lives.

Some of the benefits of adopting a flood monitoring system include:

- There is a high level of confidence since data is supplied in real time.
- Flooding concerns must be handled as quickly as feasible.
- Customized solutions that interact with external development at all levels, including connectivity, user application, and device, are available.

Data from a flood monitoring system may be used in future studies on weather patterns and climate change, they require less energy and may be powered by solar energy; they are very durable and have a long operational life cycle, making them extremely useful and cost-effective.

To recap, flooding is a worldwide issue with no permanent solution, caused by increasing sea levels and catastrophic weather events that release uncontrolled floods that engulf everything in their path. Floods have direct repercussions, including loss of life, property damage, agricultural devastation, animal loss, and aggravation of health issues due to waterborne infections. Aside from communication lines and infrastructure such as power plants, highways, and bridges being destroyed or obstructed, some economic activities may be affected, people may be pushed to leave, and ordinary life may be disturbed.

1.3 Aim and Objective

The goal of this project is to develop an intelligent system that monitors various natural factors such as floods and collects data using a flood monitoring system that can be used in future studies for weather patterns, climate change, and flood prediction, so that we can embrace caution and minimize flood damage.

- To educate the public on the dangers of natural disasters and how to prepare for, react to, recover from, and mitigate the effects of such catastrophes.
- To improve warning and emergency communication systems.
- To assist public authorities and government organizations with risk mitigation strategies, such as planning and action coordination.

1.4 Project Scope

1.4.1 Project Goals

An "IOT Early Flood Detection System" is an intelligent system that keeps a close eye on various natural factors and collects data using a flood monitoring system that can be used in future studies for weather patterns, climate change, and to predict a flood, so we can embrace caution and minimize the damage caused by the flood.

1.4.2 Project Justification

Justification for the Project Flood detection system may help prepare and notify people of an impending threat, it may also help to minimize excessive flood damage and loss, as well as maybe save lives.

1.4.3 Exclusions

1. Sim900 module

2. Arduino Uno

3. Breadboard- 400 tie points

4. 16×2 LCD Display

5. Water level sensor

6. Jumper Wires

- Male to Female Jumper Wires- 15 pcs
- Male to Male Jumper Wires- 10 pieces
- Female to Female Jumper Wires- 5 pieces

7. 9v Battery and Connector

1.5 Justification

The primary goal of this research is to provide a mechanism to help people prepare for and be aware of possible dangers. It may also help to reduce excessive damage and loss caused by floods, and may even save lives.

Timely detection of future flood threats and floods, highly reliable and easily available real-time data, and a one-of-a-kind solution that can be connected with external advancements at any level (device, connection, cloud, or user application).

The advantages of flood detection and warning are closely connected to the effectiveness of warning distribution campaigns and the actions of the public and responding agencies (both volunteer and government). The overall benefits may be defined as "the reduction in losses (tangible and intangible) resulting from the delivery of a warning as compared to the situation prior to the operation of the warning system(M & Hameed, 2020)."

CHAPTER TWO

2.0 LITERATURE REVIEW

This chapter is demystifying the current knowledge regarding IOT Early Flood Detection System. In dealing with this challenge, the researcher will focus on, internet of things based real time flood monitoring and alert management system; building of a low-cost community based real time flood monitoring and early warning system and SMS based flood monitoring and early warning.

2.1 Flood Monitoring and Alert Management System

Flooding is without a doubt the most prevalent weather-related hazard on the planet. A flood is defined as water flowing across ordinarily dry terrain; it may occur practically anywhere. Flooding is commonly thought to be caused by heavy rainfall; however, floods can occur in a variety of ways that are not directly related to ongoing weather events; thus, the origins of flooding ultimately lie in atmospheric processes that create precipitation, regardless of what specific event causes the flooding.

Floods cause damage because of the rapid velocity of the moving water and the deposition of mud and debris as the flood recedes . Flooding is often associated with faster-flowing water, which is due in part to the weight of a higher volume of water upstream, which causes an increase in the pressure gradient that propels the flow. Flood debris, such as trees, autos, stones, and buildings, generally enhances the flood's destructive power. Floodwaters often include suspended silt as well as potentially harmful bacteria and dissolved compounds, and

when floodwaters originate directly from precipitation, atmospheric processes may be recognized as a component responsible for rainfalls.

Flash floods are defined as flood situations in which the rise in water happens immediately or within a few hours after the causing rainfall. As a consequence, when the drainage basin's response time is short, flash floods occur in confined catchments. Many hydrological elements, such as terrain gradients, soil type, plant cover, human occupancy, recent rainfall, and so on, impact the occurrence of a flash flood.(Chaus et al., 2019)

2.1.1 Flooding in the context of global warming

Experts say it is difficult to observe the relationship between flooding and climate change due to limited historical records, especially for the most extreme floods, which occur infrequently, but weather is not climate, even though weather can be affected by climate

2.1.2 Impact of floods

Flooding is a natural disaster that causes anguish wherever it strikes, with uncontrollable rapids that drown and ruin everything in their path, impacting people and communities as well as bringing social, economic, and environmental harm (McAdam, 2012).

The flood consequences are as follows:

1.Flooding is hazardous to animals

Flooding may be very dangerous to animals, causing drowning, disease transmission, and habitat devastation. Hundreds of animals might be killed by a flood. Unpredictable floods may endanger aquatic life. Fish eggs, for example, may be moved and destroyed.

2. Flooding causes sedimentation and erosion.

Floodwater may also alter the terrain by eroding and collapsing riverbanks. Floodwater suspends silt in the water as it removes debris from eroding banks, possibly affecting river quality and leading to lethal algal blooms. Eventually, suspended material flows out of the water, cluttering riverbeds and streams, strangling aquatic creatures, and ruining ecosystems. Erosion and sedimentation have a larger detrimental influence on ecosystems that have already been degraded or significantly changed.

3. Floods Spread Contamination

Agricultural pesticides, industrial pollutants, rubbish, and sewage may all foul floodwater. If polluted floodwater reaches the ocean, it may degrade water quality and endanger vulnerable ecosystems.

4. Floods are a source of disease transmission

Floods are the leading cause of weather-related infectious disease outbreaks. Flooding increases the likelihood of waterborne illnesses like hepatitis A and cholera spreading. Floodwater receding may provide stagnant pools of water, which are perfect for mosquito breeding and can transmit malaria and other diseases.

2.1.3 Flood control and management

Flood control refers to physical operations undertaken to reduce the likelihood of flooding. Flood control includes the construction of a barrier to prevent the overflow of water from a river or lake, as well as the inshore movement of storm-driven ocean water. Flood

management is a strategy and plan for mitigating flood danger and damage, flooding happens when a river busts its banks and water spills onto floodplains.

2.1.4 Flood management strategy

Flood control solutions are often divided into two categories: hard engineering and soft engineering. It depends on the scenario, and both have advantages and disadvantages.

Hard engineering occurs when a large construction effort is required to halt the flood using machinery, concrete, and building materials. It uses manmade structures to slow, stop, or restrict the impact of river action.

Advantages of Hard Engineering

- Often more beneficial in averting floods than Soft Engineering option
- Dams and reservoirs create possibilities for Hydroelectric power
- Job opportunities (e.g., in erecting artificial levees/dams)
- Building flood banks is fairly affordable.

Disadvantages of Hard Engineering

- Most approaches are fairly pricy.
- Can affect the ecology and ruin animal habitats
- Building dams may induce floods upstream and generates methane gas.
- Not athletically pleasing (don't look nice).
- Skilled professionals required to construct dams or straighten river systems.

Soft Engineering methods are deemed more environmentally friendly since they aim to regulate the flood rather than prevent it. It also attempts to work with the environment rather than against it.

Advantages of Soft Engineering

- Salt marshes act as effective barriers against strong currents.
- They are less expensive than hard engineering.
- Increases the quality of the beach for locals and visitors.
- Wildlife will benefit from it.

Disadvantages of Soft Engineering

- Maintenance may be expensive.
- It takes a long time.
- Storms, strolling inhabitants, horseback riding, and other activities may quickly ruin it.

2.1.5 Flood control Methods

1. A huge mechanical barrier across the river, to guard against floods which. A huge mechanical barrier across the river, to guard against floods which is erected when the water level reaches a specified point.

2. The planting of trees in drainage basins to improve interception and storage while minimizing surface runoff is known as afforestation. This lowers the flow of a river, making it less prone to flooding. Afforestation also reduces bulk waste, which reduces the quantity of dirt entering the river, hence maintaining the river's capacity. Afforestation offers the

advantage of increasing animal habitat and improving water quality by filtering pollutants out of rainwater.

3. A levee is a low wall built along the bank of a river to protect it from flooding. It may also be used to allow boats to let people on and off. Unlike natural levees, manmade levees are bigger and often composed of a durable material such as concrete.

4. The government should develop standards to discourage the construction of dwellings on waterways. This would significantly reduce the effects of floods while also contributing to flood prevention and effective management.

5. Diversion spillways are man-made channels through which a river may flow when the discharge of the river rises. These canals convey water across a flood-prone zone and either return it to the river farther downstream or to another river. Flood gates are often used on spillways to control the flow of water.

2.2 Development of a low-cost community based real time flood monitoring

The ability to develop a low-cost real-time flood monitor will benefit communities since a low-cost flood monitoring system contains low-cost technology to detect impending floods that is easy to acquire, maintain, and run. Its potential in reducing the negative effects of floods, particularly for the poorest and most vulnerable populations in developing nations.

The low-cost community-based real-time flood monitor was developed after doing field research and community participation. The system consists of a network of rainfall and water lever measurement stations installed at strategic locations within a watershed or its sub-

basins; each station sends its data in real time to repeater stations, which are linked to a master station, where data from all basins is automatically saved(Gomathy et al., 2021b).

This system may be done by a set of sensors and data loggers, and it can be used for a variety of purposes, such as precipitation monitoring, soil moisture monitoring, and flood monitoring. The system was based on and used an ESP8266-based NodeMCU board to transmit data over WIFI to a cloud server, designed a water-based level measurement system, and focused on enhancing the energy efficiency of data transmission by utilizing the Internet Protocol Version 6 over Low Power Wireless Personal Area Network (6loWPAN) technology(Atijosan et al., 2017) .

Each unit is outfitted with a water level sensor, a battery for power supply, and data is transmitted via cellular networks, stage data is frequently measured and transmitted to be available over the internet, open-source hardware which are made available for the monitoring and management system, flood monitoring has been done using various techniques, from the use of water level sensors.

2.2.1 criteria for a low -cost real time flood monitoring

There are several techniques to designing an automated flood warning system, albeit the demands of one system may vary significantly from those of another. The number of gage sites, their locations, and the instruments and sensors installed at each may vary depending on your application and the size of the planned coverage area. Depending on the size and location of your application, ALERT-based systems, satellite, and cellular solutions may be more beneficial.

1. Integrated Data Logging System

An integrated data logging system is a real-time monitoring station that includes the data logger, telemetry module, and power/charging supply. Since it is sometimes cost-prohibitive to deliver AC power to the monitoring location, integrated solar panels are utilized to constantly charge the 12VDC battery for autonomous operation.

2. Mounting Hardware

Depending on the location and preferred monitoring technique, data recorders may be attached directly to the pier/abutment or to a bridge pole .

3. Radar Water Level Sensor

Water level sensors using radar technology provide a non-contact alternative to classic level measuring technologies such as submersible pressure transducers, allowing for monitoring in difficult-to-reach areas.

4. Telemetry

Telemetry enables real-time data access. ALERT transmits messages wirelessly through radio frequencies, although cellular and satellite-based versions are also available.

5. Live Data

A cloud-based data center provides continuous access to project data. Monitoring data may be shown in real time or as a graph to help identify patterns. When specified parameters surpass preset limits, real-time automatic notifications may be sent through SMS or email

2.3 SMS based flood monitoring and early warning.

SMS is an acronym for short message service, which is more often known as text messaging. An SMS alert is a message sent to a cellular device, such as a phone, to notify the receiver of anything that requires the use of a cellular service, such as a 3G mobile Internet connection.

Individual clients' phone numbers that have already been entered into the system are included in SMS. Aside from anticipating the remaining time before the flood, this system can detect three sorts of water levels: early flood level, flood level, and low tide level after the flood, with a maximum detection range of four meters (Hallegatte, S. 2009).

This system is based on an accurate measurement of the water level's height and sending a warning message to consumers when it reaches the previously defined threshold height; for each water level, the system would send three messages to each client number. An Arduino Uno, a GSM shield, and sensors powered by a 12v battery are used to build the system., with the system sending an SMS message to everyone in the area.

2.3.1 Advantages of SMS based flood monitoring and early warning

1. The selection of SMS as the flood warning system resulted from an assessment that determined SMS to be the most suited disaster alert system in terms of clarity, promptness, efficacy, and resistance to a disaster. SMS has the potential to reach the majority of people living in flood-prone areas owing to the availability of mobile phones, via which SMS is conveyed.

2. When the volume of water exceeds the user-specified threshold value, the system sends an SMS alert to at-risk or threatening individuals and authorized authorities.

3. An SMS-based remote metering system for water level monitoring is proposed, consisting of numerous distant meters and a central server. (Mr. Sudharshan Banakar, Ms. Sree Vani K. Ms. Shruthi K Y, 2019)

CHAPTER THREE

3.0 METHODOLOGY

3.1 Introduction

IOT Early Flood Detection System Using Arduino is an intelligent system that maintains a careful eye on many natural characteristics to predict a flood, so we may embrace caution and prevent the damage caused by the flood. Natural disasters, such as flooding, may cause extensive property damage and loss of life. The method uses several natural elements to detect floods in order to prevent or mitigate their effects. Because the system includes a Wi-Fi connection, its discovered data may be retrieved from anywhere pretty easily via IOT(Gomathy et al., 2021a).

The method analyses various environmental components, including humidity, temperature, water level, and flow level, to determine a flood. The system includes multiple sensors that gather data for certain characteristics, such as detecting changes in water level using a water level sensor, to capture data on specific natural variables.

3.2 Flowchart of IOT Early detection system Using Arduino

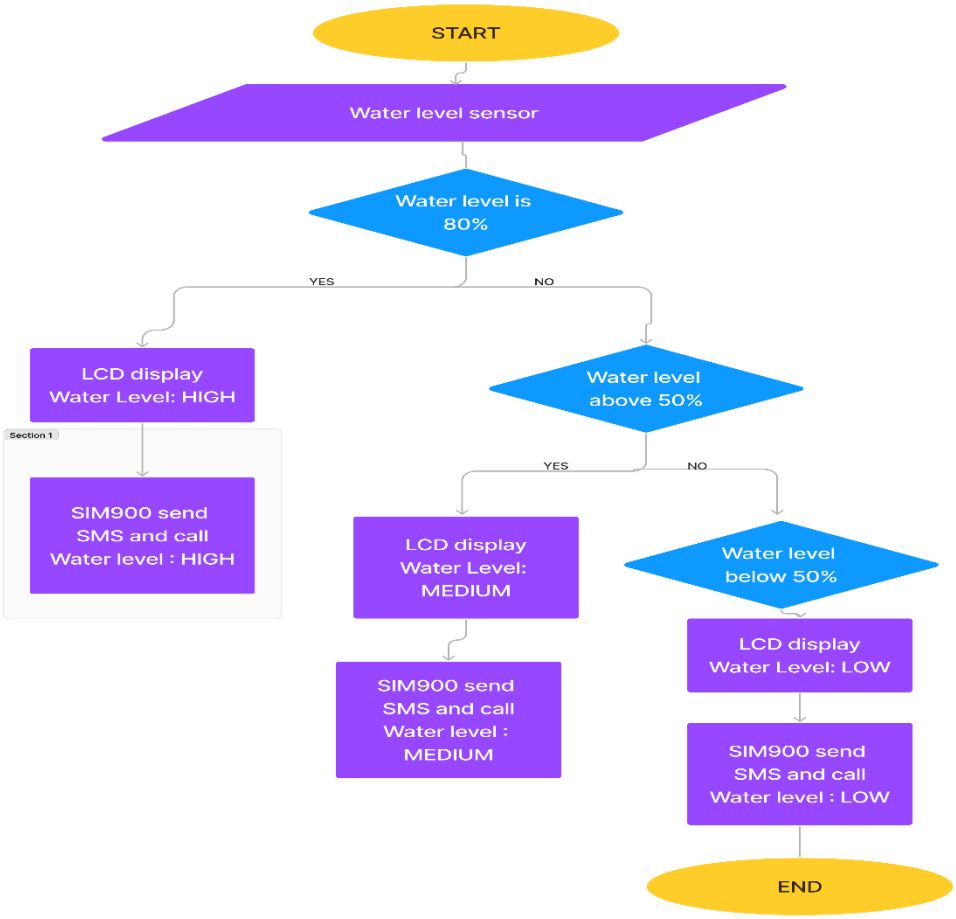

Figure 1: Block diagram of IOT Early Flood Detection System Using Arduino

3.3 Operating Principal of IOT Early Flood detection system using Arduino

Division of project in different modulus

1) Information gathering stage
2) Processing stage
3) Transmission stage
4) Notification stage

A. Information gathering stage

This stage involves the use of the water level sensor to collect the reading of the three-water levels.

- Water level above 80% (HIGH)
- Water level above 50% (MEDIUM)
- Water level below 50% (LOW)

B. Processing stage

This stage involves the processing of the data gotten from the water level sensor with the application of Arduino uno.

C. Transmission stage

At this stage the data processed by the application of the Arduino, will be transmitted to the 16x2 LCD display which will display the three water level (HIGH),(MEDIUM) and (LOW) as well as the SIM900.

D. Notification stage

This stage involves the use of SIM900 to notify the three- water levels (HIGH), (MEDIUM) and (LOW) which will notify in form of text message (SMS) and call.

3.4 Hardware Design layout and System Component

1) Arduino Uno
2) Water level Sensor
3) Sim900
4) 16x2 LCD display
5) Breadboard
6) Jumper wires

1. Arduino Uno

Figure 2: Arduino uno

The ATmega328P-based Arduino UNO is a microcontroller board. It contains 14 digital I/O pins (of which 6 may be used as PWM outputs), 6 analog inputs, a ceramic

resonator operating at 16 MHz, a USB connection, a power connector, an ICSP header, and a reset button.

2. **Water level Sensor**

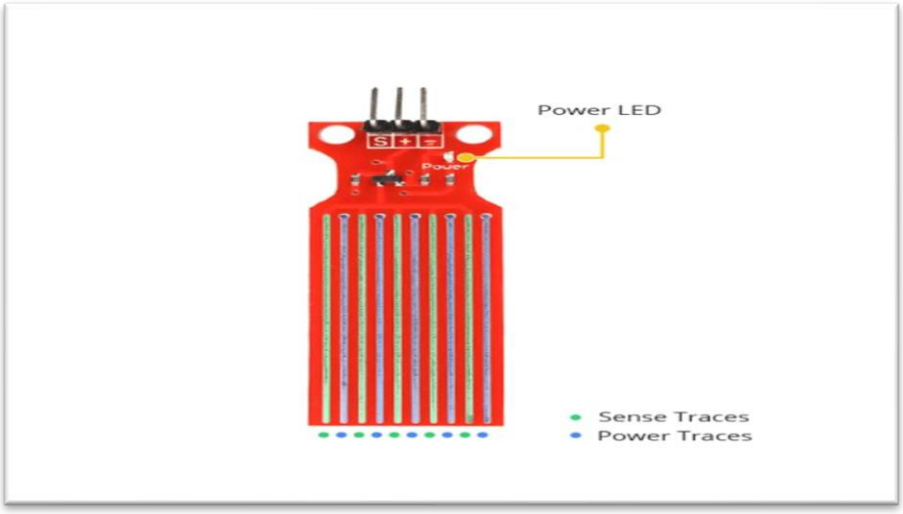

Figure 3: Water level Sensor

The water level sensor is a device that detects excessively high or low liquid levels in a fixed container.

3. **SIM900**

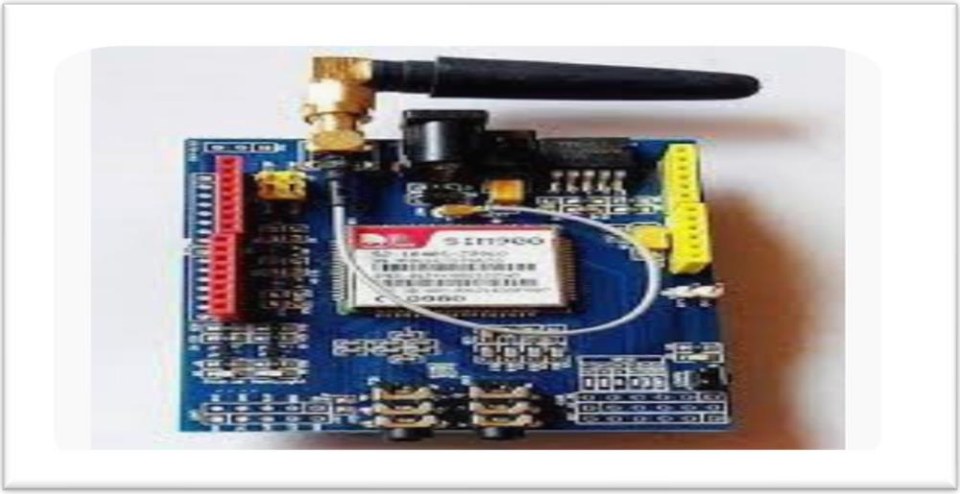

Figure 4: SIM900 Module

The SIM900 GSM/GPRS shield is a GSM modem that may be used in a number of Internet of Things applications. This shield allows you to do practically everything a standard mobile phone can do, such as sending SMS messages, making phone calls, connecting to the Internet through GPRS, and much more.

4. 16x2 LCD display

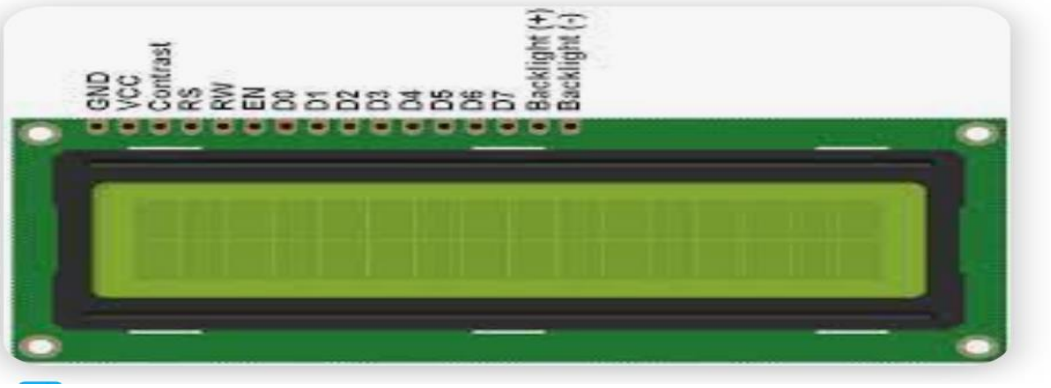

Figure 5: Liquid Crystal Display

LCD 16x2 refers to Liquid Crystal Display, which uses plane panel display technology and is used in computer monitors and TVs, smartphones, tablets, mobile devices, and so forth.

Breadboard

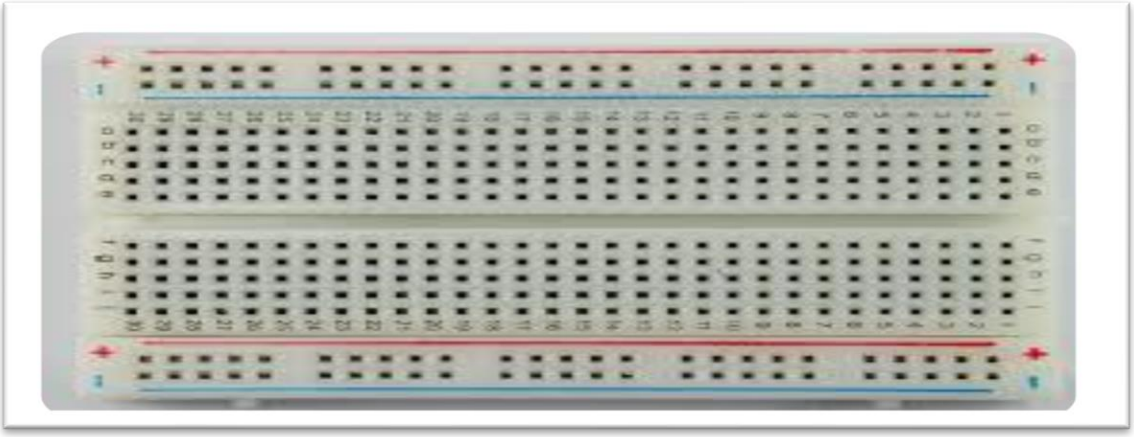

Figure 6: Breadboard

A breadboard a board on which to prototype or develop circuits. It enables you to arrange components and connections on the board in order to construct circuits without the need for soldering.

5. **Jumper Wires**

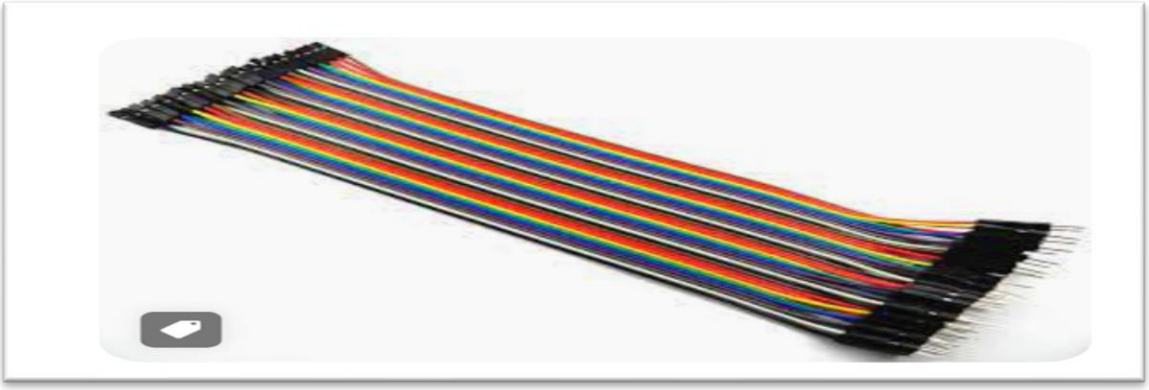

Figure 7: Jumper Wires

Jumper wires are basic cables with connecting points on each end that may be used to link two locations without soldering

3.5 BEME (Bill of Engineering and Evaluation)

Table 1:Bill of Materials

illustrates the cost allocation to various components.

S/N	Item	Product description	Quantity	Price (NGN)
1	Arduino uno	8-bit ATmega328P Microcontroller	1	12,960
2	Simcom Sim900 Shield	Dual band GSM/GPRS engine	1	15,600
3	Water level sensor		1	2,000
4	Breadboard		1	1,000
5	16x2 LCD	Liquid Crystal Display	1	3,000
6	PVC Pipe	Polyvinyl-Chloride	1	2,000
7	Female -female jumper wires	Connecting Wires	8	1,300
8	male-male jumper wires	Connecting Wires	8	1,300
9	Battery	9v	10	6,000
10	Switch		2	200
11	Water pump	12v	1	2,400
12	Plastic Container		1	4,000
13	Antique/Design		1	22,000
TOTAL				73,760

3.6 Design Layout of IOT flood detection System Using Arduino

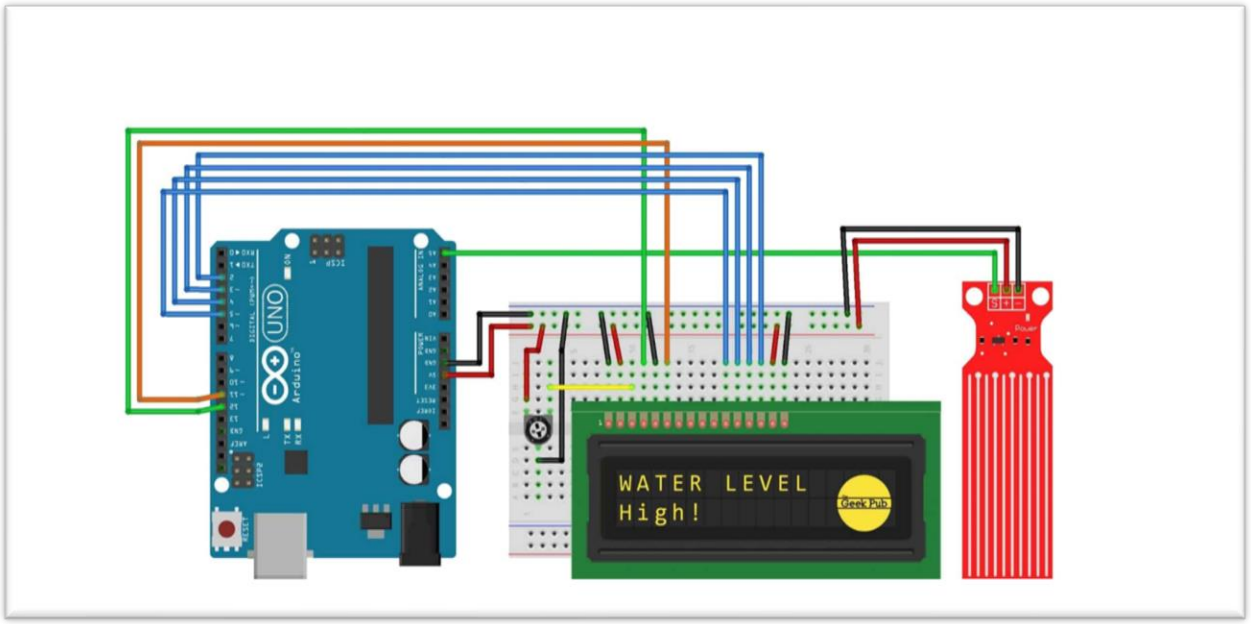

Figure 8: Wiring IOT flood detection system using Arduino

a. The Arduino is connected to the computer system using Arduino cable, (5v) and (GND) is connected to the breadboard using jumper wires. The water level sensor using the jumper wires is connected to the Arduino Uno.

- S(Signal) Will be connected to (A5) on the Arduino.
- +(VCC) Provides power to the sensor. That is (5V) on the breadboard.
- -(GND) The ground pin, that is (GND) on the breadboard.

b) Connect the 16X2 LCD display on the breadboard, using jumper wires connect the two (5V) and (GND) to the breadboard. Using the jumper wires connect the 16x2 display to (2,3,4,5,11 and 12) pins to the Arduino uno.

c) Place the Potentiometer to the breadboard, using jumper wires connect (5V) and (GND) to the breadboard. Using jumper wire connect the potentiometer to the 16X2 LCD display to tune the 16X2 LCD display.

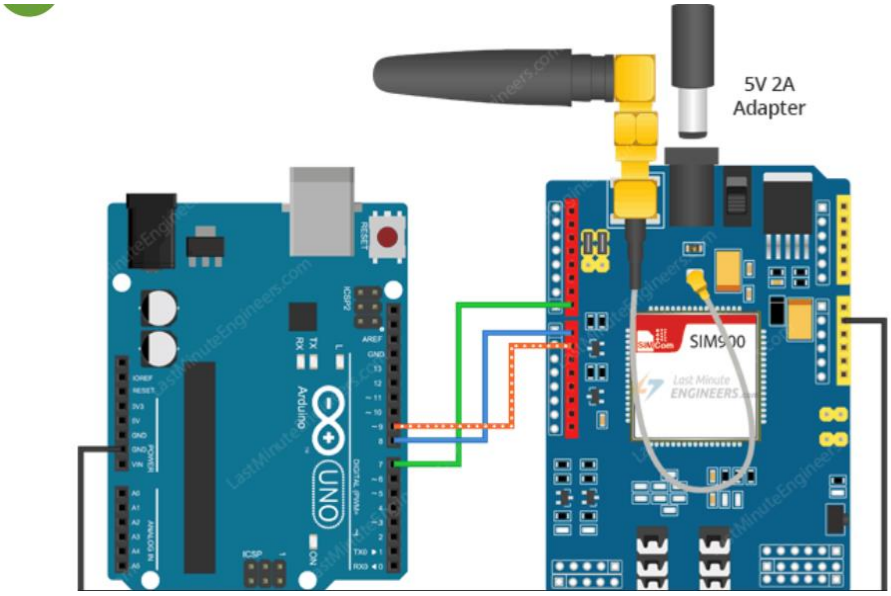

Figure 9:Wiring SIM900 module to an Arduino

a) The Sim900 is connected to the breadboard using jumper wires, Sim900 is powered by the(5V) on the breadboard, (GND) is connected as well from SIM900 to bread broad.

b) Connect the TX and RX to the Arduino using jumper wires to pin (7and 8).

3.7 Code

1. **WATER LEVEL SENSOR AND LCD**

```
#include <LiquidCrystal.h>



//WATER SENSOR
int resval = 0; // holds the value
int respin = A5; // sensor pin used

// Inistallizing variable for LCD
const int rs = 12, en = 11, d4 = 5, d5 = 4, d6 = 3, d7 = 2;
LiquidCrystal lcd(rs, en, d4, d5, d6, d7);

int Vesval = 0; // holds the value
int Vespin = A5; // sensor pin used


void setup() {
//start the serial console
Serial.begin(9600);

 lcd.begin(16, 2); // columns and rows
 // Print a message to the LCD.
  lcd.print("WATER LEVEL:");
}

void loop() {
```

Figure 10:Water level sensor and LCD

i. #include <libraryCrystal.h>: Allow's the Arduino to control the LCD (library).

ii. Int resval: Hold the value acquired by the water level sensor.

iii. Int respin : The pin that the water level sensor is connected on the Arduino **(A5)**.

iv. Liquid Crystal lcd(rs, en, d4, d5, d6, d7): Initializing variable for LCD.

v. Int Vasval : Hold the value acquired by the water level sensor.

vi. Int Vespin:Water level sensor pin on Arduino**(A5)**.

vii. Void setup: Frist function to be executed.

viii. Serial. Begin(9600**):** Establishing serial communications between Arduino and water level sensor.

ix. Lcd.begin(16, 2**)**: Number of columun and rows on the LCD.

x. Lcd.print: Display message on LCD.

xi. Void loop: The code will Repeat

sketch_apr19a.ino

```
25
26  void loop() {
27
28
29    resval = analogRead(respin); //Read data from analog pin and store it to resval variable
30
31    lcd.setCursor(0, 1);
32   if (resval<=100){
33     Serial.println("Water Level: LOW");
34     lcd.println("LOW ");
35
36   } else if (resval>100 && resval<=200){
37     Serial.println("Water Level: MEDIUM");
38     lcd.println("MEDIUM");
39    } else if (resval>230){
40      Serial.println("Water Level: HIGH");
41      lcd.println("HIGH ");
42
43     }
44    delay(1000) ;
45
46
```

Figure 11: Water level sensor and LCD

xii. **Resval =analog Read(respin)**: Water level sensor value(data) will be stored in resval.

xiii. **Lcd.setCursor(0,1)**: Set the position of cursor.

CONDITION FOR WATER LEVEL SENSOR AND LCD

I. If water level sensor value (data) is (<=100), print “EMPTY”.

II. Else if water level sensor (data) is (>100 but <300), print “MEDIUM”.

III. Elseif water level sensor (data) is (<330), print “HIGH”.

Relay (1000): on a line of code for 1sec

2. SIM900

Sending SMS

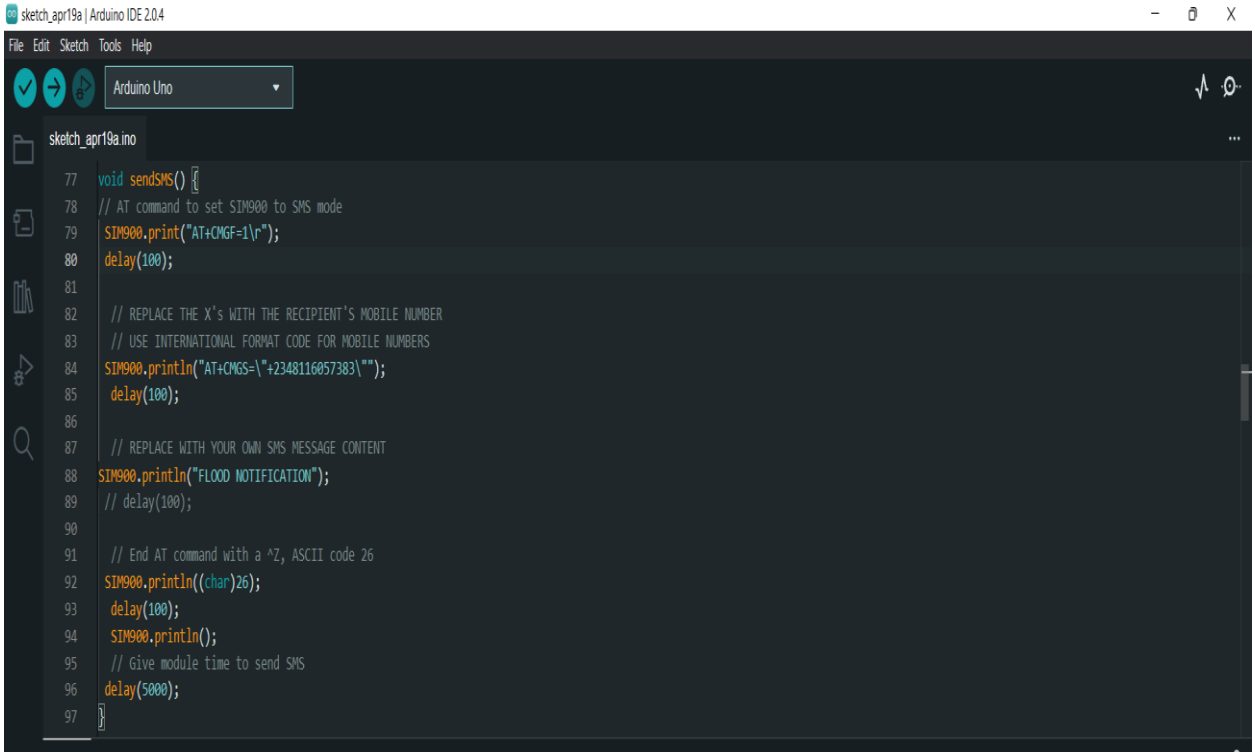

Figure 12: Text Message

SIM900.print("AT+CMGF+1/r"): Set SMS to text mode.

SIM900.print(AT+CMGS=\ +2348116057383): Phone number.

SIM900.print(): Display Text message.

Make a Phone call

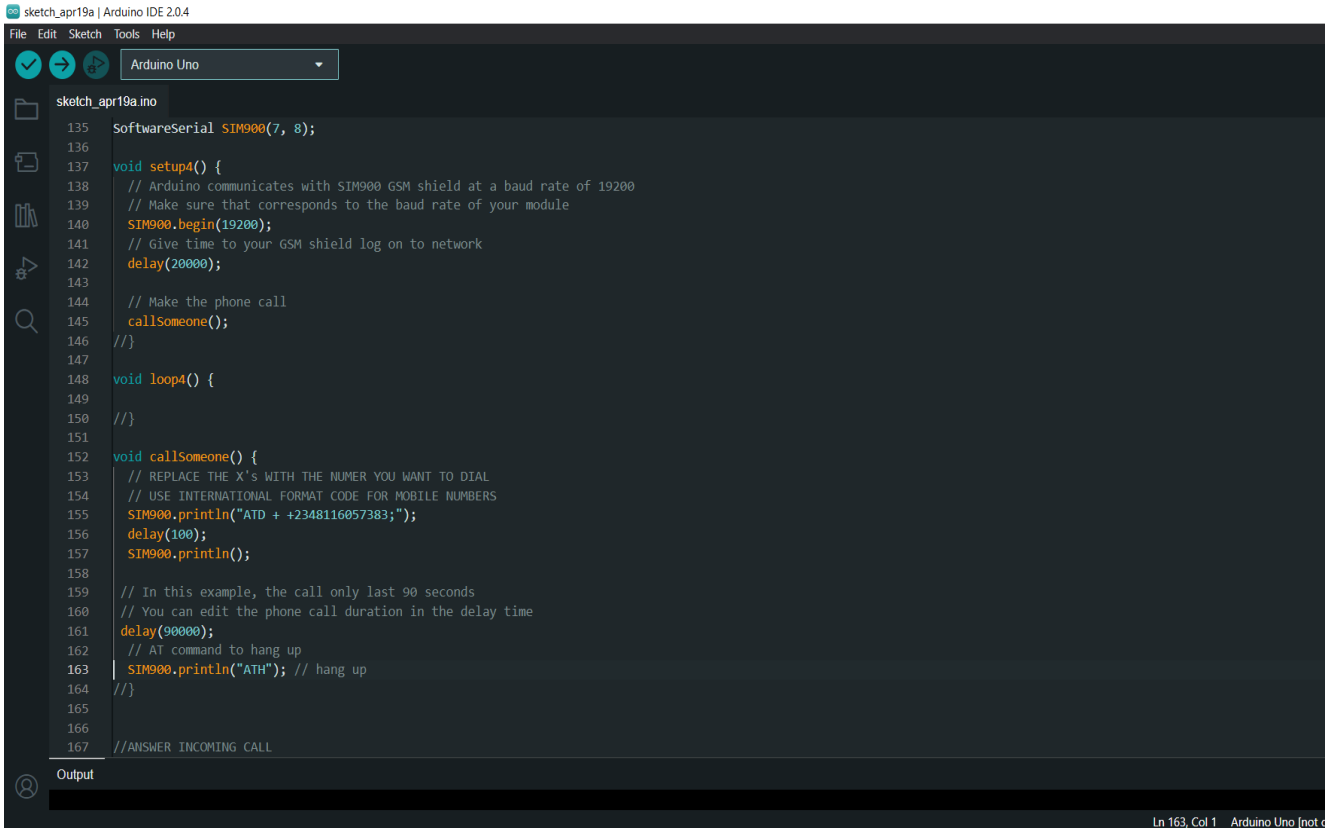

Figure 13: Phone call

Call Someone (): Make a phone call.

Sim900.printIn("ATD + +2348116057383;"): Phone Number.

Sim900.printIn("ATH'): Hang up.

CHAPTER FOUR
RESULTS AND DISCUSSION

4.1 Introduction

This chapter contains a complete demonstration of the results of how the Arduino flood detection system, which were all inferred from testing and debugging of the system .in view of the system being a standalone system and the choice of programming language that are more suitable for the simulation task.

4.2 Choice of Programming Languages and programs used

Below are the programming languages utilized in implementing the system

1. **Programming language (c):** High-level and all-purpose programming languages are both types of the C programming language. It offers a simple, reliable, and effective interface for system development. Because of this, system software, application software, and embedded systems all frequently employ the C programming language.
2. **Arduino:** The IDE in which the programming language c was written in to communicate with the micro controller is the Arduino. It is also known to be an open-source electronic platform based on east-to-use hardware and software.

4.3 Result

4.3.1 Main System Design Implementation

Below shows the different build phase of the system

STAGE ONE

1. Ploystryrene craving

2. 12v water pump system
3. Painting of house
4. Artifical grass installmennt

Figure 14: Model

Figure 15: 12v Water pump

STAGE TWO

Assembling Arduino part together

1. Arduino Uno
2. Water level sensor
3. Sim900 module

Figure 16: Arduino installation

STAGE THREE

Programming ,Debugging and Testing of IOT Flood Detection System Using Arduino

Figure 17: System Model

4.4 Discussion

This project was very exciting, I enjoyed being actively involved in all the stages involved in building the Early flood detection system using Arduino. It challenged me mentally and physically which is a new experience I will not forget anytime soon.

4.4.1 Skill Acquired

I. Soldering

II. Painting

III. Arduino installation

IV. Partitioning of a system

V. Creative thinking

4.4.2 Challenges Encountered

I faced a lot of obstacles along the way while overseeing IOT flood detection System using Arduino which I was able resolve, but the obstacle that wasn't able to resolve is the SIM900 module.

I. **Hardware failure**

SIM900 module SIM holder detected making it difficult to hold a SIM card in place, which will cause the sytem not able to send and receive phone call as well text message.

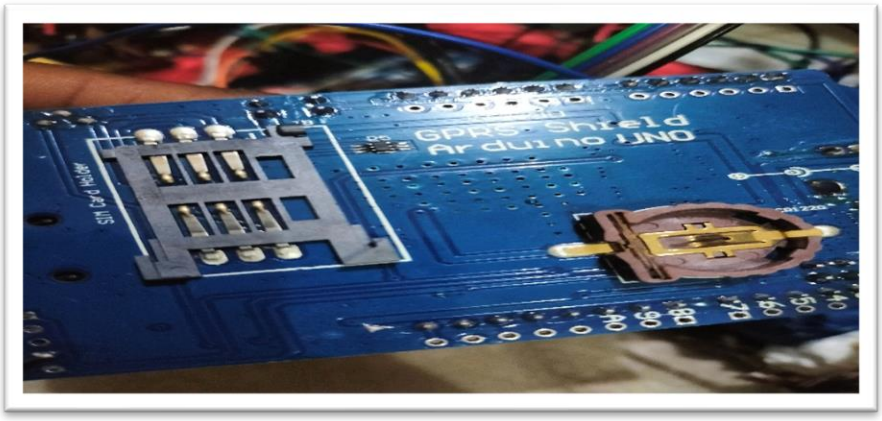

Figure 18: SIM card holder fault

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

IOT Early Flood Detection System Using Arduino is an intelligent system that maintains a careful eye on many natural characteristics to predict a flood, so we may embrace caution and prevent the damage caused by the flooding, using low-cost real-time flood monitor system which contains low-cost technology that is not difficult to acquire, maintain, and run.

The results of the IOT flood detection system using Arduino, shows the potential of the system in flood monitoring and alert management system, a low -cost real time flood monitoring and SMS based flood monitoring and early warning which equipped this flood to product expected result. Therefore, the project gives an insight into how good an IOT flood detection system using Arduino can be, as it provides a constant monitor and alert system.

5.2 Recommendation

For future research, the project work can be improved upon. The following areas were highlighted for this purpose.

1. I will recommend an improvement in SIM900, to improve in material analysis, to use better material to make the SIM holder to prevent a SIM card form displacing out of the SIM holder.
2. The whole circuitry can be reduced by using an integrated circuit with a larger scale of integration.

3. Moreover, it is recommended that students be enlightened on new areas of technology that are yet to be addressed to bring the solution to the various problems man faces in his day-to-day activities.

5.3 Contribution to Knowledge

The completion of this project contributed much knowledge, and its significant contributions are listed below:

1. The system I designed can help solve flood monitoring and alertness using Arduino in homes and communities that is low-cost, not difficult to acquire and maintain,
2. The students who participated in this project can also install similar systems in houses and industries; this would help solve the problem of unemployment common in developing societies.

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