A PROJECT REPORT ON

<< Flood Monitoring & Alerting System>>

Submitted in partial fulfilment of the requirements for the award of the degree of

Bachelor of Technology

In

ELECTRONICS & COMMUNICATION ENGINEERING

Submitted By

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CERTIFICATE

This is to certify that the project titled **Flood Monitoring and Alerting System** submitted by Anjali Shaw [Team Leader], Tuhina Roy Chaudhury, Shruti Das, Riya Kundu , Students of UNIVERSITY OF ENGINEERING & MANAGEMENT, KOLKATA, as submitted for the partial fulfilment of requirements for the degree of Bachelor of Technology in Electronics & Communication Engineering, is a bona fide work carried out by them under the supervision and guidance of **Prof. Arpita Das** during 6th Semester of academic session of 2023. The content of this report has not been submitted to any other university or institute for the award of any other degree.

I am glad to inform that the work is entirely original, and its performance is quite satisfactory.

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Abstract

Flooding is considered one of the most destructive natural disasters in the world. In countries like India with climatic conditions occurrence of heavy rain fall and subsequent discharge of water leads to Flood. Flooding creates major damages to life, their habitats and the economy. The loss of properties and living population is getting enhanced every year due to the dynamic alterations in weather conditions which results in heavy floods. Therefore, implementation of an intelligent analysis of flood risk is necessitated for the field of research in Disaster management. Normal Weather monitoring and alerting systems are not quick and accurate enough to predict floods in time to prevent personal or environmental damages. By installing smart flood alerting systems near major waterways vital information can be collected so that lives and property can be protected. The government has to spend tons of money in flood mitigation plans to help the victims and also to reduce the number in the long run damages that can occur after flooding. Nowadays every prediction level has been moved from physical to mathematical modelling. Where, this paper deals with the strategies of flood alerting system with help of Internet of Things (IoT) an embedded system which would give the real time calculation along with data for computational processing, prediction and analysis that would help to send an alert message to the nearby surrounding and reduces the time of risk. The data can be accessed from android smart phones using mobile application at anytime from anywhere in the world. Here the Arduino uno is connected to water flow sensors to analyse the water level and temperature sensor to predict the humidity level, Further, these analysed values will be passed to the Arduino which is been developed with programming languages like C. The Arduino would pass the alert message to the IoT module. These analyses are made to show how the Iot is embedded in real time to prediction and alerting.

Keywords:

Internet of things, Arduino, Sensors, Modelling.

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Anjali Shaw

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INTRODUCTION

The extreme climatic changes due to the effect from various human activities such as pollutions, cutting of innumerable trees and too much of gas emission are the some of the main reason for natural disasters that occur in worldwide. The most common factor that cause major damage to life, property and country's economy is the flood. A flood can be described as an overflow of water in an area considered to be relatively dry. They can cause considerable damage to property and the environment, including crops and wildlife, and are an additional financial cost. Floods can be caused by natural disasters or water pipe breaks. Flooding is also associated with the development of mold which can appear within 24 hours. Overflowing rivers can lead to flooding the areas along the river. If heavy precipitation is received upstream of a river, the large water volumes can flood the houses of people who live along the river downstream, even if it did not rain severely there. Broken dams can also lead to flooding. Aging dams, which can be overwhelmed by high levels of water, can fail and unleash torrents of water to the unsuspecting residents, causing devastating flooding. Melting snow and ice after a heavy snowfall and other forms of precipitation can lead to flooding once temperatures begin to warm. Because of the devastating effects that floods can have on people and their environments, flood monitoring systems have been developed to help prepare and warn people of emanating danger. While some areas are more prone to flooding than others, the establishment of flood warning systems near any major waterway or body of water provides critical information that can protect property and save lives. Of course, the most effective flood warning methods extend beyond the installation of gages and telemetry equipment, and employ qualified staff and carefully designed procedures to provide the earliest warning about whether a flood should be expected, when it will occur, and how severe it will be. This guide offers instruction to

individuals, communities, and organizations interested in establishing and operating flood warning systems. The systems can help prevent excessive damage and loss as a result of flooding and possibly save lives. To manage floods, alerting people, understanding of increased water level and speed of water flow are valuable for discovering potential seriousness of the flood. This project presents the details of how the data - like flood level and rain intensity are collected from sensors and made available on cloud and sending alert messages by using Bolt IOT module and Arduino Uno and a Global System for Mobile communication (GSM) and short message service (SMS) to relay data from sensors to computers or directly alert the people present in that area through their mobile phone. The data from the IOT cloud can be accessed by android smart phones at anytime from anywhere in the world using the mobile app things view.

Some benefits of using a flood monitoring system include:

- High reliability as data is sent in real-time
- Timely detection of flood risks

- Tailored solutions that can easily be integrated with external development at any level such as connectivity, user application, and device.

Data collected using a flood monitoring system can be used in future studies for weather patterns and climate change. Many western European countries were recently subjected to severe flooding which resulted in huge economic losses and multiple deaths. Floods have become a frequent threat as a result of climate change, but with the development of artificial intelligence (AI), a much more advanced flood detection system has been developed based on deep computer algorithms. The development of smart cameras and sensor technology helps detect the water levels and measure the probability of flooding even before the floods happen. With much more research being carried out to improve flood monitoring systems, many governments are investing in much quicker methods of detection. Aside from

realtime analysis, visualization will also help emergency authorities to showcase current conditions, allowing citizens to take action and prepare adequately. Flood monitoring systems also have total integration and adaptation with emergency plans. They consume less energy and can be powered with solar energy. Flood monitoring system equipment is highly resilient and has a long working life span, making it very convenient and cost-effective.

PROBLEMS FACED DUE TO FLOODS

Floods impact on both individuals and communities, and have social, economic, and environmental consequences. Flooding of areas used forsocio-economic activities produces a variety of negative impacts. The magnitude of adverse impacts depends on the vulnerability of the activities and population and the frequency, intensity and extent of flooding. Some of these factors are shown below:

Loss of lives and property: Immediate impacts of flooding include loss of human life, damage to property, destruction of crops, loss of livestock, non-functioning of infrastructure facilities and deteriorationof health condition owing to waterborne diseases. Flash floods, with little or no warning time, cause more deaths than slow-rising riverine floods.

Loss of livelihoods: As communication links and infrastructure such aspower plants, roads and bridges are damaged and disrupted, economic activities come to a standstill, resulting in dislocation and the dysfunction of normal life for a period much beyond the duration of theflooding. Similarly, the direct effect on production assets, be it in agriculture or industry, can inhibit regularly activity and lead to loss of livelihoods. The spill over effects of the loss of livelihoods can be felt in business and commercial activities even in adjacent non-flooded areas.

Decreased purchasing and production power: Damage to infrastructure also causes long-term impacts, such as disruptions to clean water and electricity, transport, communication, education and health care. Loss of livelihoods, reduction in purchasing power and lossof land value in the flood plains lead to increased vulnerabilities of communities living in the area. The additional cost of rehabilitation, relocation of people and removal of property from flood-affected areas can divert the capital required for maintaining production.

Mass migration: Frequent flooding, resulting in loss of livelihoods, production and other prolonged economic impacts and types of suffering can trigger mass migration or population displacement.
Migration to developed urban areas contributes to the overcrowding inthe cities. These migrants swell the ranks of the urban poor and end upliving in marginal lands in cities that are prone to floods or other risks.Selective out-migration of the workforce sometimes creates complex social problems.

Psychosocial effects: The huge psycho-social effects on flood victimsand their families can traumatize them for long periods of time. The loss of loved ones can generate deep impacts, especially on children.
Displacement from one's home, loss of property and livelihoods and disruption to business and social affairs can cause continuing stress. The stress of overcoming these losses can be overwhelming and produce lasting psychological impacts.

Hindering economic growth and development: The high cost of relief and recovery may adversely impact investment in infrastructure and other development activities in the area and in certain cases may cripple the frail economy of the region. Recurrent flooding in a region may discourage long-term investments by the government and private sector alike. Lack of livelihoods, combined with migration of skilled labour and inflation may have a negative impact on a region's economic growth. Loss of resources can lead to high costs of goods andservices, delaying its development programmes.

Political implications: Ineffective response to relief operations duringmajor flood events may lead to public discontent or loss of trust in the authorities or the state and national governments. Lack of developmentin flood-prone areas may cause social inequity and even social unrest posing threat to peace and stability in the region.

COMPONENTS REQUIRED

The **Hardware and Software Components** required are:

Table 1: Hardware Requirements

S.No.	COMPONENTS	SPECIFICATION	QUANTITY
1.	Arduino UNO	22 pins, operating voltage: 6-20V	1
2.	HC-SR04 Ultrasonic Sensor	5V, (4)I/O Pins; Operating Current: 15mA; Detection Range:50cm	1
3.	Buzzer	Operating Voltage: 4-8V; Current: 30mA	1
4.	LEDs	5mm, Operating Voltage: 5V	(green , orange, red)
5.	Breadboard & Jumper wires	-	1 breadboard, Wires:M-F(15), M-M(10), F-F(5)
6.	DC Batteries and Snap Connector	Operating Voltage: 9V	1
7.	Miscellaneous	-	-

Table 2: Software Requirements

S.No.	COMPONENTS	DESCRIPTION
1.	Arduino IDE	Arduino provides a simple and easy-tounderstand coding platform through the Arduino IDE. It is friendly to students and to those who are still new in electronics projects, simplifying coding and compiling and uploading codes to the board, eliminating the need for an external programmer or burner.

COMPONENTS DESCRIPTION

- **ARDUINO UNO**

  The Arduino Uno is a microcontroller board which is based on the ATmega328 series controllers and has an IDE (Integrated Development Environment) for writing, compiling and uploading codes to the microcontroller. It has 14 digital input and output pins (of which 6 are PWM) and 6 analogue inputs for communication with electronic components such as sensors, switches, motors and so on. It also has 16 MHz ceramic resonators, a USB connection jack, an external power supply jack, an ICSP (in-circuit serial programmer) header, and a reset button. Its operating voltage is 5V, input voltage 7 to 12V (limit upto 20V).

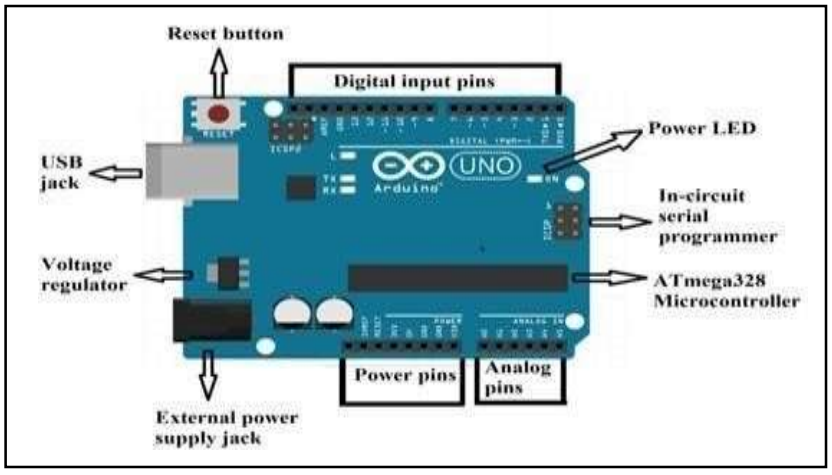


Figure 1: ARDUINO UNO

- **HC-SR04 ULTRASONIC SENSOR**

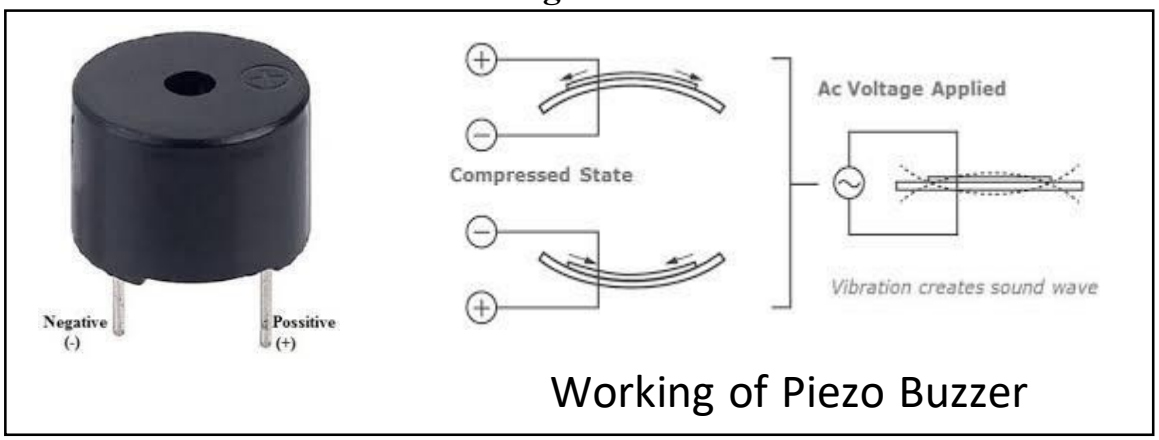
The HC-SR04 Ultrasonic Distance Sensor is a sensor used for detecting the distance to an object using sonar. It measures the distance to the target by measuring the time between the emission and reception. This sensor reads from 2cm to 400cm (0.8inch to157inch) with an accuracy of 0.3cm (0.1inches), which is good for our project. In addition, this particular module comes with ultrasonic transmitter and receiver modules.

Figure 2: HC-SR04 Ultrasonic Sensor

- **BUZZER**

  A "piezo buzzer" is basically a small speaker which will be connected directly to an Arduino. "Piezoelectricity" is an impression where certain crystals can deform once electricity is applied to them. By applying an electrical signal at the proper frequency, the crystal will create sound.

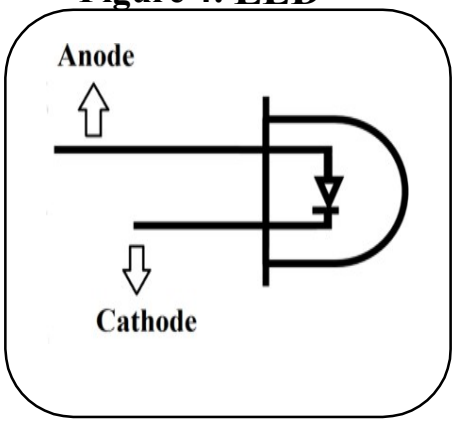
Figure 3: Buzzer



- **LED**

A LED (Light emitting diode) is a PN junction diode which is used for emitting visible light when it is activated. When the voltage is applied over its elements, electrons regroup with holes within the LED, releasing energy in the form of photons which gives the visible light. LEDs may have dim/full capability.

Figure 4: LED

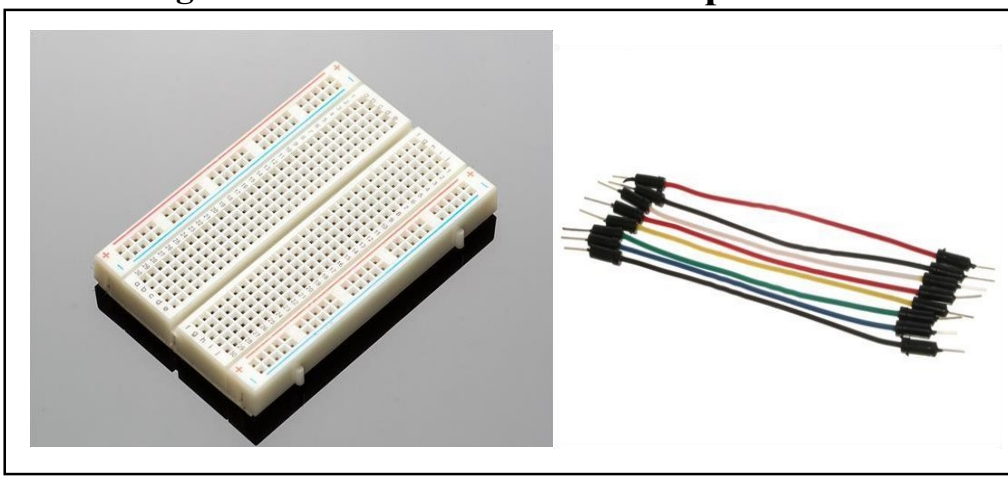


- **Breadboards and Jumper Wires**

  A breadboard is a rectangular plastic board with a bunch of tiny holes in it. These holes let you easily insert electronic components to prototype an electronic circuit, with a battery, switch, resistor, and LED.

  A jump wire is an electrical wire, or group of them in a cable, with a connector or pin at each end which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

Figure 5: Breadboards and Jumper Wires



WORKING PRINCIPLE

The main working principle of this project is to detect flooding of the water bodies with ease and to be warned whenever their water level rises to a specific level. A warning signal via buzzer produces beeping sound which alerts that flooding has been occurred.
The main component used for this device is the Ultrasonic Sensor HC-SR04. The Arduino Uno microcontroller is used for communication with the ultrasonic sensor. The microcontroller sends a trigger signal to the sensor. When triggered, the sensor generates ultrasonic waves. These waves will detect the water level distance in centimeters and the waves are reflected back to the sensor. The output of the sensor is the time difference between the transmitted ultrasonic waves and the received echo signal. The microcontroller then interprets the time signal into distance. Finally, based on the water level distance, LED light of particular color will glow and also the buzzer will make a buzzing sound as an alarm when water level exceeds normal level thus detecting a possibility of flood occurring.

DESIGN METHODOLOGY

CIRCUIT DIAGRAM:

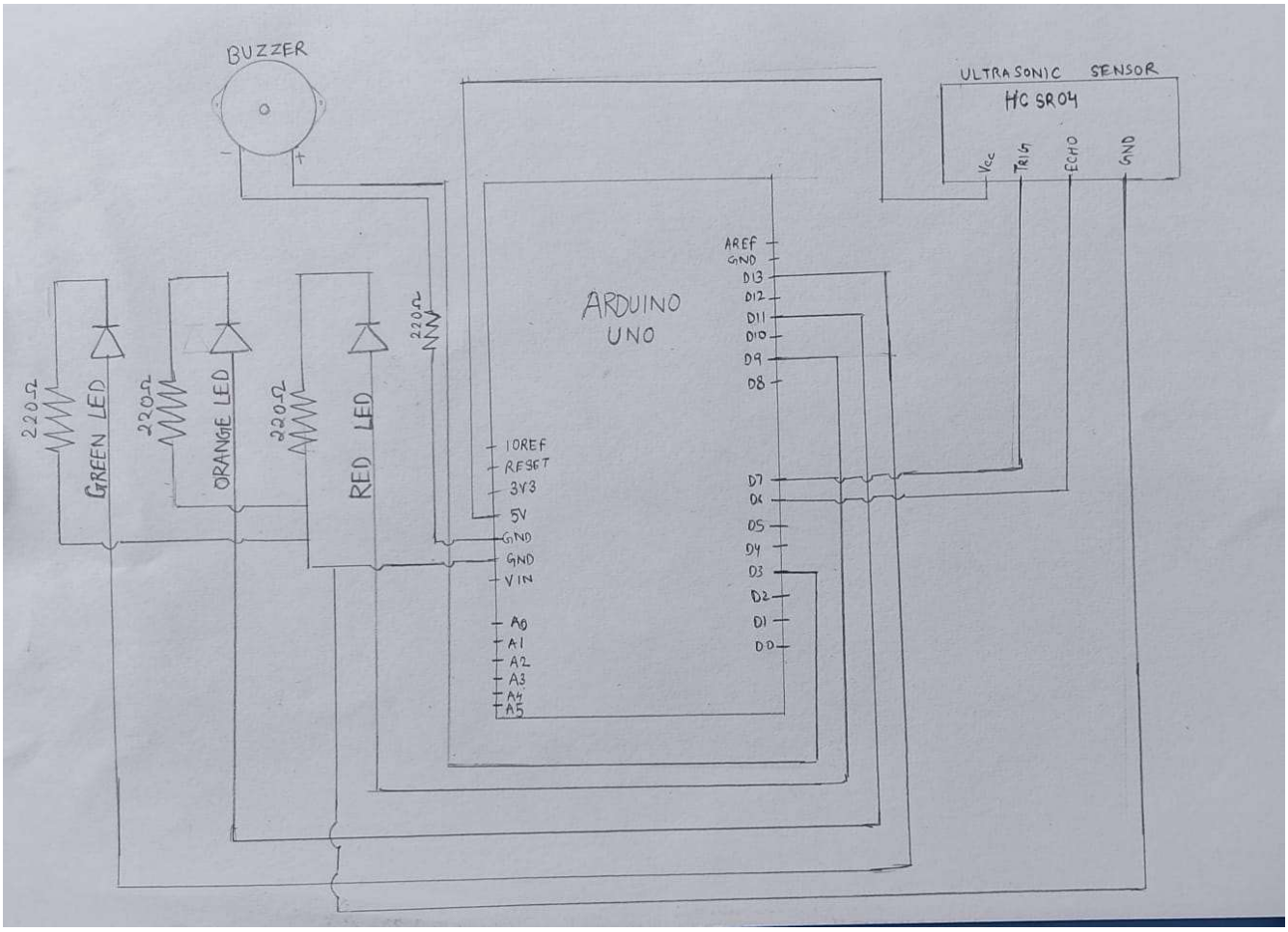


Figure 7: Circuit Diagram

CONNECTIONS:

A. LED's Connection

1)For Green LED:

- VCC of Green Color LED to Digital Pin '13' of the Arduino.
- GND of Green Color LED to the GND of Arduino via a 220ohm resistor.

2)For OrangeLED:

- VCC of Orange Color LED to Digital Pin '11' of the Arduino.
- GND of Orange Color LED to the GND of Arduino via a 220ohm resistor via a 220ohm resistor.

3)For RedLED:

- VCC of Red Color LED to Digital Pin '9' of the Arduino.
- GND of Red Color LED to the GND of Arduino via a 220ohm resistor.

B. Buzzer Connection

- VCC of Buzzer to Digital Pin '3' of the Arduino.
- GND of Buzzer to the GND of Arduino.

C. HC-SR04 Ultrasonic Sensor Connection

- VCC of Ultrasonic Sensor to 5v of Arduino.
- GND of Ultrasonic Sensor to GND of Arduino.
- Echo of Ultrasonic Sensor to Digital Pin '7' of Arduino.
- Trig of Ultrasonic Sensor to Digital Pin '6' of Arduino.

CIRCUIT PICTURES:

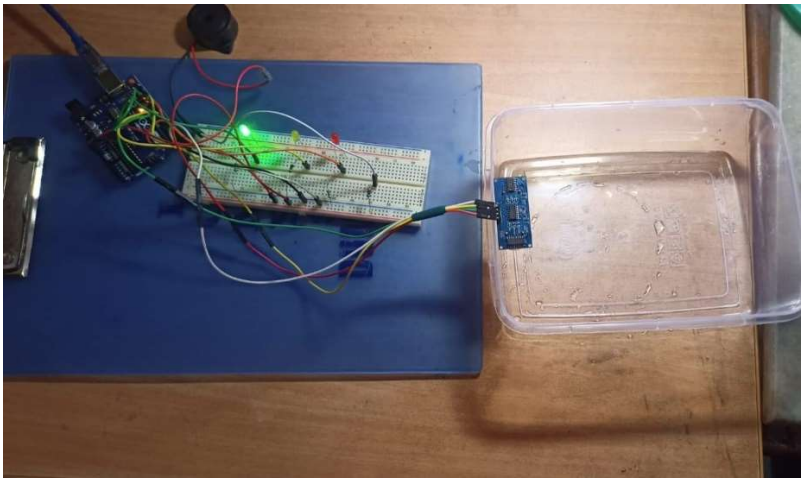


Figure 8: When water level is LOW

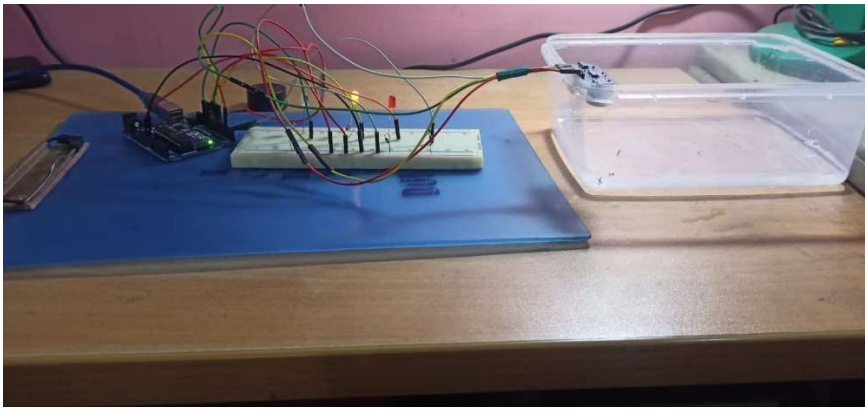


Figure 9: When water level is MODERATE

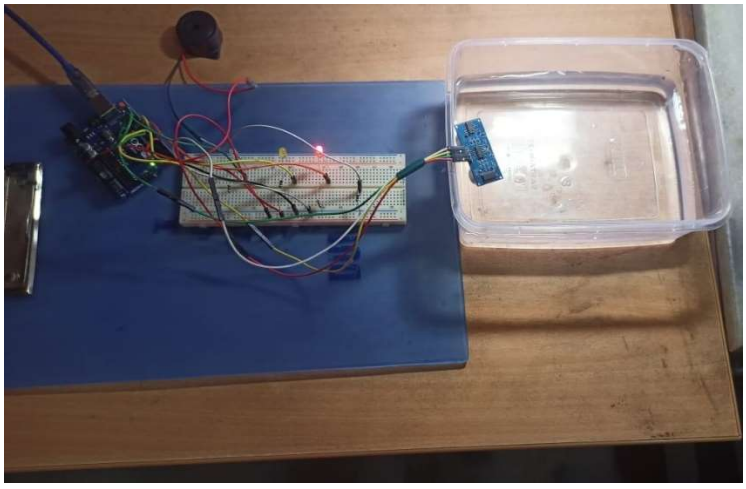


Figure 10: When water level is HIGH

WORKING

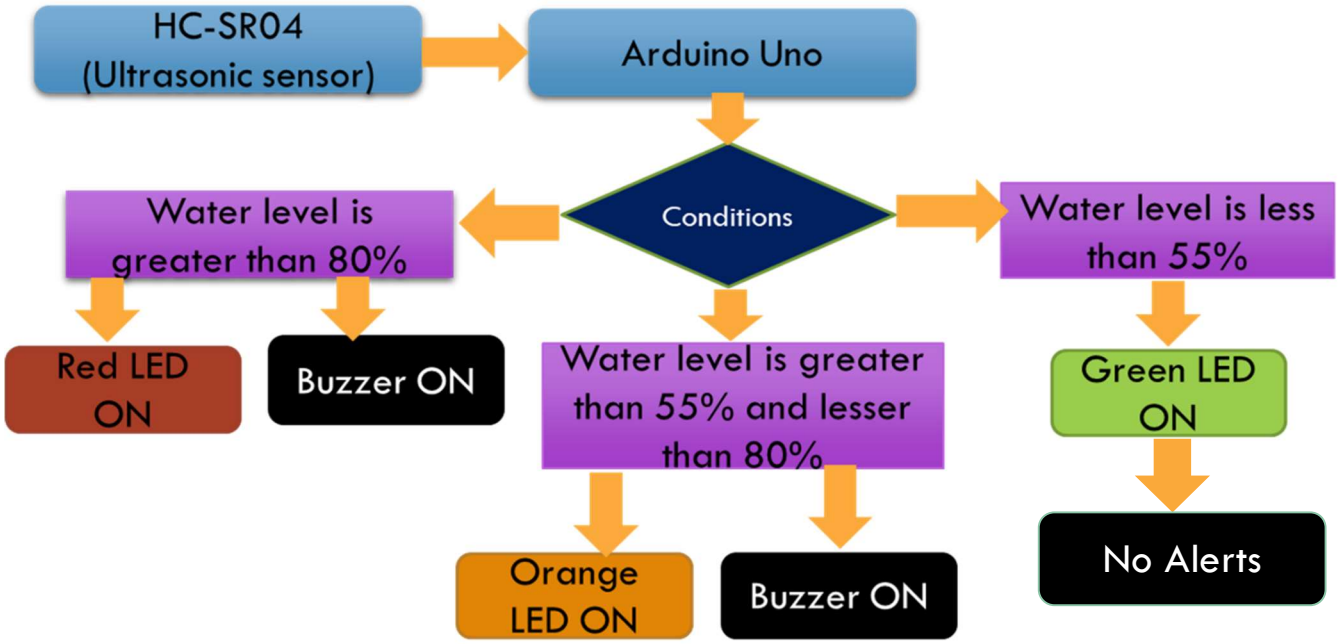


Figure 11: Workflow of the model

Firstly the USB cable type-B is connected to the Laptop's USB slot for power supply. Also the Arduino code file is run simultaneously. The ultrasonic sensor will sense the water level in distance and then the arduino program will help to convert it into centimeters. Also the distance will be displayed on serial monitor.The full water tank/container is divided into 3 zones i.e Green, Orange and Red.

GREEN ZONE:

When water level is at Min/Normal level. That resembles 'Green Zone'. This means that water is at normal position and no sign about flood condition. Also green led will glow.

ORANGE ZONE:

When water level crosses the Intermediate level. That resembles 'Orange Zone'. This means that water is rising and there can be chances of flood condition at that place. With increase in water level the orange led will glow and buzzer will buzz.

RED ZONE:

When water level crosses the Max Level. That resembles 'Red Zone'. This means that water level has crossed the 80% and flood situation has occured at that place. With increase in water level the red led will glow and buzzer will buzz.

If the water level is too far, it will show a message of out of range.

WORKING CODE

Arduino Code:

```
//IOT Based Flood Monitoring And Alerting System.



const int trigPin = 7;
const int echoPin = 6;
//#define led1 13
//#define led2 11
//#define led3 9
//#define buzzer 3
long duration, distance;
void setup()
{
  Serial.begin (9600);
  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);
  pinMode(13, OUTPUT);   //led1
  pinMode(11, OUTPUT);  //led2
  pinMode(9, OUTPUT);   //led3
  pinMode(3, OUTPUT);   //buzzer

}
void loop()
{
  digitalWrite(trigPin, LOW);
```

```
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);
  duration = pulseIn(echoPin, HIGH);
  distance = duration*0.034/2;
  Serial.println("Distance: ");
  Serial.println(distance);
  delay(100);

  if (distance <=6 && distance>4.2)
  {
   digitalWrite(13, HIGH);
   digitalWrite(3, LOW);
  }
  else
  {
   digitalWrite(13,LOW);
   digitalWrite(3, LOW);
  }
  if (distance < 4 && distance >=2.5)
  {
     digitalWrite(11, HIGH);
     digitalWrite(3, HIGH);
}
  else {
     digitalWrite(11, LOW);
```

```
    }
  if (distance < 2.8) {
      digitalWrite(9, HIGH);
      digitalWrite(3, HIGH);
}
  else {
    digitalWrite(9, LOW);
  }

  if (distance > 6 || distance <= 0){
    Serial.println("Out of range");
    noTone(3);
  }
  delay(500);
}
```

CONCLUSION

Nowadays the Internet Of things (IoT) is broadly used in worldwide, this system will display the distance of the water level measured on serial monitor. This project can be very helpful to the Meteorological Department to continuously monitor the dams and river beds water level. With this project it can save many people lives by giving alerts when the water level crosses beyond the limit. This project is very cost-effective, flexible and productive in areas where flood conditions happens everytime.

BIBLIOGRAPHY

1) Sheikh Azid, Bibhya Sharma, Krishna Raghuwaiya, Abinendra Chand, Sumeet Prasad, SMS based flood monitoring and early warning system, ARPN Journal of Engineering and Applied Science, 10(15) 2015.

2) Abubaker Rahmtalla, Abdalla Mohamed, Wang Guang Wei, Real Time Wireless Flood Monitoring System using Ultrasonic waves, International Journal of Science and Research (IJSR) ,3(8) 2014.

3) http://www.circuitstoday.com/interface-gsm-module-with-arduino

4) Manish M. Patil and Prof. Chhaya S. Khandelwal, Implementation of Patient Monitoring System Using GSM Technology. International Journal of Electronics and Communication Engineering & Technology (IJECET).4(1), 2013, pp. 18–24

5) S. J. Priya, S. Akshaya, E. Aruna, J. A. M. Julie, and V. Ranjani, “Flood monitoring and alerting system,” International Journal of Computer Engineering & Technology (IJCET), vol. 8, no. 2, p. 15, Mar 2017.