FLOOD WATER MANAGEMENT AND EARLY WARNING SYSTEM

INTERENT OF THINGS - PAHSE5 -GRUP1 - FINAL PROJECT

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OBJECTIVES:

Risk Reduction: To minimize the risks associated with flooding and reduce the potential damage to human life, infrastructure, and the environment.

Public Safety: To protect the safety and well-being of the public by providing early warnings and guidance for evacuation or other protective actions.

Property Protection: To safeguard homes, businesses, and critical infrastructure from flood damage through early warnings and preparedness measures.

Environmental Protection: To minimize the negative environmental impacts of flooding, such as soil erosion and water pollution.

Economic Resilience: To enhance the economic resilience of communities by minimizing flood-related disruptions and economic losses.

Infrastructure Resilience: To ensure the resilience of critical infrastructure, such as bridges, dams, and transportation systems, to withstand flood events.

Timely Information: To provide timely and accurate information about flood events, including their magnitude, location, and potential impacts.

Community Preparedness: To promote community awareness and preparedness through education and outreach programs.

Effective Response: To support emergency response agencies and organizations with the information they need to coordinate and manage resources during a flood event.

Adaptive Management: To continuously improve flood water management strategies and early warning systems based on evolving technology and scientific knowledge.

Public Participation: To engage with the public and stakeholders in the development and improvement of flood water management and early warning systems.

Monitoring and Prediction: To monitor weather and hydrological conditions, predict flood events, and issue timely warnings to reduce the element of surprise and provide adequate lead time for preparations.

International Cooperation: To cooperate with neighboring countries and international organizations to manage transboundary rivers and mitigate flooding risks in a coordinated manner.

<p align="center">**IOT DEVICE SETUP:**</p>

- **Water level sensors:** Measure water levels in rivers, streams, and flood-prone areas.
- **Rainfall and precipitation sensors:** Monitor precipitation to predict potential flooding.
- **Weather sensors:** Measure temperature, humidity, wind speed, and direction.
- **Soil moisture sensors:** Assess soil saturation levels.
- Connect the sensors to a data acquisition system.
- like **microcontroller, data logger, or IoT gateway** that collects data from the sensors.
- communication modules ex: cellular , wifi, LAN, Satellite etc.
- **Early warning system.**
- **Data processing and analysis.**
- **User interface.**
- **backup power.**
- **Remote Monitoring and Control.**

<p align="center">**RESULTS AND ANALYSIS:**</p>

After all the complete connections of the system were made successfully along with the required software, the system was ready for testing. Individual models were tested at the beginning of the project. The system was tested for analyzing the various parameters such as temperature, humidity and level of water.

Time	DHT11 (in celsius)	Thermometer (in celsius)
6:00 AM	21	22
7:00 AM	21	22
8:00 AM	21	22
9:00 AM	23	24
10:00 AM	25	26
11:00 AM	26	26
3:00 PM	28	28
4:00 PM	24	25
5:00 PM	24	25
6:00 PM	22	23
7:00 PM	23	24
8:00 PM	23	24
9:00 PM	23	24
10:00 PM	23	24

Relative Humidity
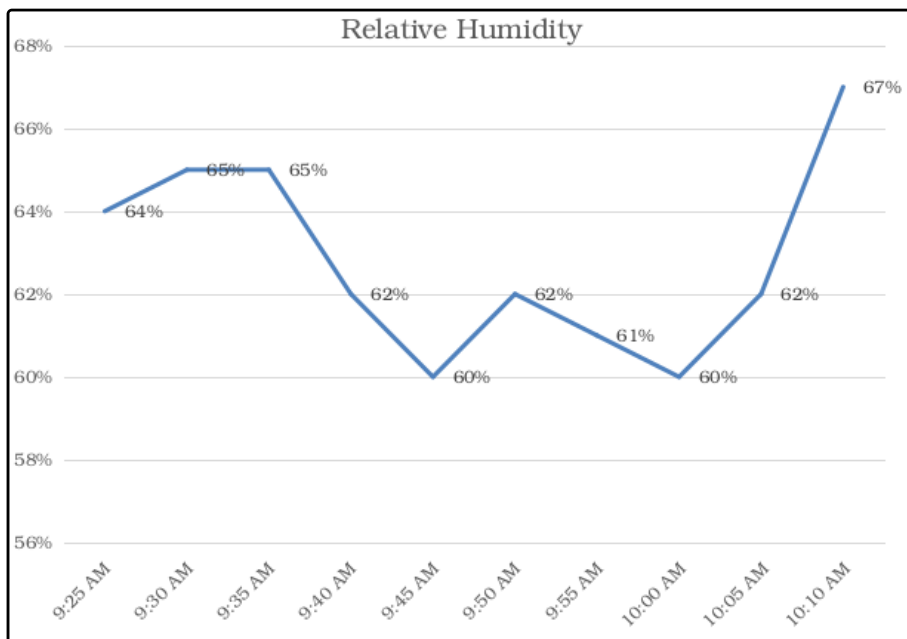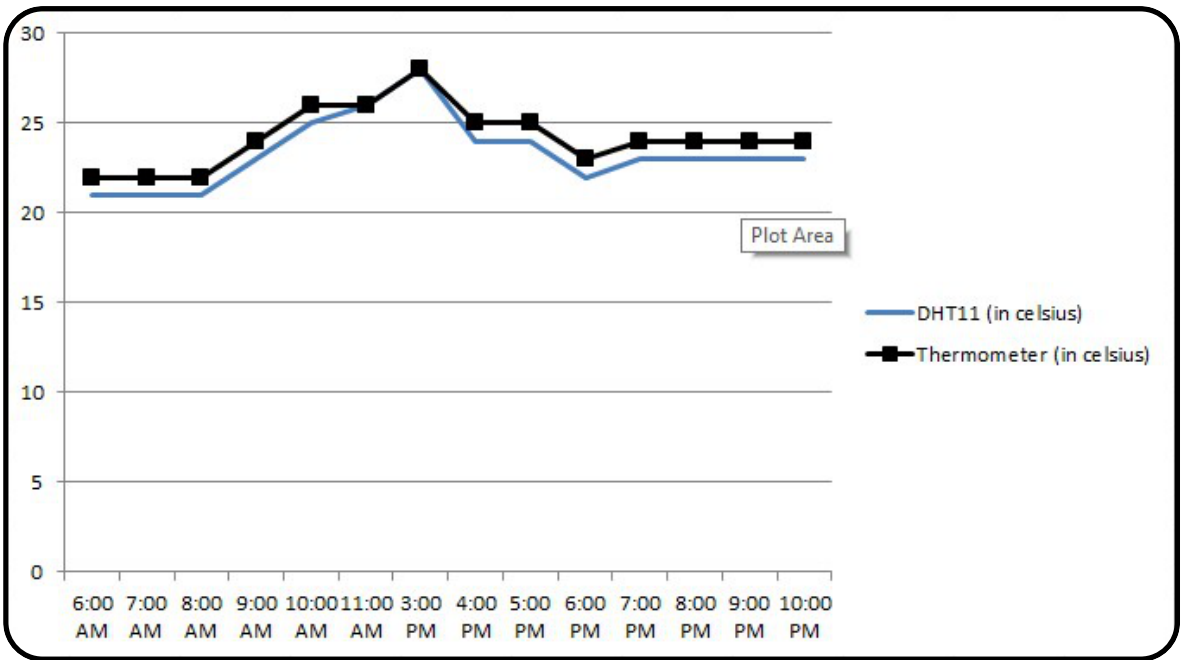
LIMIATIONS:

As no any machine can be perfect and this line also affect out project as well. Desired output was observed. The system designed has the following limitation:

DHT11 sensor can measure the temperature only from 0-50 degree Celsius and cannot operate on lower or higher range of temperature than this.

DHT11 sensor can measure the humidity only from 20-95% RH and hence cannot operate on lower or higher range than this.

HC-SR04 (Ultrasonic sensor) has the maximum range of only 400 centimeters.

The web API delays sometime to deliver the SMS.

```html
<!DOCTYPE html>
<html lang="en">
<head>
   <meta charset="UTF-8">
   <meta name="viewport" content="width=device-width, initial-scale=1.0">
   <title>Flood Management & Early Warning System</title>
   <style>
      /* Reset some default styles */
      * {
         margin: 0;
         padding: 0;
         box-sizing: border-box;
      }
      /* Basic styling for the body */
      body {
         font-family: Arial, sans-serif;
         background-color: #f0f0f0;
         margin: 20px;
      }
      /* Header styling */
      header {
         background-color: #0074D9;
         color: #fff;
         padding: 20px;
         text-align: center;
      }
      /* Main content container */
      .container {
         max-width: 1200px;
         margin: 0 auto;
         padding: 20px;
         background-color: #fff;
      }
      /* Footer styling */
      footer {
         background-color: #333;
         color: #fff;
         text-align: center;
         padding: 10px;
      }
   </style>
</head>
<body>
   <header>
      <h1>Flood Management & Early Warning System</h1>
   </header>
   <div class="container">
      <!-- Your content goes here -->
      <h2>Welcome to our Flood Management System</h2>
      <p>This is a basic template. You can add more content and functionality as needed.</p>
   </div>
   <footer>
      &copy; 2023 Your Organization
   </footer>
</body>
</html>
```

CODE FOR APLICATION IN PYTHON FOR THE ABOVE TECHNOLOGY:

1. We simulate the acquisition of environmental data, such as water level and rainfall. In a real system, you would replace with actual sensor data or data from external sources.

2. We analyze the acquired data to issue warnings based on predefined criteria. This is a simplified warning system; in a practical application, you would use more advanced algorithms and possibly integrate machine learning for prediction.

3. The code runs in a loop, continually acquiring and analyzing data, and issuing warnings.

```python
# Import necessary libraries
import random
import time
from datetime import datetime

# Simulate a data acquisition process (replace with real data sources)
def acquire_environmental_data():
    water_level = random.uniform(1.0, 10.0)  # Simulated water level
    rainfall = random.uniform(0.0, 5.0)      # Simulated rainfall
    return water_level, rainfall

# Analyze environmental data and issue warnings if necessary
def analyze_data(water_level, rainfall):
    if water_level > 7.0:
        return "High risk of flooding. Take immediate action."
    elif water_level > 5.0:
        return "Moderate risk of flooding. Prepare for possible evacuation."
    elif rainfall > 3.0:
        return "Heavy rainfall. Keep a close watch on water levels."
    else:
        return "No immediate threat. Stay alert."

# Main application loop
while True:
    water_level, rainfall = acquire_environmental_data()
    timestamp = datetime.now().strftime('%Y-%m-%d %H:%M:%S')

    # Analyze data and issue warnings
    warning = analyze_data(water_level, rainfall)

    # Display the results
    print(f"Timestamp: {timestamp}")
    print(f"Water Level: {water_level:.2f} meters")
    print(f"Rainfall: {rainfall:.2f} mm/hour")
    print(f"Warning: {warning}\n")

    # Simulate data acquisition interval (e.g., every 15 minutes)
    time.sleep(900)
```
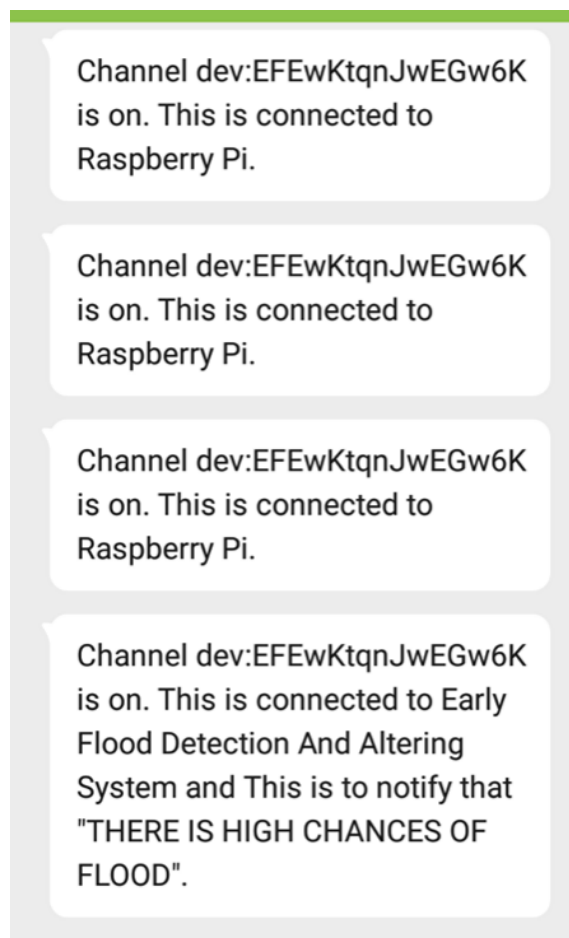
DISCUSSION AND CONCLUSION :

Finally, it is concluded that, the system can detect and hypothesize the flood earlier. The project is based on embedded system and close loop control system. System consists of hardware and software applications to detect water level of rivers, dams etc. System automatically detects the change in level of water and alerts the system when it crosses the threshold value(less than 20cm). The system include ultrasonic sensor to detect the rise in water level and alert if distance between water and sensor is less than 20 cm. DHT11 sense the temperature and humidity which help to analysis the environmental factor for flooding. If the water level crosses the threshold value than Raspberry pi turns the buzzer and led turn on which symbolizes the warning for early flood.

SAMPLE APPLICATION'S ALERT MESSAGES:

Channel dev:EFEwKtqnJwEGw6K is on. This is connected to Raspberry Pi.

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Channel dev:EFEwKtqnJwEGw6K is on. This is connected to Early Flood Detection And Altering System and This is to notify that "THERE IS HIGH CHANCES OF FLOOD".

The flowchart , block diagram ,python code , integrated components and its construction and working have been discussed and submitted in the prior project phases submitted.

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