IoT Enabled Flood Prediction System Using Rain and Water Sensors

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Abstract: Floods are among the most damaging natural disasters, resulting in significant loss of life, destruction of infrastructure, and economic losses. Although floods cannot be prevented, their impact can be reduced through early monitoring and timely warnings. This study presents an Internet of Things (IoT)-enabled flood monitoring and alert mechanism designed to continuously observe environmental conditions and notify users of potential flood risks. The proposed system utilizes an NodeMCU ESP8266 microcontroller interfaced with multiple sensors to measure environmental parameters. An ultrasonic sensor monitored variations in the water level, and a rain sensor detected precipitation intensity. Additionally, a DHT11 sensor was used to measure the atmospheric temperature and humidity to analyze weather trends. The sensed data were transmitted through Wi-Fi to the Blynk cloud platform, where they were visualized and stored. Whenever the readings exceed the predefined safety limits, warning notifications are sent to users through a mobile application and email alerts, and a buzzer provides immediate local indication. A 16×2 LCD panel displayed real-time values for the field operators. The device is portable, low-cost, and suitable for installation near rivers, drainage systems, reservoirs, and urban flood-prone zones. The integration of sensing, wireless communication, and cloud monitoring improves preparedness and helps minimize potential losses.

keywords: Arduino IDE, BLYNK IOT, Node MCU ESP8266, Rain sensors, Ultrasonic sensor, DHT11 sensor

1. Introduction

In India, the monsoon season typically extends from June to October. Initial rainfall usually begins in June, becomes fully active in July, and gradually declines by October, with occasional showers continuing until November. Flooding during this period is often caused by intense rainfall, structural weaknesses, and human-induced factors. The occurrence and severity of floods depend on precipitation intensity and duration, topography, geological characteristics, land use patterns, and existing soil moisture conditions.

In early September 2024, Vijayawada, Andhra Pradesh, India, experienced severe flooding due to extremely heavy rainfall that began on August 31, 2024. The disaster caused at least 35 fatalities in the NTR district and affected nearly 270,000 residents in Vijayawada. More than 29 cm (11 inches) of rain fell within a single day, leading to the overflow of the Krishna River and Budameru Rivulet. Floods have resulted in widespread destruction of infrastructure, residential properties, and agricultural land. This event exposed significant weaknesses in the city's flood management systems and urban planning strategies, emphasizing the urgent need for more resilient and efficient disaster mitigation measures.

To address this challenge, we propose a real-time flood detection and prevention system based on IoT and sensor networks. The model focuses on three essential components: real-time data collection through water-level sensors, data processing and analysis, and rapid dissemination of warning alerts. Although automated flood warning systems can be costly, the overall expense largely depends on the number of sensor installation sites.

For flood prediction, ultrasonic sensors are used to continuously monitor water levels in storage bodies, such

as dams. The DHT11 sensor measures the ambient temperature and humidity, which are important environmental indicators. Additionally, a rain sensor detects precipitation intensity in real time, enabling early alerts before the water levels become critical. The system can recognize heavy rainfall that may lead to rapid runoff or flash floods and can activate local alarms through buzzers or send remote notifications via Internet of Things platforms.

To enable Internet connectivity, the NodeMCU ESP8266 module was integrated into the system, allowing wireless communication between the components. A 16 × 2 LCD display provides real-time data and system status updates directly on the device. Furthermore, an Android application developed using the Blynk IoT platform allows users to monitor the sensor data remotely through a smartphone, ensuring timely alerts and improved flood response management.

2. System Design Methodology

2.1 Block Diagram
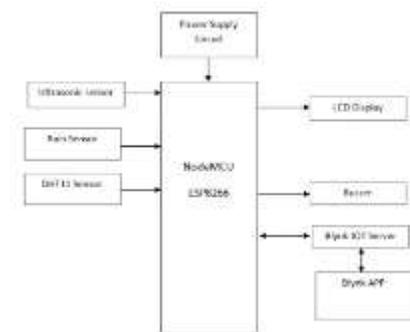
The NodeMCU ESP8266 acted as the central controller. Various sensors connected to the controller collect environmental data. The rain sensor detects rainfall intensity, the ultrasonic sensor measures the water level in reservoirs or rivers, the DHT11 records temperature and humidity, the LCD shows the system status locally, the Blynk Cloud stores and visualizes data, and the Mobile App sends alerts to users.

The system continuously compared the sensor readings with the predefined safety thresholds. Alerts are automatically generated if dangerous conditions are detected.

2.2 Working flow

The system powers ON and connects to Wi-Fi, Sensors begin collecting environmental readings, and data are uploaded to the cloud server. The values are compared with safe limits, and if they are safe, the display normal status. If unsafe, the trigger alerts and buzzer are activated.

3. Hardware Components

3.1 Ultrasonic Sensor (HC-SR04)
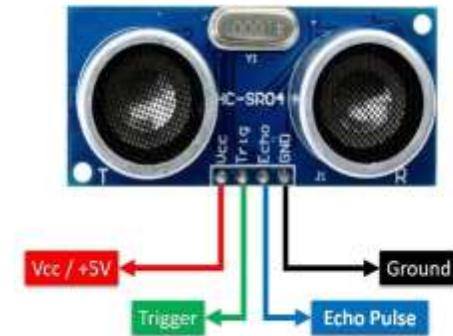
The ultrasonic sensor determines the water level by calculating the distance using sound wave reflection. The formula used is:
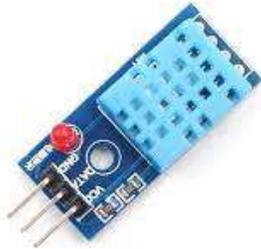
Distance = Speed of Sound × Time / 2

It operates at 5V and consumes a very low current, making it suitable for continuous monitoring applications.

3.2 Rain Sensor

The rain module detects the presence and intensity of rain. High rainfall detection allows the system to warn users even before the water level rises significantly, helping to prevent flash flood situations.

3.3 DHT11 Temperature and Humidity Sensor

A 16×2 LCD screen provides local monitoring by displaying the sensor readings and system status without requiring a smartphone.

The DHT11 sensor measures atmospheric temperature (0–50℃) and humidity (20–90% RH). These parameters help in understanding the weather conditions associated with flooding.

4. Software Components

4.1 Arduino IDE

3.4 NodeMCU ESP8266

Arduino IDE is used to write, compile, and upload code to the NodeMCU. It supports C/C++ programming and includes libraries for sensor interfacing and Wi-Fi communications.

Node MCU is a Wi-Fi-enabled microcontroller that is widely used in IoT systems. It contains a built-in TCP/IP stack and allows for wireless communication with cloud platforms. The board operates at a 3.3V logic level and supports UART, SPI, and I2C communication protocols.

4.2 Blynk IoT Platform

3.5 LCD Display

Blynk enables remote monitoring and control through a smartphone application. Mobile Application — user interface, Cloud Server— communication and storage,

Libraries — hardware communication support. Users can observe real-time sensor data and receive instant notifications.

5. Result

The developed system successfully monitors environmental conditions and sends alerts whenever risk levels increase. Authorities and residents can view live readings through the mobile application. Continuous cloud logging allows long-term data analysis. Future improvements include applying machine learning techinques such as regresion models to predict floods based on historical pattern.

6. Conclusion

The proposed IoT flood monitoring system provides a cost-effective and efficient alternative to traditional monitoring methods. It continuously measures rainfall and water level conditions and delivers real-time alerts to users. The use of cloud connectivity and mobile notifications improves disaster preparedness and response time. The system is economical, easy to install, and suitable for deployment in flood-sensitive areas. With further integration of predictive analytics, it can become a powerful tool for disaster management authorities.

7.References

[1] Joshi & Murali (2025) – An Efficient Smart Flood Detection and Alert System based on Automatic Water Level Recorder Approach using IoT — This peer-reviewed article presents an IoT flood detection system using automatic water level recording sensors and cloud communication.

[2] "Design of Flood Early Detection Based on the Internet of Things and Decision Support System" (2024) – Uses rain measuring devices (ombrometer), water flow, ultrasonic water level sensors, and real-time sensor data to predict flooding and support decisions.

[3] High-Precision AI-Enabled Flood Prediction Integrating Local Sensor Data & Weather Forecast (2023) – Combines local rain and water level sensors with AI forecasting. Useful if your project includes machine learning prediction.

[4] "Design and Implementation of IoT-Based Flood Alert Monitoring System using Microcontroller 8051" (2021) – Describes a microcontroller flood alert system with rising water detection and SMS alerts.

[5] "A Literature Survey on IoT-Based Flood Detection and Monitoring System Using Raspberry Pi" (2019) – A good review reference covering early IoT flood detection systems and sensor types

Research Highlights:

1. Proposes an IoT-based flood alerting system to detect and monitor flood risks in real time using sensors for water levels and environmentl data.
2. Employs dynamic threshold algorithms that adapt to changing environmental conditions for accurate flood predection and reduced false alarms.

3. Integrates multiple sensors (water level, rainfall, temperature, and humidity)for comprehensive data collection.

4. Implemented real-time data transmission via Wi-Fito the cloud (Blynk IoT platform) for remote monitoring.

5. Delivers automated multi-channel alerts via SMS, emails, buzzers, and LCD display to authorities, residents, and local population.