Gnanamani
College of Technology
Gateway to Great Life !
Accredited by NAAC 'A' Grade & NBA
AUTONOMOUS

DEPARTMENT : BIO MEDICAL ENGINEERING

YEAR : THIRD YEAR

TOPIC : FLOOD MONITORING AND ALERTING SYSTEM

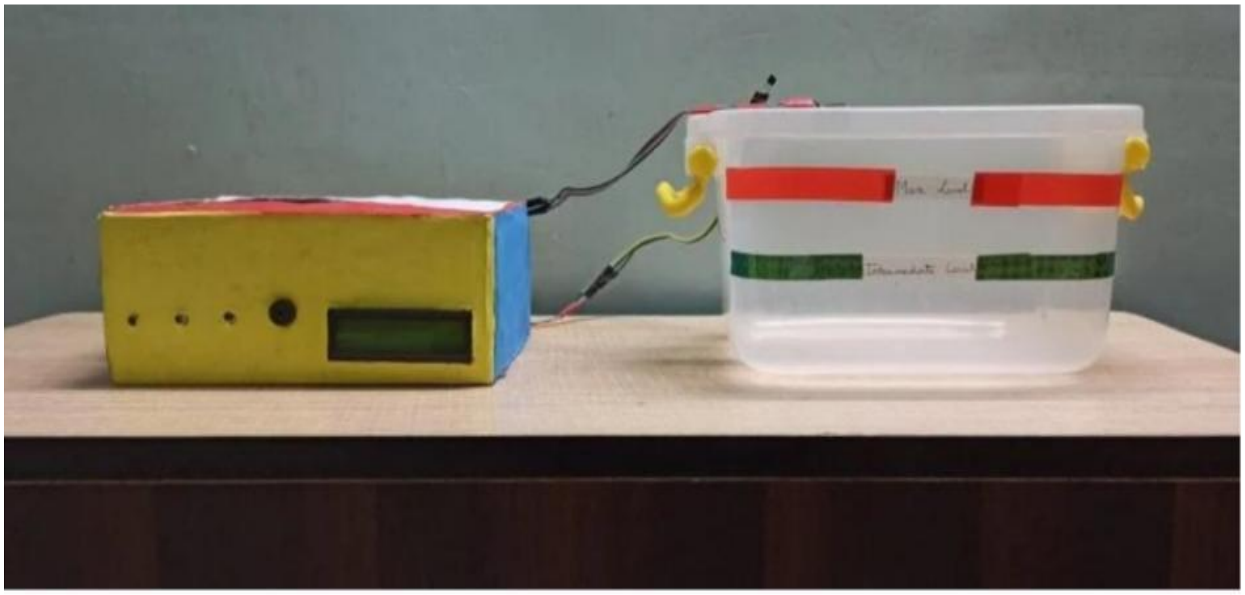
Team members :

1. **SANDHIYA.N**
2. **MONISHA.V**
3. **VISHNU PRIYA.S**
4. **RAMYAKRISHNAN.T**
5. **VANATHI.S**

By:

Vishnupriya.s

Flood Monitoring And Alerting System



As we all know that Flood is one of the major well know Natural Disasters. When water level suddenly rises in dams, river beds etc.Alot of Destruction happens at surrounding places.It causes a huge amount of loss to our environment and living beings as well.So in these case ,it is very important to get emergency alerts of the water level situation in different conditions in the river bed.

The purpose of this project is to sense the water level in river beds and check if they are in normal condition. If they reach beyond the limit, then it alerts people through LED signals and buzzer sound. Also it alerts people through Sms and Emails alerts when the water level reaches beyond the limit.

The composition of the Flood warning System ;

The warning System includes:

1. **Wireless Sensor network** capturing relevant variables about the flow of rivers and streams (level.flow.speed, water Temperature, etc)
2. **A smart computer System** for the exploitation of hydrometerological and notifications for events that may involve a Flood risk situation.

Real -time Monitoring

ENVIRA loT's System controls the flow and its behavior in real time,detects possible water courses and alerts about the flood risk with real and accurate data.it includes autonomous stations located at strategic points, equipped with adatalogger that reads the data captured by the Sensors, Besides the Sensors for the level of watercourses, Sensors for Temperature and humidity,turbidity,water speed, capacity,etc.can be installed.

A series of determinants identifying and predicting a certain event can be defined for each station, with the purpose of sending a warning to the control center and to the users predefined from the beginning.

These meters include a radar Sensor with a Maximum range from 10 to 70 meters. This technology enables independent measurments of the environmental contactless Monitoring principle,there is an absence of wear and maintenance.

Warning System;

Acquisition and communication Electronics continuously control the level of water and the delivery of data to the control center at planned intervals.

If a present level or flow is surpassed,it generates data communication through SMS or e-mails to the authorized users.

The solution can be integrated with the early flood warning System (EFWS) of public Administration.

Things used in this project-

Hardware component-

1. Bolt-IoT wifi module
2. Arduino uno
3. Breadboard-400 tie points
4. 5mm LED:(Green, Red,Orange) and Buzzer
5. 16×2 LCD Display
6. LM35 Temperature Sensor
7. HC-SR04 Ultrasonic Sensor
8. Some Jumper Wires
    - Male to Female jumper   Wires-15 pcs
    - Male to Male Jumper   Wires-10 pcs
    - Female to Female   Jumper Wires-5 pcs

9.9v Battery and Snap   Connector

Software components :

1. Arduino IDE
2. Python 3.7 IDLE
3. Bolt IoT Cloud
4. Bolt IoT Android App
5. Twillo SMS Messaging API
6. Mailgun EMAIL Messaging APISoftware components

Hand tools and fabrication machines

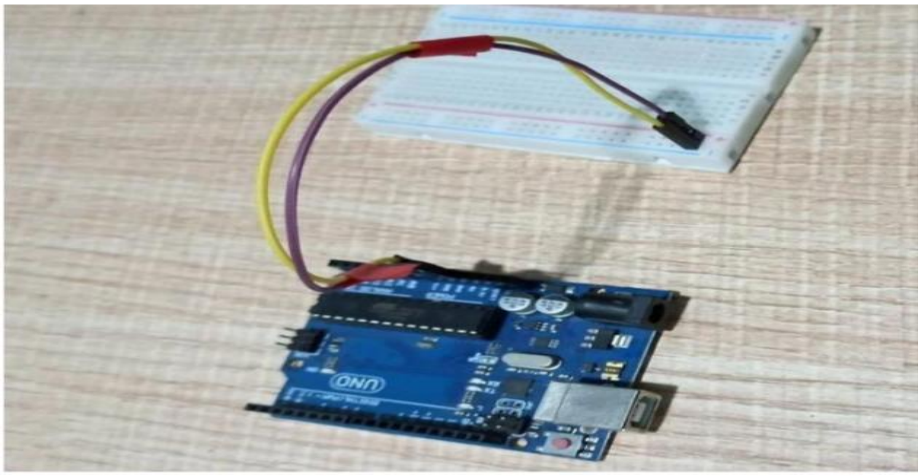
1.Electrical Tape

2.Green Cello Taps

STEP:1   Connecting 5v and GND of Arduino to the Breadboard for Power connection to other components

STEP:2

.   Connecting LED’s



For Green LED

- VCC of Green Colour LED to Digital Pin ‘10’ of the Arduino.
- GND of Green Colour LED to the GND of Arduino.

For Orange LED

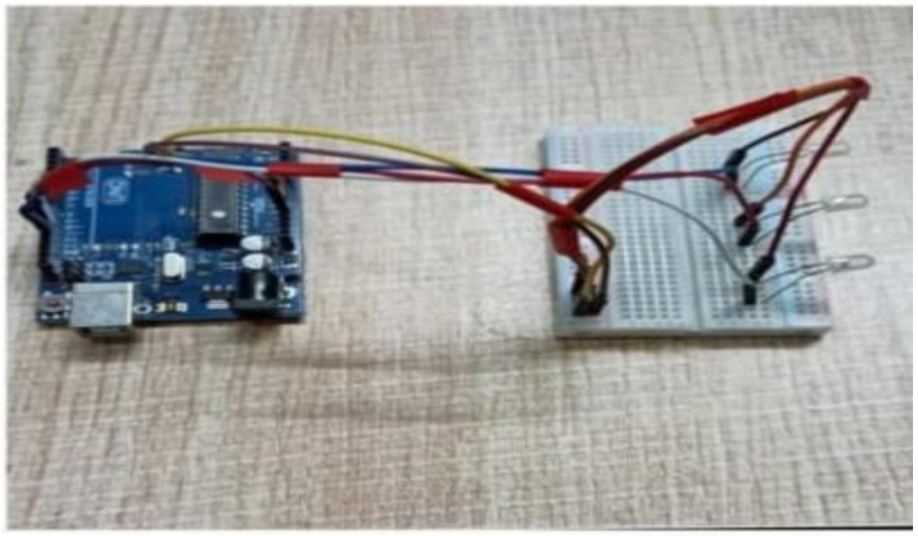
- VCC of Orange Colour LED to Digital Pin ‘11’ of the Arduino.
- GND of Orange colour LED to GND of Arduino.

For Red LED

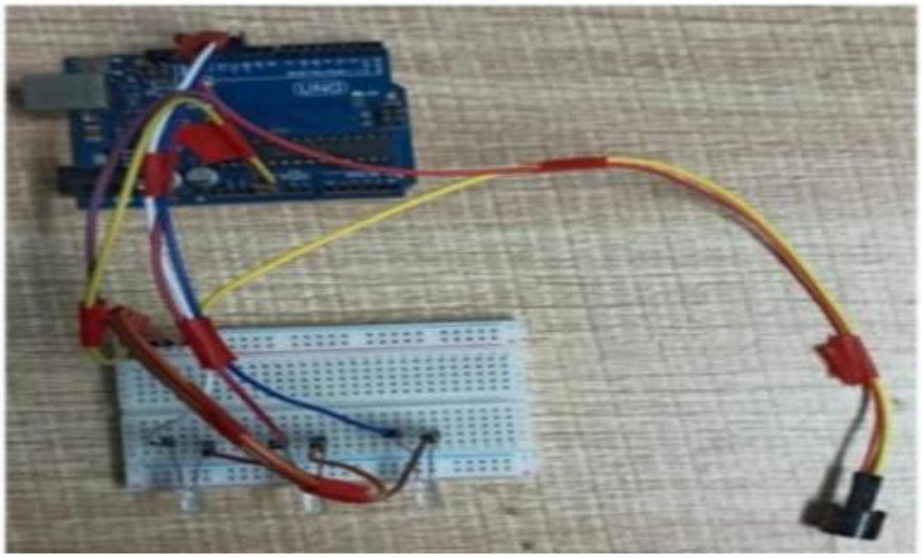
- VCC of Red colour LED to Digital Pin ‘12’ of the Arduino.
- GND of Red Colour LED to the GND of Arduino.

STEP:3

Connecting Buzzer



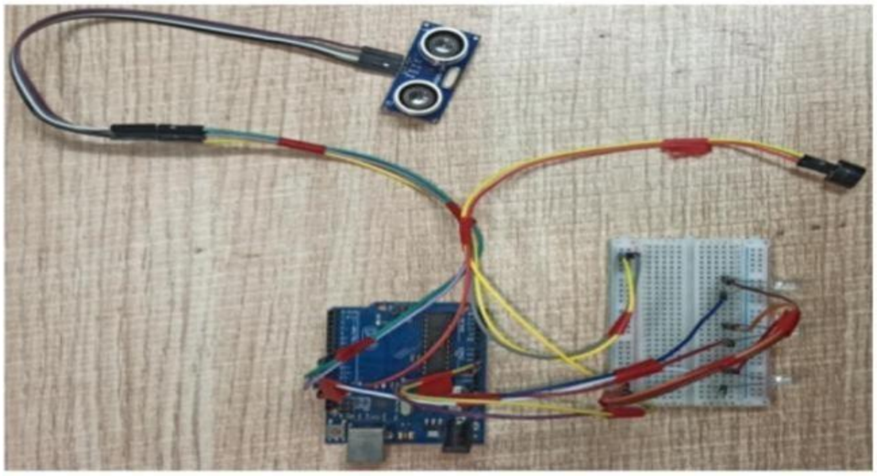
- VCC of Buzzer to Digital Pin ‘13’ of the Arduino.
- GND of Buzzer to the GND of Arduino.



STEP:4

. Connecting HC-SR04 Ultrasonic Sensor

- VCC of Ultrasonic Sensor to 5v of Arduino.
- GND of Ultrasonic Sensor to GND of Arduino.
- Echo of Ultrasonic Sensor to Digital Pin ‘8’ of Arduino.
- Trig of Ultrasonic Sensor to Digital Pin ‘9’ of Arduino.



STEP:5

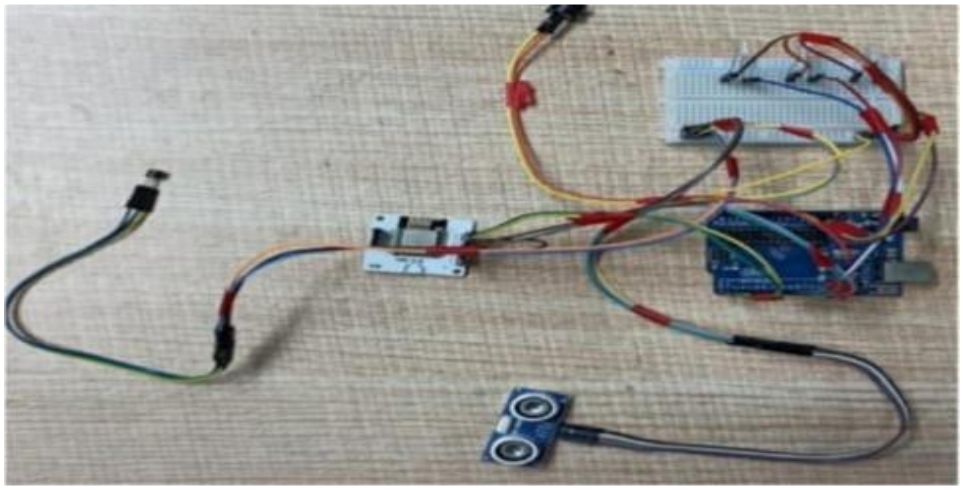
Connecting Bolt WiFi Module

- 5v of Bolt WiFi Module to 5v of Arduino.
- GND of Bolt WiFi Module to GND Arduino.
- TX of Bolt WiFi Module to RX of Arduino.
- RX of Bolt WiFi Module to TX of Arduino

STEP:6

Connecting LM35 Temperature Sensor

- VCC of LM35 to 5v of Bolt WiFi Module.
- Output Pin of LM35 to Pin ‘A0’ of Bolt WiFi Module.
- GND of LM35 to GND of Bolt WiFi Module.

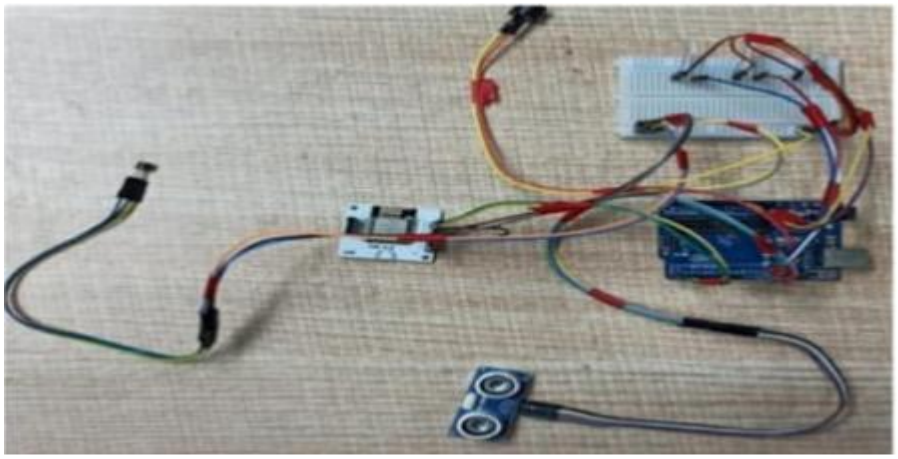


STEP:7

Connecting 16×2 LCD Display

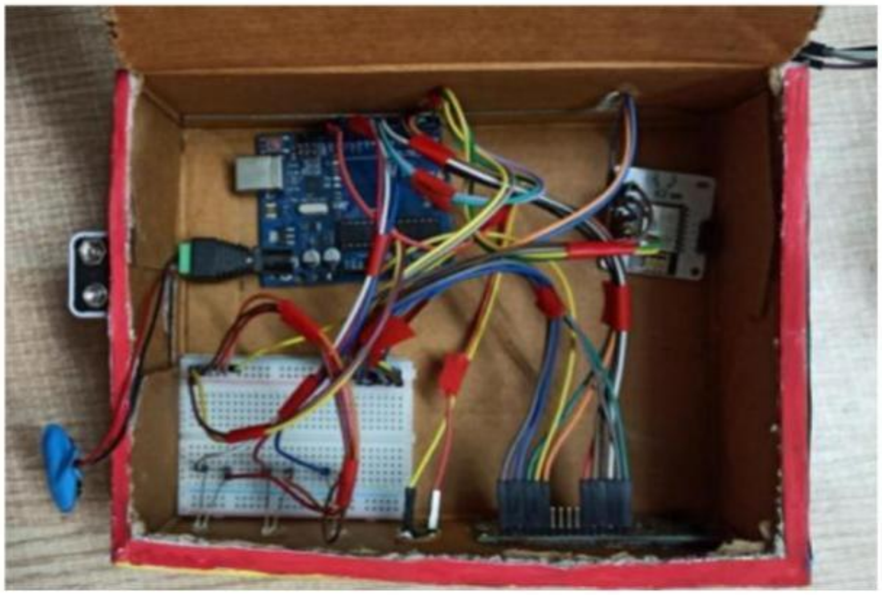
- Pin 1,3,5,16 of 16×2LCD to GND of Arduino.
- Pin 2,15 of 16×2LCD to 5v of Arduino.

- Pin 4 of 16×2 LCD to Digital Pin ‘2’ of Arduino.
- Pin 6 of 16×2 LCD to Digital Pin ‘3’ of Arduino.
- Pin 11 of 16×2 LCD to Digital Pin ‘4’ of Arduino.
- Pin 12 of 16×2 LCD to Digital Pin ‘5’ of Arduino.
- Pin 13 of 16×2 LCD to Digital Pin ‘6’ of Arduino.
- Pin 14 of 16×2 LCD to Digital Pin ‘7’ of Arduino.

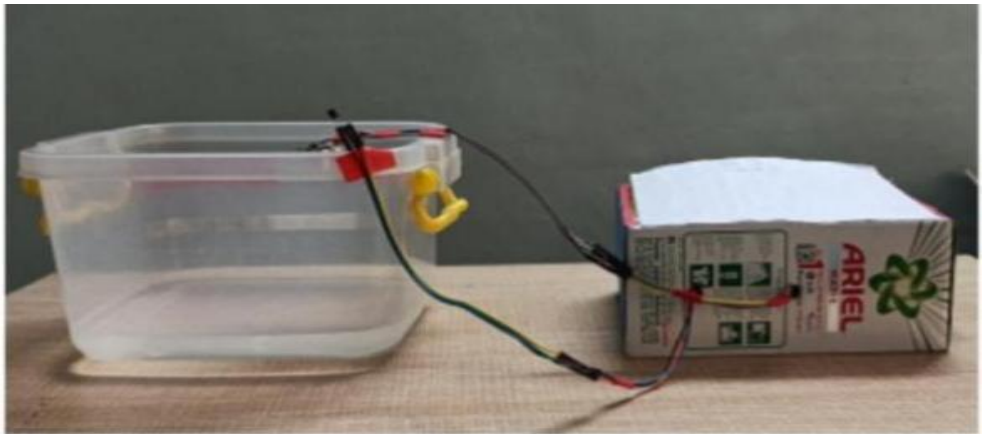


After doing the hardware connection put all the hardware components in one box .

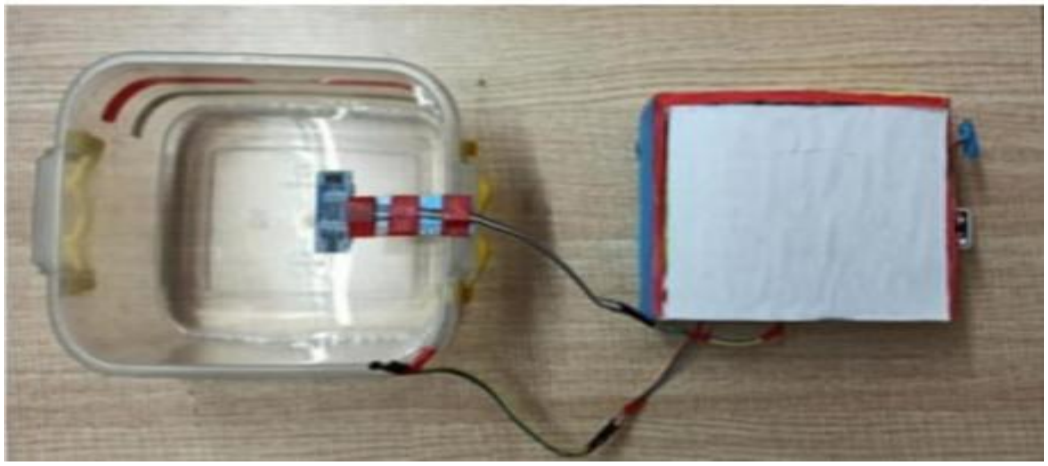
Also attach LM35 Temperature Sensor on the side of the container.



Also attach Ultrasonic Sensor on the top of the container.



Also attach Ultrasonic Sensor on the top of the container.



PROBLEM STATEMENT

- Many flood warnings stations have been developed and installed in prosperous countries but the manufacturing cost is usually too high to be practical in developing countries.

- Therefore, building an efficient flood warning System while maintaining reasonable production cost has been a meaningful mission for many researchers including our project.

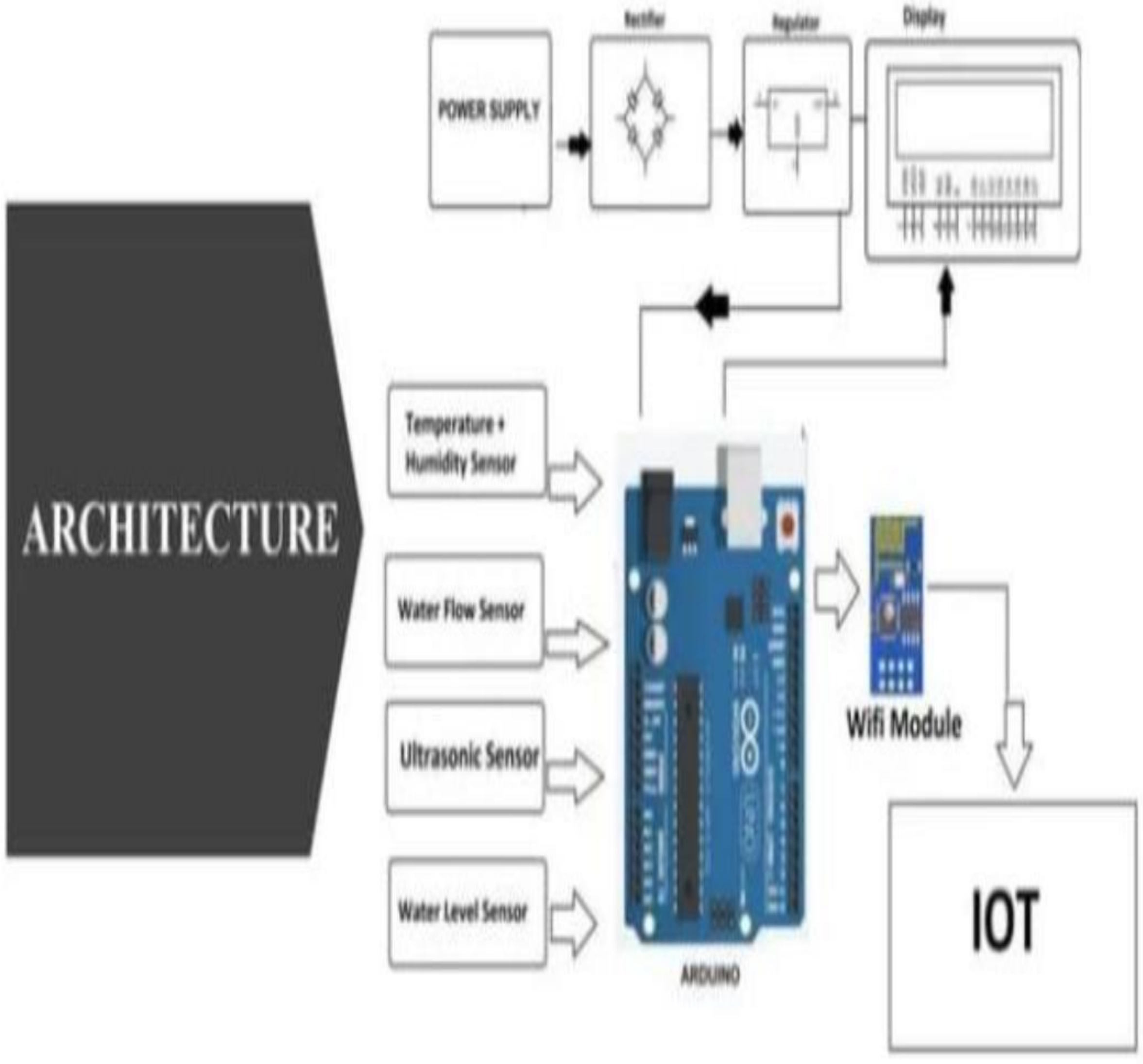
SCOPE OF THE PROJECT

- Historical records have shown that Flood is the most frequent Natural hazards, accounting for 41% of all Natural perils that occurred globally in the last decade.

- In this period alone (2009 to 2019),there were over 1566 flood occurrences affecting 0.754 billion people around the world with 51.002 deaths recorded and damage estimated at ₹371.8 billion. Put in context, these statistics only account for “reported “ cases of large scale floods.

- The ultimate goal was to improve the prediction accuracy, for this purpose some researchers have explored the correlation among weather features and prediction accuracy and tried to find the best combination of those features to tune the performance.

- Few researchers on the other hand worked to train the mining Technique well to achieve the high accuracy in prediction. Few have compared the moden techniques with the conventional ones.



- The LCD is used to display the real time values of the Sensors .these data can also be viewed on the cloud, which constantly retrieves the information from the remote IOT platforms.

- If the values of ant Sensor crosses over a certain threshold values, an alerts is send to the end user via the WiFi module. Using this system, the flood related parameters can be monitored from anywhere in the world remotely.

- **In** this system we make use of an Arduino with Sensors to predict flood and alerts respective authorities and sound instant alarm in nearby villages to instantly transmit information about possible floods using IoT.

- **All** these features provided by the application can be efficiently used by any individual to monitor the system. It is user friendly and avoids complications of different data used as the useris only provided with what really is important.

Software programming:

- After the successful completion of hardware setup. Now it's the time to do software setup for the project. For that you have to first Download and Install Arduino IDE and Python IDE from the link given above in the software apps and online services section. Also Creating account on various online app services and noting down the important keys and id's. Below all the steps given to create account on online app services and noting down the keys.

After setting online app services and saving the keys somewhere. Now most important is to write code and allow sensors attached to microcontroller to take specific decisions. After setting online app services and saving the keys somewhere. Now most important is to write code and allow sensors attached to microcontroller to take specific decisions.

Basically this project contains two editors to write the code. First is Arduino IDE in that we will write the arduino code. Second the Python IDE in that we will write the configuration file and the main code. Also the download link of both the editor can find above in the online app services section.

- Open the Arduino IDE(Downloaded from the above section).
- Click on new file. Choose the correct file path to save the file. Give appropirate name to the file and add .ino extention to the file and save the file.
- Now the core part of the project is writing code for Arduino Uno. Below this line complete code is given. You can refer the below code.

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

#include<LiquidCrystal.h>


LiquidCrystal lcd(2, 3, 4, 5, 6, 7);


const int in = 8;

const int out = 9;

const int green = 10;

const int orange = 11;

const int red = 12;
const int buzz = 13;


void setup() {
Serial.begin(9600);
lcd.begin(16, 2);
pinMode( in , INPUT);
pinMode(out, OUTPUT);
pinMode(green, OUTPUT);
pinMode(orange, OUTPUT);
pinMode(red, OUTPUT);
pinMode(buzz, OUTPUT);
digitalWrite(green, LOW);
digitalWrite(orange, LOW);
digitalWrite(red, LOW);
digitalWrite(buzz, LOW);
lcd.setCursor(0, 0);
lcd.print("Flood Monitoring");
lcd.setCursor(0, 1);
lcd.print("Alerting System");
delay(5000);
lcd.clear();
}

void loop() {
long dur;
long dist;
long per;
digitalWrite(out, LOW);
delayMicroseconds(2);
digitalWrite(out, HIGH);
delayMicroseconds(10);
digitalWrite(out, LOW);
dur = pulseIn( in , HIGH);
dist = (dur * 0.034) / 2;
per = map(dist, 10.5, 2, 0, 100);
#map
```

function is used to convert the distance into percentage.

```
if(per < 0) {
per = 0;
}
if (per > 100) {
per = 100;
}
Serial.println(String(per));
lcd.setCursor(0, 0);
lcd.print("Water Level:");
lcd.print(String(per));
lcd.print("% ");
if (per >= 80) #MAX Level of Water--Red Alert!{
lcd.setCursor(0, 1);
lcd.print("Red Alert! ");
digitalWrite(red, HIGH);
digitalWrite(green, LOW);
digitalWrite(orange, LOW);
digitalWrite(buzz, HIGH);
delay(2000);
digitalWrite(buzz, LOW);
delay(2000);
digitalWrite(buzz, HIGH);
delay(2000);
digitalWrite(buzz, LOW);
delay(2000);

}
else if (per >= 55) #Intermedite Level of Water--Orange Alert!{
lcd.setCursor(0, 1);
lcd.print("Orange Alert! ");
digitalWrite(orange, HIGH);
digitalWrite(red, LOW);
digitalWrite(green, LOW);
digitalWrite(buzz, HIGH);
delay(3000);
```

```
digitalWrite(buzz, LOW);

delay(3000);


}

else #MIN / NORMAL level of Water--Green Alert!{

lcd.setCursor(0, 1);

lcd.print("Green Alert! ");

digitalWrite(green, HIGH);

digitalWrite(orange, LOW);

digitalWrite(red, LOW);

digitalWrite(buzz, LOW);

}


delay(15000);

}
```

- After writing the code. Verify the code and then upload the code to the specific Arduino using USB Cable type A. Remember while uploading select specific board you want to upload.
- For writing python code we will be using python IDE.
- In this project we will be making two python files. One will be saved in the name of conf.py and other will be main.py.
- The purpose of making two files is to make the code understandable. Also this both python files will be usefull in sending sms and emails alerts to users.
- Now the most important part is arrived writing code in Python IDE. The full code is divided into two parts. The detailed code is given below.
- Open Python 3.7 IDE(Downloaded from the above section).
- Click on new file. Save the file in the name conf.py.
- **conf.py:** The file consists of important Api keys, Device id of Bolt IoT WiFi Module. Also it consists of important keys of Twillo and Mailgun respectively which will be further usefull in this project.
- Below is the complete structure of conf.py file. Make sure that you add the updated Bolt API key, device id and Mailgun and Twillo details respectively:

```
#twillo details for sending alert sms
SID = 'You can find SID in your Twilio Dashboard'
AUTH_TOKEN = 'You can find  on your Twilio Dashboard'
FROM_NUMBER = 'This is the no. generated by Twilio. You can find
this on your Twilio Dashboard'
TO_NUMBER = 'This is your number. Make sure you are adding +91
in beginning'

#bolt iot details
API_KEY = 'XXXXXXXXXX'
```

```
   #This is your Bolt cloud API
Key.
DEVICE_ID = 'BOLTXXXXXXXXX' #This is the ID of your Bolt
device.

#mailgun details for sending alert E-mails
MAILGUN_API_KEY = 'This is the private API key which you can
find on your Mailgun Dashboard'
SANDBOX_URL= 'You can find this on your Mailgun Dashboard'
SENDER_EMAIL = 'test@ + SANDBOX_URL' # No need to modify
this. The sandbox URL is of the format test@YOUR_SANDBOX_URL

RECIPIENT_EMAIL = 'Enter your Email ID Here'
```

- After writing the conf.py now the last part is to write the main.py code. This code will be helpfull to send sms and email alerts when the water level crosses the threshold.
- Open the Python IDE.
- Click on new file. Save the file in the name main.py. Save the file in the same path where conf.py is saved.
- **main.py:** This file consists of the main coding facility. Discussed earlier it will be used to send sms and emails alerts. It will be also helpfull to keep close monitor on water level to send alerts whenever required.
- Below is the complete code of main.py.

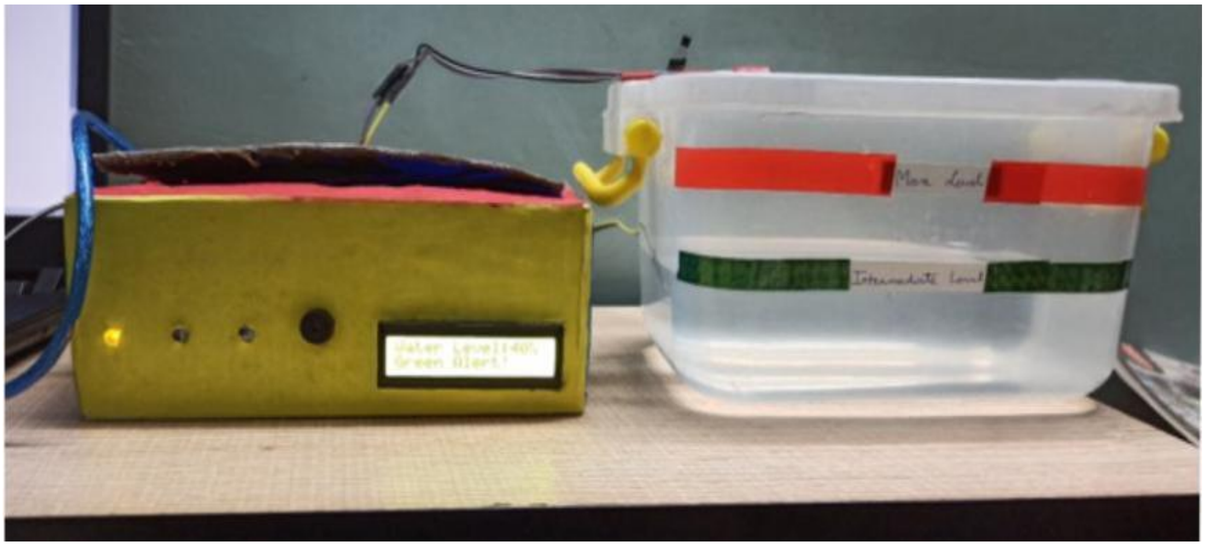
```
import conf

from boltiot import Sms, Email, Bolt

import json, time


intermediate_value = 55

max_value = 80




mybolt = Bolt(conf.API_KEY, conf.DEVICE_ID)

sms = Sms(conf.SID, conf.AUTH_TOKEN, conf.TO_NUMBER,
conf.FROM_NUMBER)

mailer = Email(conf.MAILGUN_API_KEY, conf.SANDBOX_URL,
conf.SENDER_EMAIL, conf.RECIPIENT_EMAIL)




def twillo_message(message):

  try:

    print("Making request to Twilio to send a SMS")

    response = sms.send_sms(message)

    print("Response received from Twilio is: " + str(response))

    print("Status of SMS at Twilio is :" + str(response.status))
  except Exception as e:
     print("Below are the details")
     print(e)

def mailgun_message(head,message_1):
  try:
     print("Making request to Mailgun to send an email")
     response = mailer.send_email(head,message_1)
     print("Response received from Mailgun is: " + response.text)
  except Exception as e:
     print("Below are the details")
     print(e)

while True:
    print ("Reading Water-Level Value")
    response_1 = mybolt.serialRead('10')
    response = mybolt.analogRead('A0')
    data_1 = json.loads(response_1)
    data = json.loads(response)
    Water_level = data_1['value'].rstrip()
    print("Water Level value is: " + str(Water_level) + "%")

    sensor_value = int(data['value'])

    temp = (100*sensor_value)/1024

    temp_value = round(temp,2)

    print("Temperature is: " + str(temp_value) + "°C")

    try:



        if int(Water_level) >= intermediate_value:

            message ="Orange Alert!. Water level is increased by " 
+str(Water_level) + "% at your place. Please be Safe. The current 
Temperature is " + str(temp_value) + "°C."

            head="Orange Alert"

            message_1="Water level is increased by " + str(Water_level) + "% at 
your place. Please be Safe. The current Temperature is " + str(temp_value) 
+ "°C."

            twillo_message(message)

            mailgun_message(head,message_1)



        if int(Water_level) >= max_value:

           message ="Red Alert!. Water level is increased by " + str(Water_level) 
+ "% at your place. Please Don't move out of the house. The Current 
Temperature is " + str(temp_value) + "°C"

           head="Red Alert!"
           message_1="Water level is increased by " + str(Water_level) + "% at your place. Please Don't move out of the house. The Current Temperature is " + str(temp_value) + "°C."

           twillo_message(message)

           mailgun_message(head,message_1)


    except Exception as e:

        print ("Error occured: Below are the details")

        print (e)

    time.sleep(15)
```

After Successfully writing code for Arduino and Python. Now it is the time to test and demonstrate the project. Move to next section for demonstration of the project.

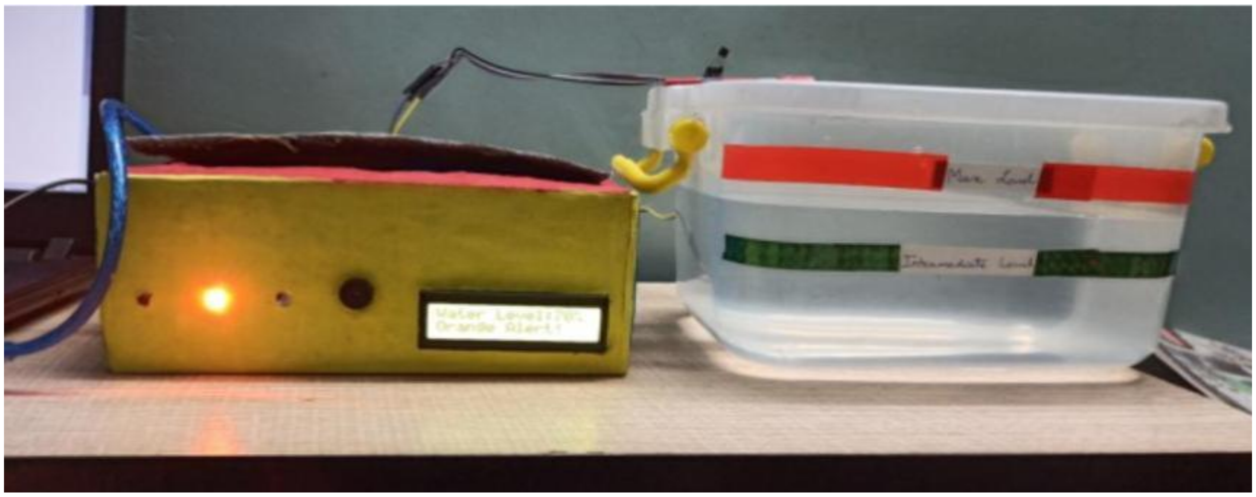
For doing the practical demonstration. First connect the USB cable type-B to the Laptop's USB slot for power supply. Also simultaneously run the python program(i.e Main.py). Firstly the ultrasonic sensor will sense the water level in distance and then the arduino program will help to convert it into percentage. Also the sensed water level will be displayed on Lcd display(In

Percentage) along with zone/area the water level is present. The full water tank/container is divided into 3 zones i.e Green, Orange and Red. Now lets look into each zone.

- When water level is at Min/Normal level. That resembles ‘Green Alert’. This means that water is at normal position and no sign about flood condition. Also green led will glow and it will also show green alert in Lcd display with water level.

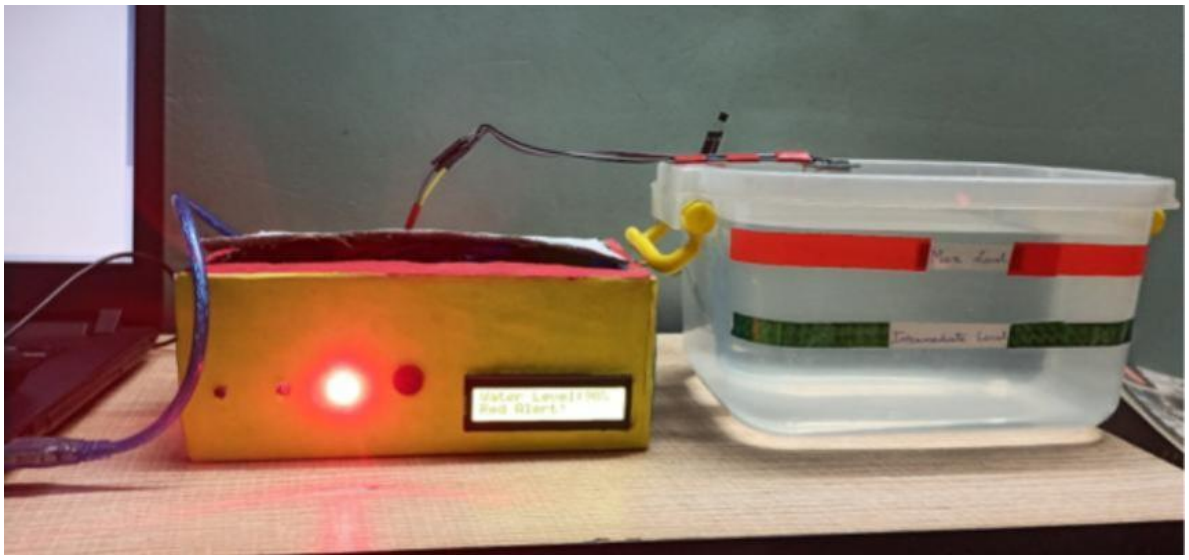


- When water level crosses the Intermediate level. That resembles ‘Orange Alert’. This means that water has crossed the 55% mark and there can be chances of flood condition at that place. With increase in water level the system sends Sms and Email alerts to the authority or registered user from Twillo and Mailgun Services respectively. Also orange led will glow and buzzer will buzz. It will also show orange alert in Lcd display.



Also Sms and Email is send to registered user with proper message and current temperature of that place.

When water level crosses the Max Level. That resembles ‘Red Alert’. This means that water level has crossed the 80% and flood situation has occured at that place. With increase in water level the system sends Sms and Email alerts to the authority or registered user from Twillo and Mailgun Services respectively. Also red led will glow and buzzer will buzz for two times. It will also show red alert in Lcd display.



Also Sms and Email is send to registered user with proper message and current temperature of that place