Flood Monitoring and Early Warning System

Introduction:

- The existing flood monitoring system consists of two microcontrollers and one sensor. The microcontroller used here is node MCU and the sensor used is an ultrasonic sensor which senses the level. The ultrasonic sensor continuously monitors the level of water each time it reaches the certain defined level. The flood warning system utilizes computer technology, database technology, communication technology, and sensor technology. Powered by IoT technology, rainfall and water levels are monitored and floods are predicted. Early warning of impending flooding can save lives and reduce extensive property damage.

OBJECTIVE:

- The Flood Monitoring and Early Warning System project aims to create a comprehensive system for monitoring water levels in rivers and other water bodies prone to flooding. The primary objectives of the project include.

Real-time Monitoring: Develop a network of IoT (Internet of Things) devices to continuously monitor water levels and weather conditions in flood-prone areas.

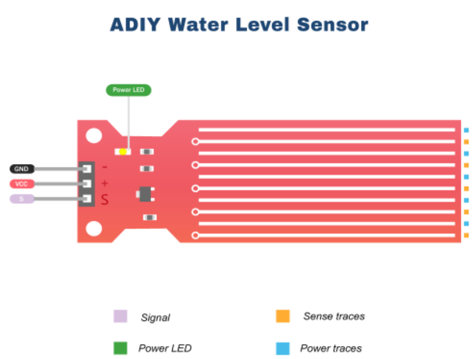
Early Warning System: Implement an early warning system that can provide timely alerts to local authorities and residents when flood risks are detected.

Data Analysis and Prediction: Analyze historical data and use machine learning algorithms to predict potential floods, allowing for proactive response planning.

Public Accessibility: Provide a user-friendly platform for public access to real-time data and flood alerts.

IOT DEVICE SETUP:

Water Level Sensors: Deploy water level sensors at strategic locations along rivers and in flood-prone areas. These sensors measure water levels continuously and transmit the data to a central server.

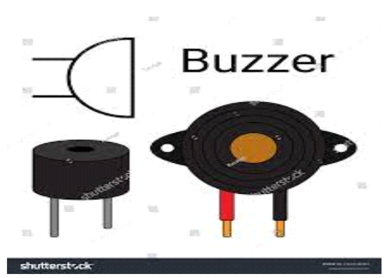


Weather Stations: Set up weather stations to monitor meteorological conditions, including rainfall, temperature, humidity, and wind speed. This data is crucial for flood prediction.

Data Transmission: Use various communication technologies, such as LoRa, GSM, or satellite, to transmit sensor data to a central server. Ensure redundancy to prevent data loss.

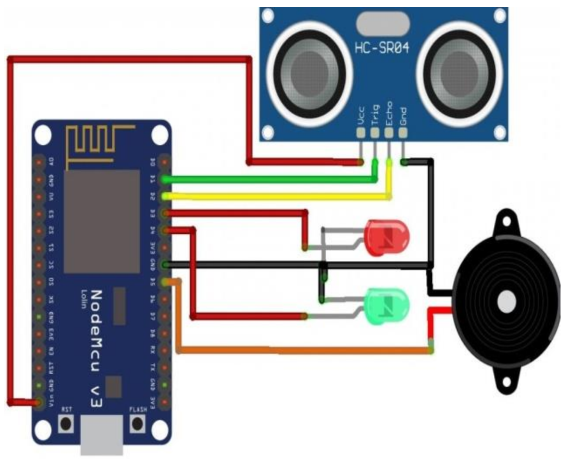
Power Supply: Provide a reliable power source for the IoT devices, which could include solar panels, batteries, or a combination of power sources.

Buzzer or Alarm Devices: These are placed in strategic locations, such as public areas and government buildings. They are triggered when the system detects a potential flood. Buzzer activation is typically controlled remotely through the IoT platform.



Proposed System:

- The Proposed system consists of Rain Sensor, Ultrasonic Sensor, Power Source, Node MCU ESP8266, Buzzer and LEDs and finally Blank App. This Wireless Sensor Node is Kept in desired location Like dam, Bridge. etc. and Blynk App is downloaded by victims near the flooding area. The Schematic Diagram of the proposed flood forecasting and Monitoring System**.**



PLATFORM DEVELOPMENT:

Centralized Data Repository: Create a centralized database to store incoming sensor data, including water level and weather information.

Data Processing and Analysis: Develop algorithms to process and analyze the collected data to identify potential flood conditions, such as rising water levels and heavy rainfall.

Alert Generation: Implement an alert system that generates notifications when the analysis indicates an impending flood. Alerts should be sent to relevant authorities and made available to the public.

User Interface: Create a user-friendly web or mobile application that displays real-time data, flood forecasts, and alert notifications. This interface should be accessible to both authorities and the general public.

WEB PAGE CREATION:

HTML (VJ.HTML):

- **Start by creating the basic structure of your web page. Here's a simple example:**

```
<!DOCTYPE html>

<html>

<head>

  <title>Early Warning Platform</title>

  <link rel="stylesheet" type="text/css" href="My_prog1.css">

</head>

<body>

  <div class="container">

    <h1>Early Warning Platform</h1>

    <div class="data-container">

      <div class="data-box" id="water-level">

        <h2>Water Level</h2>

        <p id="water-level-value">0.00 m</p>

      </div>

      <div class="data-box" id="flood-warning">

        <h2>Flood Warning</h2>

        <p id="flood-warning-value">No Alert</p>

      </div>

      <div class="data-box" id="temperature">

        <h2>Temperature</h2>

        <p id="temperature-value">0.00°C</p>

      </div>

      <div class="data-box" id="humidity">

        <h2>Humidity</h2>
```

```
            <p id="humidity-value">0%</p>
          </div>
        </div>
    </div>
    <script src="My_prog2.js"></script>
</body>
</html>
```

CSS (My_prog1.css):

- Style your page to make it visually appealing and responsive:

```
body
{
    font-family: Arial, sans-serif;
    background-color: #f4f4f4;
}
.container
 {
    max-width: 800px;
    margin: 0 auto;
    background-color: #fff;
    padding: 20px;
    border-radius: 5px;
    box-shadow: 0 0 10px rgba(0, 0, 0, 0.1);
}
 {
    display: flex;
    flex-wrap: wrap;
    justify-content: space-between;
}
```

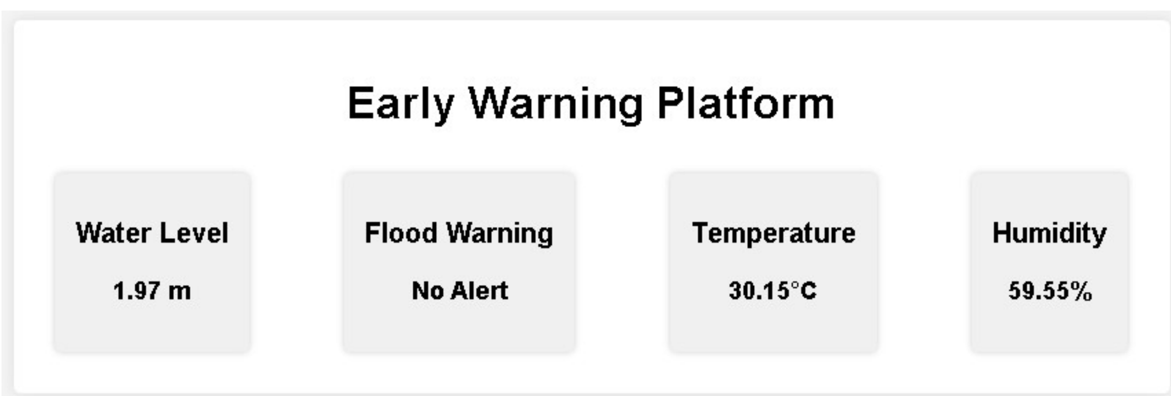
```
data-box
 {
   background-color: #f0f0f0;
   padding: 15px;
   margin: 10px;
   border-radius: 5px;
   text-align: center;
   box-shadow: 0 0 5px rgba(0, 0, 0, 0.2);
}
h1
 {
   text-align: center;
}
h2
 {
   font-size: 20px;
   margin-bottom: 10px;
}
p
 {
   font-size: 18px;
   font-weight: bold;
}
```

JAVASCRIPT (My_prog2.js):

- Use JavaScript to fetch real-time data from your IoT device and update the webpage.

```
function updateData()
{
  // Generate random data for water level, flood warning, temperature, and humidity
   const waterLevelValue = (Math.random() * 10).toFixed(2);
   const floodWarningValue = Math.random() < 0.2 ? "Alert" : "No Alert";
   const temperatureValue = (Math.random() * 40).toFixed(2);
   const humidityValue = (Math.random() * 100).toFixed(2);
    document.getElementById("water-level-value").textContent = ` ${waterLevelValue} m`;
  document.getElementById("flood-warning-value").textContent = floodWarningValue;
  document.getElementById("temperature-value").textContent = `${temperatureValue}°C`;
  document.getElementById("humidity-value").textContent = `${humidityValue}%`;
}
// Update data every 5 seconds (5000 milliseconds)
setInterval(updateData, 5000);
// Initial data update
updateData();
```

OUTPUT:



CODE IMPLEMENTATION: The code implementation involves several components:

IoT Device Firmware: Develop firmware for water level sensors and weather stations to collect and transmit data. This code should be optimized for low power consumption and reliable data transmission.

Data Processing and Analysis: Write code to process and analyze incoming data, looking for patterns that indicate a flood risk. This could involve using machine learning and data analytics techniques.JavaScript) for the frontend and server-side technologies (e.g., Python, Node.js) for the backend.

Alert Generation: Develop algorithms to trigger alerts when predefined thresholds are exceeded. Alerts can be sent via email, SMS, or push notifications.

User Interface: Create a web or mobile application for end-users to access real-time data and receive alerts. Use web development languages (e.g., HTML, CSS,

Database Management: Set up a database to store historical and real-time data. Use database management systems like MySQL, PostgreSQL, or NoSQL databases, depending on your project's requirements.

Communication Protocols: Implement communication protocols (e.g., MQTT, HTTP, WebSocket) to facilitate data exchange between IoT devices, the central server, and the user interface.

Security: Prioritize security measures to protect the system from cyber threats and unauthorized access.

REAL TIME FLOOD MONITORING AND ALART SYSTEM:

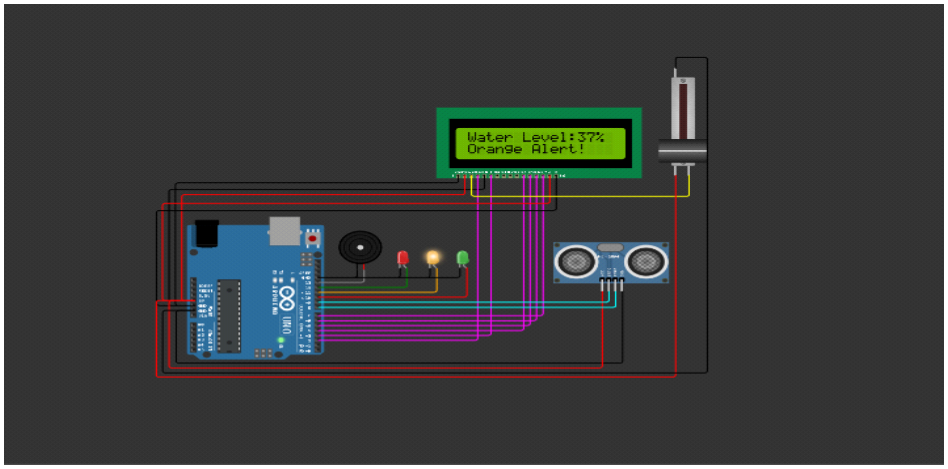
```
#include <LiquidCrystal.h>

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);
  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);
if (per < 0)
{
  per = 0;
}
if (per > 100)
{
  per = 100;
}
Serial.print("Water Level:");
Serial.println(String(per));
lcd.setCursor(0, 0);
lcd.print("Water Level:");
lcd.print(String(per));
lcd.print("%  ");
  if (dist <= 3)
{
  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 (dist <= 10)
 {
  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
 {
  lcd.setCursor(0, 1);
  lcd.print("Green Alert!  ");
  digitalWrite(green, HIGH);
  digitalWrite(orange, LOW);
  digitalWrite(red, LOW);
  digitalWrite(buzz, LOW);
 }
}
```

OUTPUT:



A real-time flood monitoring and early warning system can significantly enhance public safety and emergency response coordination in several ways:

Early Alerting:

Timely Warnings: These systems provide advance notice of potential flood events, allowing authorities to issue timely warnings to the public. This early warning can save lives and reduce injuries by giving people ample time to take protective actions.

Location-Specific Alerts: The system can issue alerts tailored to specific geographic areas or communities at risk. This enables residents and responders to prepare for potential flooding in their specific vicinity.

Public Awareness:

Informing the Public: When the system is publicly accessible, it informs individuals and communities about current weather conditions, water levels, and flood risks. This information can empower people to make informed decisions, such as evacuating to safety or avoiding flood-prone areas.

Educational Outreach: The system can also be used as a tool for educational outreach, teaching people how to respond to flood warnings and prepare emergency kits.

Emergency Response Coordination:

Prepositioning Resources: Early warnings enable emergency response agencies to preposition resources, such as personnel, equipment, and supplies, in strategic locations to facilitate faster response times.

Evacuation Planning: Knowing in advance which areas are at risk allows authorities to plan and execute organized evacuations, ensuring that vulnerable populations are safely moved to evacuation centers.

Traffic Management: Coordinating traffic flow is crucial during evacuations. Real-time data on road closures and traffic conditions helps optimize routes and prevents congestion.

Data-Driven Decision-Making:

Allocation: By monitoring real-time data, authorities can make informed decisions about the allocation of resources. For example, they can deploy more rescue teams to areas experiencing rapid flooding.

Risk Assessment: Ongoing monitoring of weather and water levels can provide a comprehensive understanding of the evolving situation, enabling authorities to assess the level of risk and respond accordingly.

Communication and Public Engagement:

Two-Way Communication: Real-time systems often include two-way communication channels, allowing the public to report incidents or seek assistance, further enhancing coordination between authorities and affected individuals.

Community Engagement: Such systems can foster community engagement by encouraging residents to take responsibility for their safety, report hazards, and assist their neighbors.

Resource Efficiency:

Optimized Resource Deployment: By relying on real-time data, resources can be deployed where and when they are needed most, reducing waste and enhancing efficiency.

Cost Savings: Effective early warning and response systems can ultimately reduce the financial burden of flood-related disasters, as they minimize the damage caused by floods.

Enhanced Data Accuracy:

Sensor Networks: Real-time flood monitoring systems often rely on sensor networks, which provide high-precision data. This accuracy enhances the ability assessrisks and make well-informed decisions.

Connection to mobile app:

- The prototype works accordingly, an experiment was conducted to test the measurement of water detected by wireless sensor node. Buzzer and LED started to trigger when the water level reached 40 until it reaches critical level (62) in the gauge, a notification sent to victim through Blynk and email. Rain sensor detects the rain intensity and sends an alert when rain heavily started.

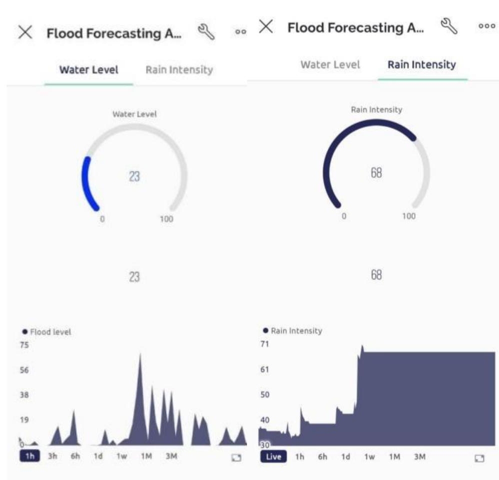


Fig 1.3:Interfaceof Water

Leveland RainIntensity:

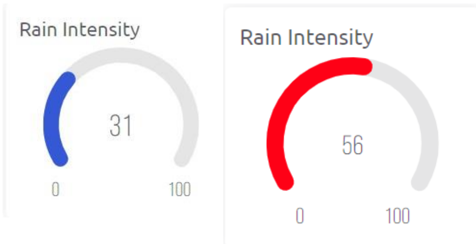


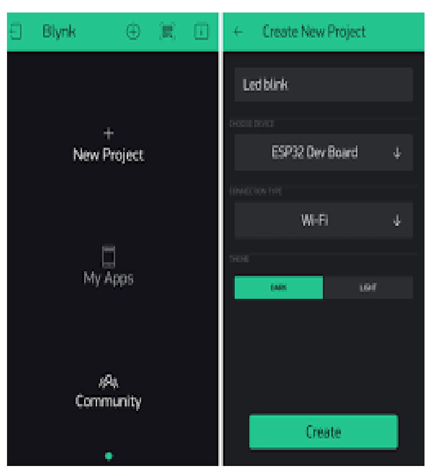
Fig 1.4 Low&High Rain Intensity

fig 1.5Medium&Critical levels water

The level of rain intensity which is in Blue colour shows that the rain just started to fall. This indicates that the people who livenearby should alert as they know their place will get a very disastrous disaster if the rain started heavily. The user receive a “Rain Warning!!” warning in order to atert them

Bylnk Application:

Blynk platform powers low-batch manufacturers of smart home products,complex HVAC systems, agricultural equipment, and everyone in the between. These companies build branded apps with no code and get the full back-end IoT infrastructure through one subscription.



CONCLUSION:

- A real-time flood monitoring and early warning system plays a pivotal role in public safety and emergency response coordination.
- By providing timely information and data-driven insights, it empowers individuals, communities, and authorities to prepare for, respond to, and mitigate the impact of flood events, ultimately saving lives and reducing property damage.
- The success of the Flood Monitoring and Early Warning System project depends on the effective integration of these components and the continuous monitoring and improvement of the system's performance over time.
- Additionally, collaboration with local authorities and stakeholders is crucial for successful implementation and response coordination during flood events.