RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES

ONGOLE CAMPUS

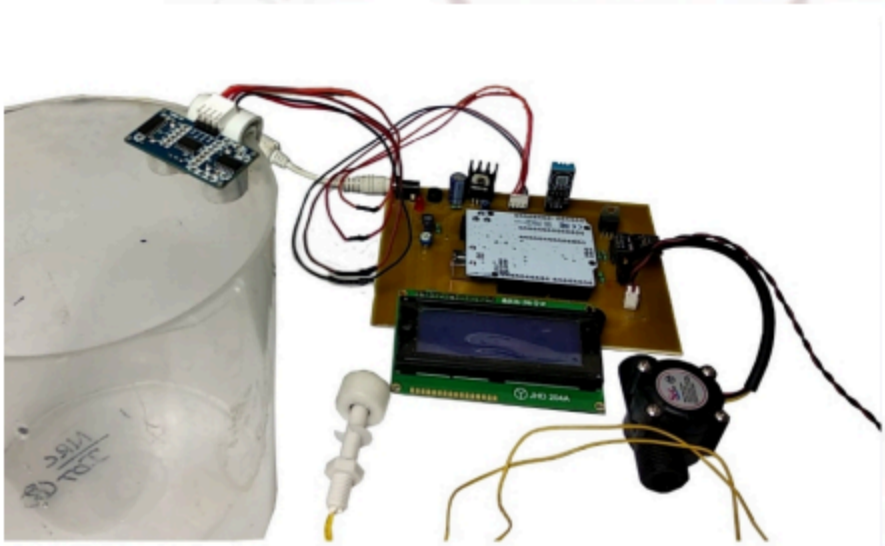
BACHELOR OF TECHNOLOGY

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

PROJECT REPORT

EARLY FLOOD DETECTION USING ARDUINO UNO



BY

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INTRODUCTION

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).

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.

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.

Project Scope

* 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.

* 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.

WORKING

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.

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)

***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

***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.

5. 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

METHODOLOGY

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.

Flowchart of IOT Early detection system Using Arduino

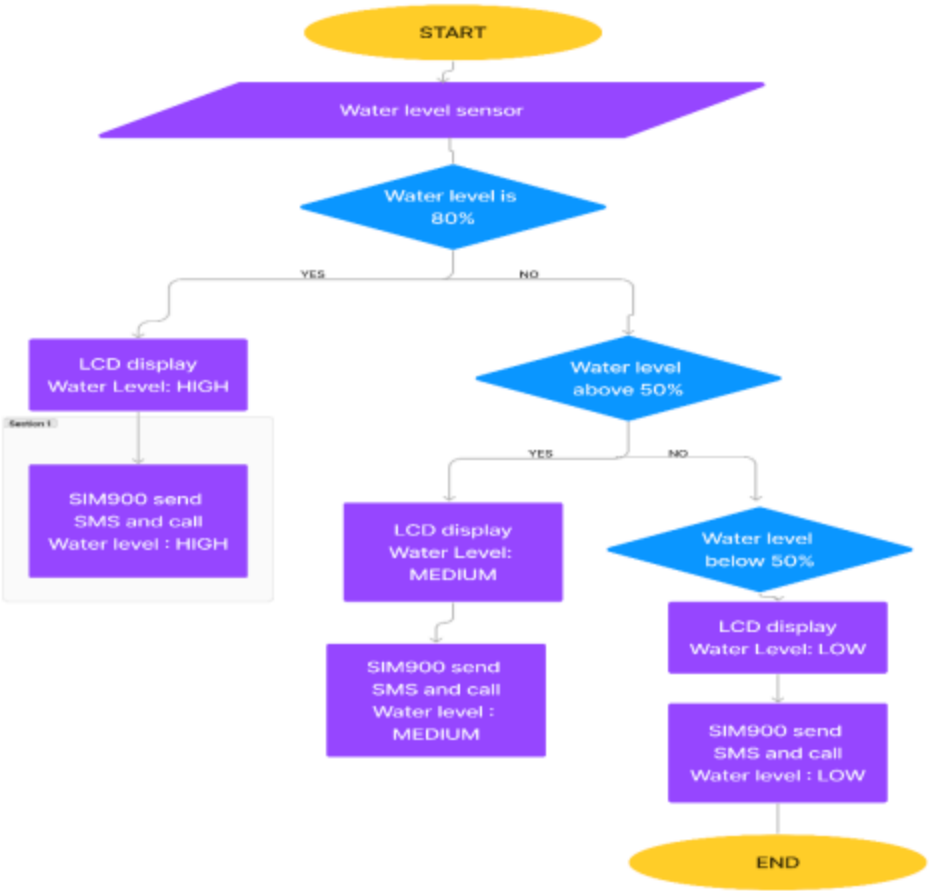

Figure 1: Block diagram of IOT Early Flood Detection System Using Arduino

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.

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

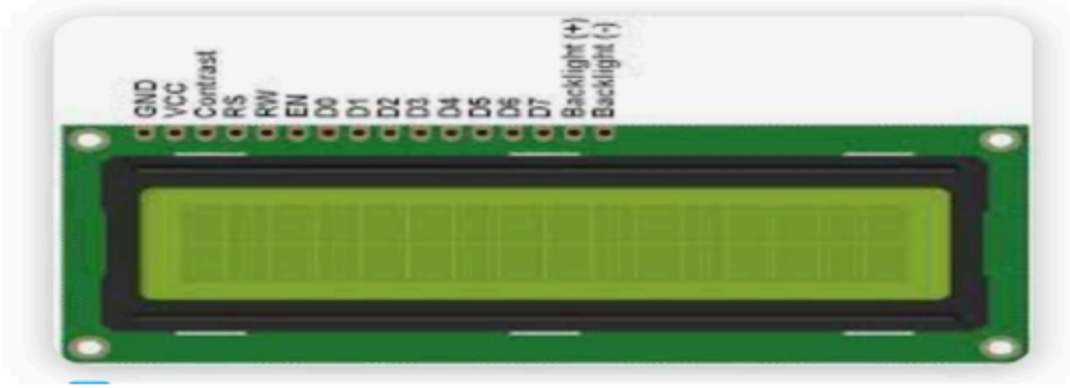

Figure 5: Liquid Crystal Display

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

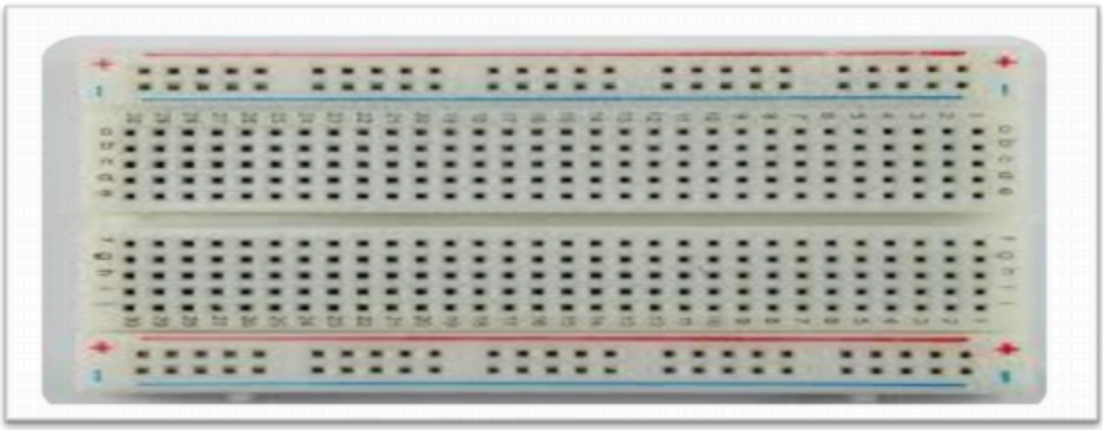

Figure 6: Breadboard

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**

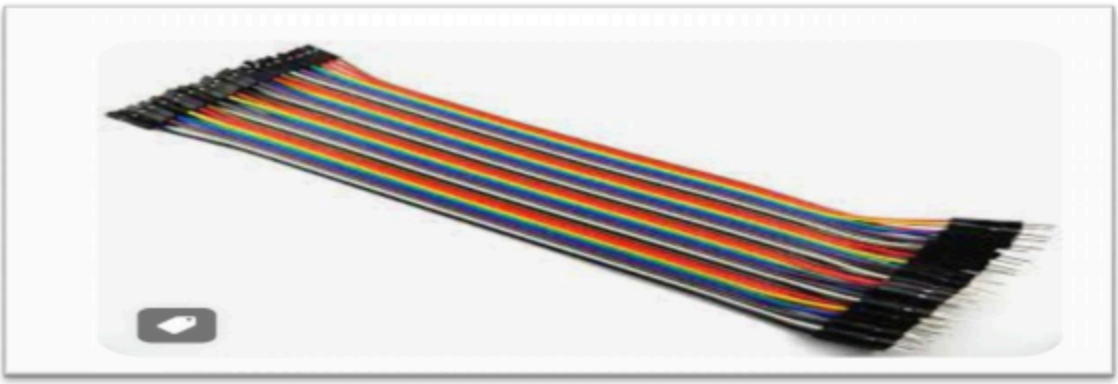

Figure 7: Jumper Wires

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

Design Layout of IOT flood detection System Using Arduino

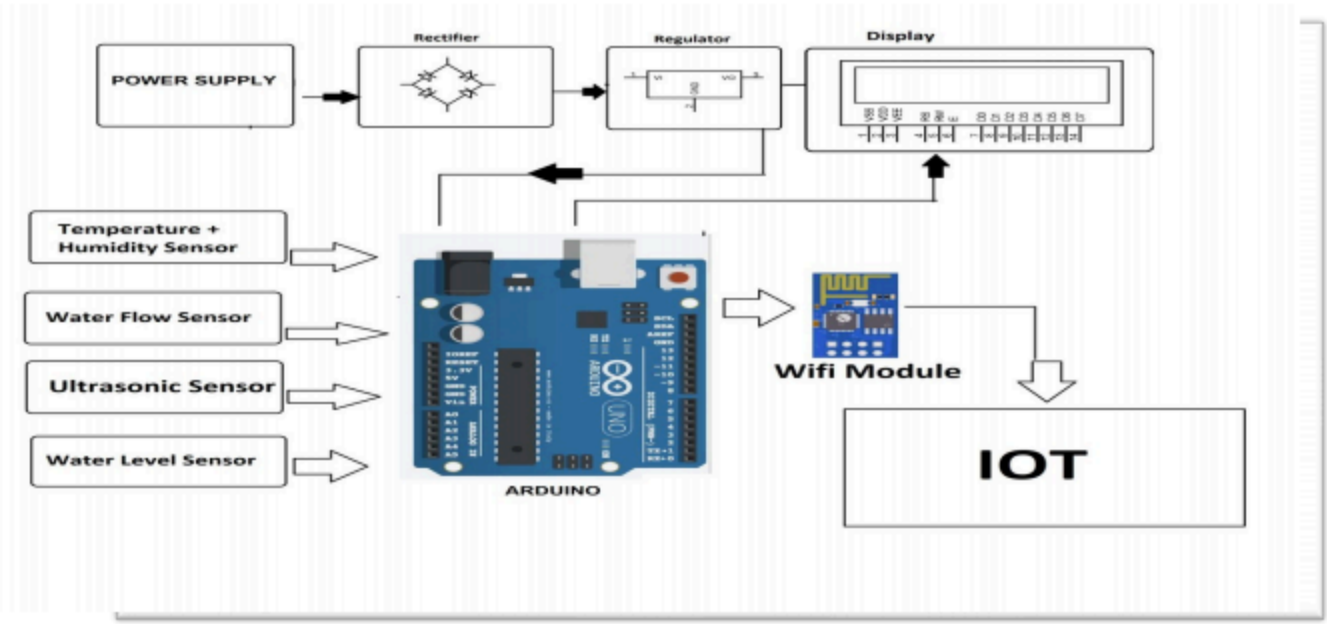

Figure 8: Wiring IOT flood detection system using Arduino

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.

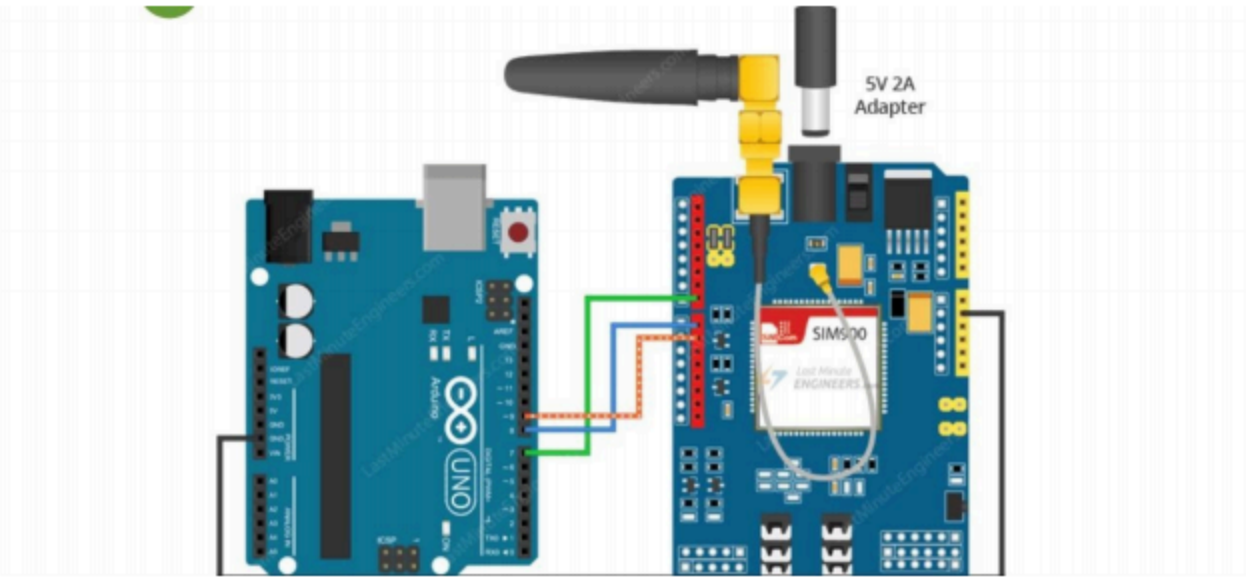

Figure 9:Wiring SIM900 module to an Arduino

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).

CONCLUSION AND RECOMMENDATION

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 if 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.

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.