URBAN FLOOD WEB

Project Overview Report

Project Title: Urban Flood Web – IoT-Based Real-Time Flood Monitoring & Early Warning System

Location: Prayagraj, Uttar Pradesh, India

Domain: Internet of Things (IoT), Machine Learning, Full-Stack Web Development, Embedded Systems

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1. Problem Statement

Prayagraj experiences severe urban flooding during the monsoon season. Currently, there is no comprehensive real-time monitoring and early warning system available for citizens and authorities.

Major Challenges:

• No real-time water level monitoring
• Delayed flood warnings
• Lack of ward-specific alerts
• Dangerous manual inspection methods
• No predictive flood analytics

The absence of timely information results in delayed response, property damage, traffic disruption, and risk to human life.

2. Proposed Solution

Urban Flood Web is an IoT-based flood monitoring and early warning platform that integrates sensor nodes, machine learning, and a web dashboard to provide real-time flood intelligence.

System Architecture:

ESP32 Sensor Nodes
↓
Flask Backend Server
↓
Machine Learning Engine
↓
Web Dashboard
↓
SMS / WhatsApp / Telegram Alerts

The system continuously monitors water levels, predicts flood risks, and automatically sends alerts to relevant stakeholders.

3. Technology Stack

Hardware:
• ESP32 DevKit V1
• HC-SR04 Ultrasonic Sensor
• FC-37 Rain Sensor

Backend: Python, Flask, SQLite

Machine Learning: XGBoost, Scikit-Learn, TensorFlow/Keras

Frontend: React.js, Vite, Leaflet.js

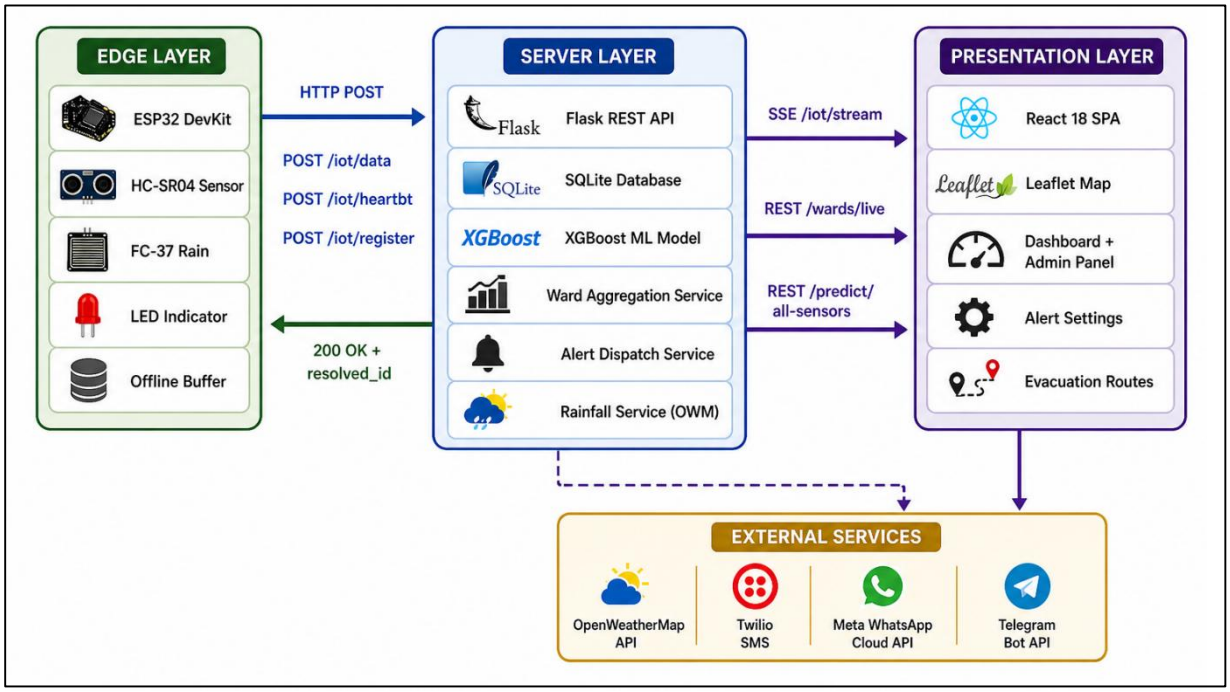
Communication: Twilio SMS API, WhatsApp Cloud API, Telegram Bot API

4. Hardware Requirements

Component Estimated Cost:

- ESP32 DevKit V1 ₹350–400
- HC-SR04 Ultrasonic Sensor ₹50–80
- FC-37 Rain Sensor ₹30–50
- Resistors & Wiring ₹5–20
- Weatherproof Enclosure ₹200–300
- Total Cost Per Node ₹635–835

5. System Design and Architecture



Urban Flood Monitoring System is organized into three distinct layers, each with well-defined responsibilities and interfaces.

6. Data Flow Diagram

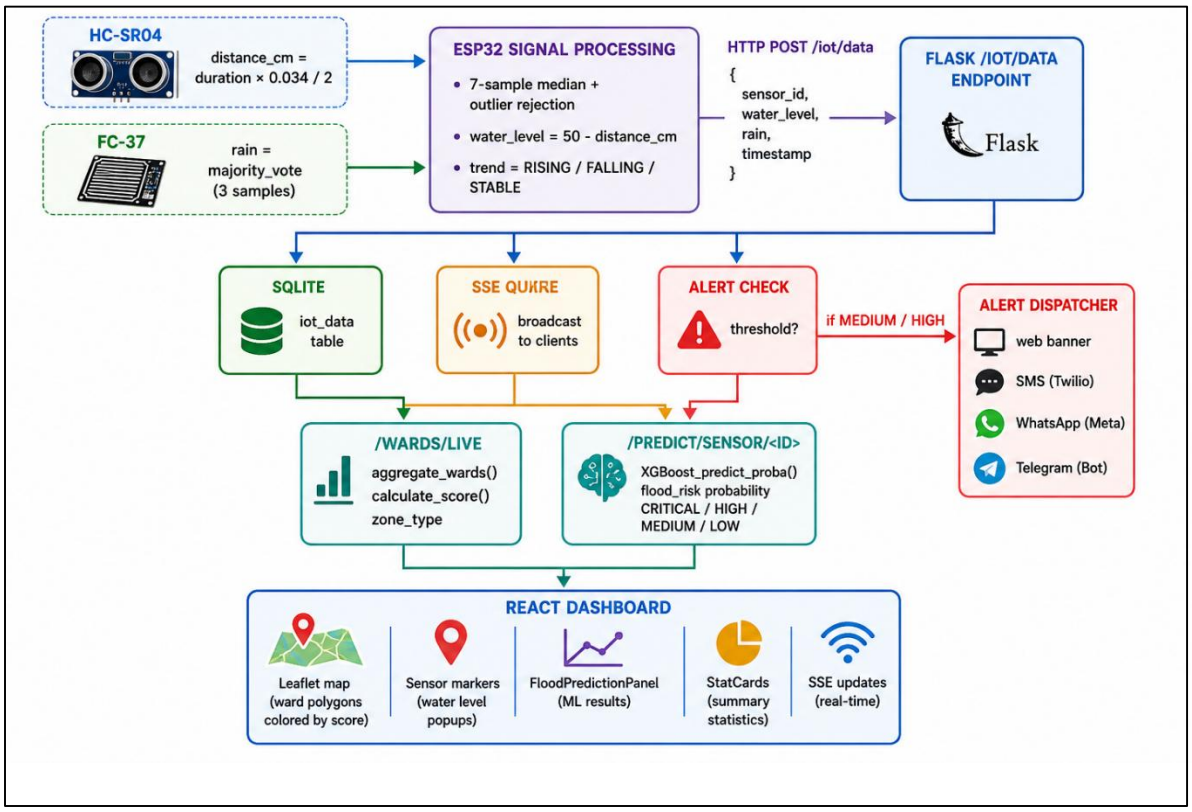
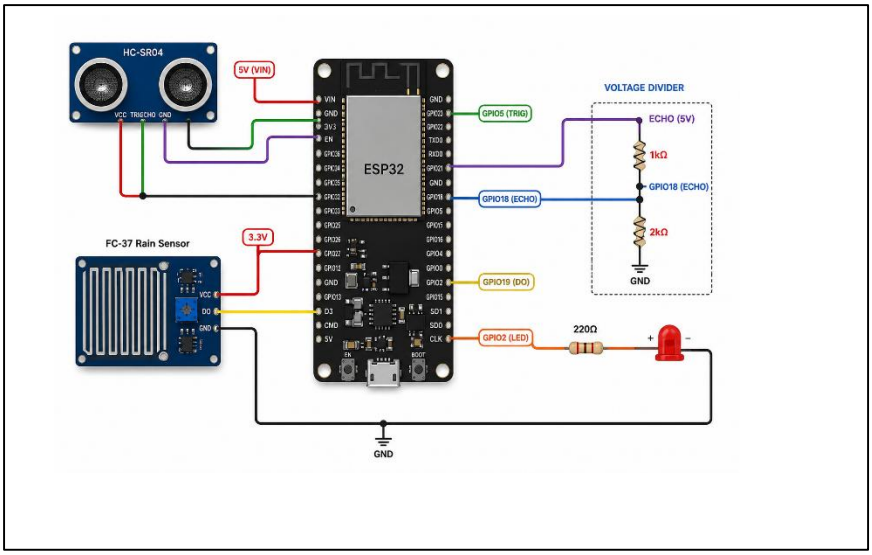
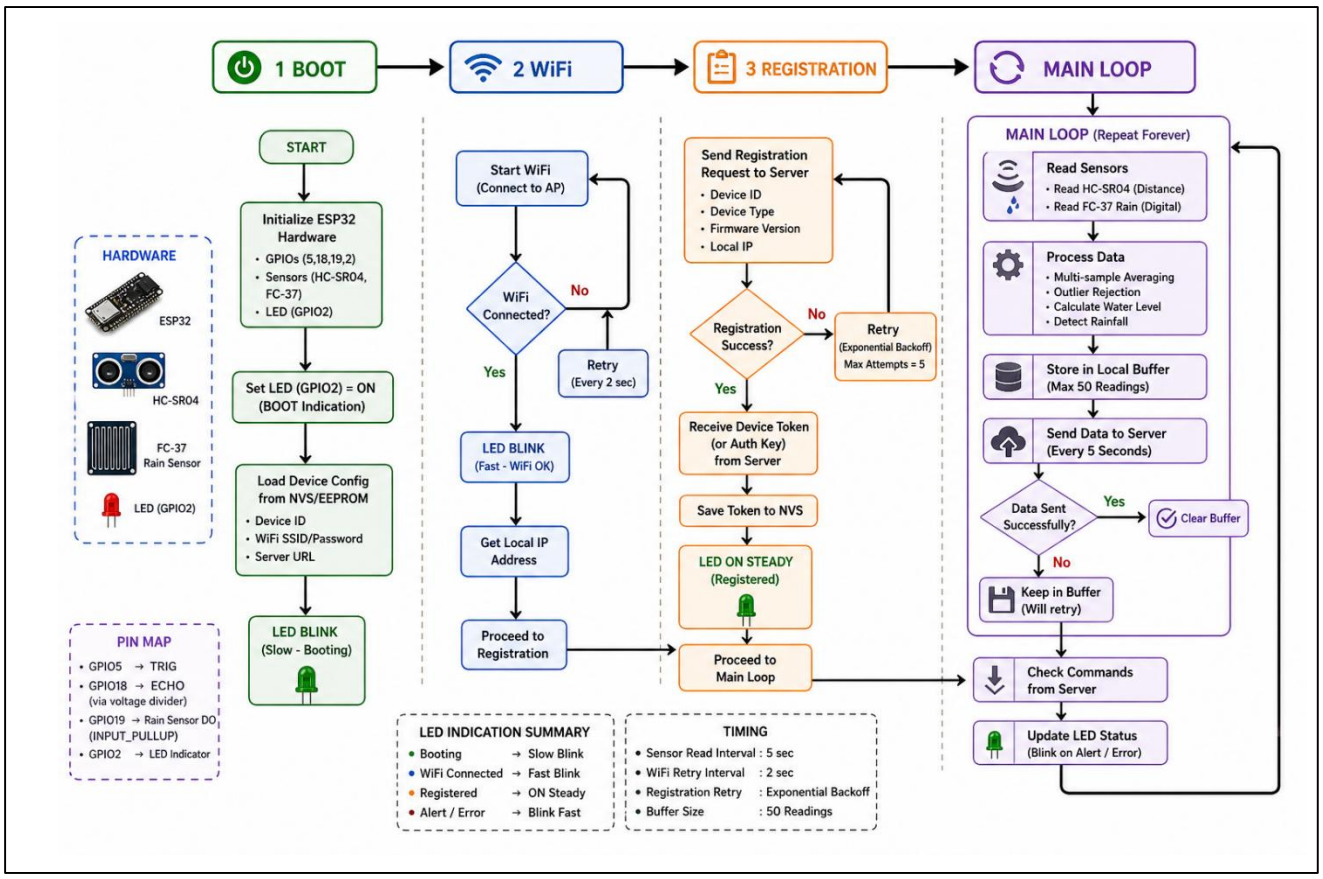


Fig no. Data Flow Diagram

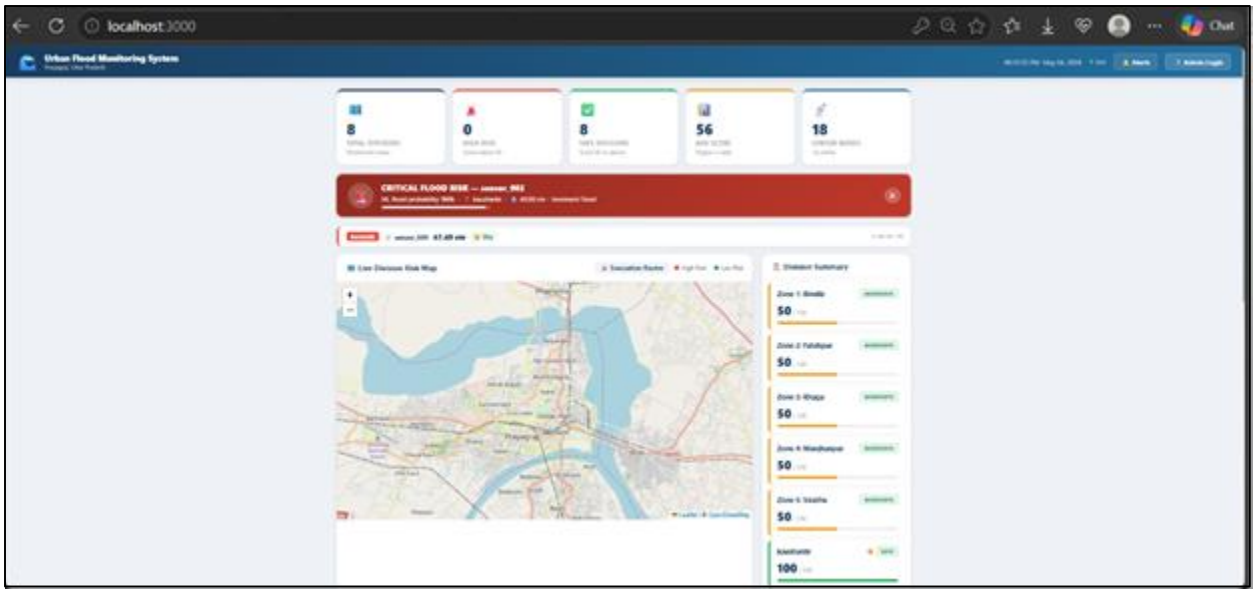
7. Circuit Diagram



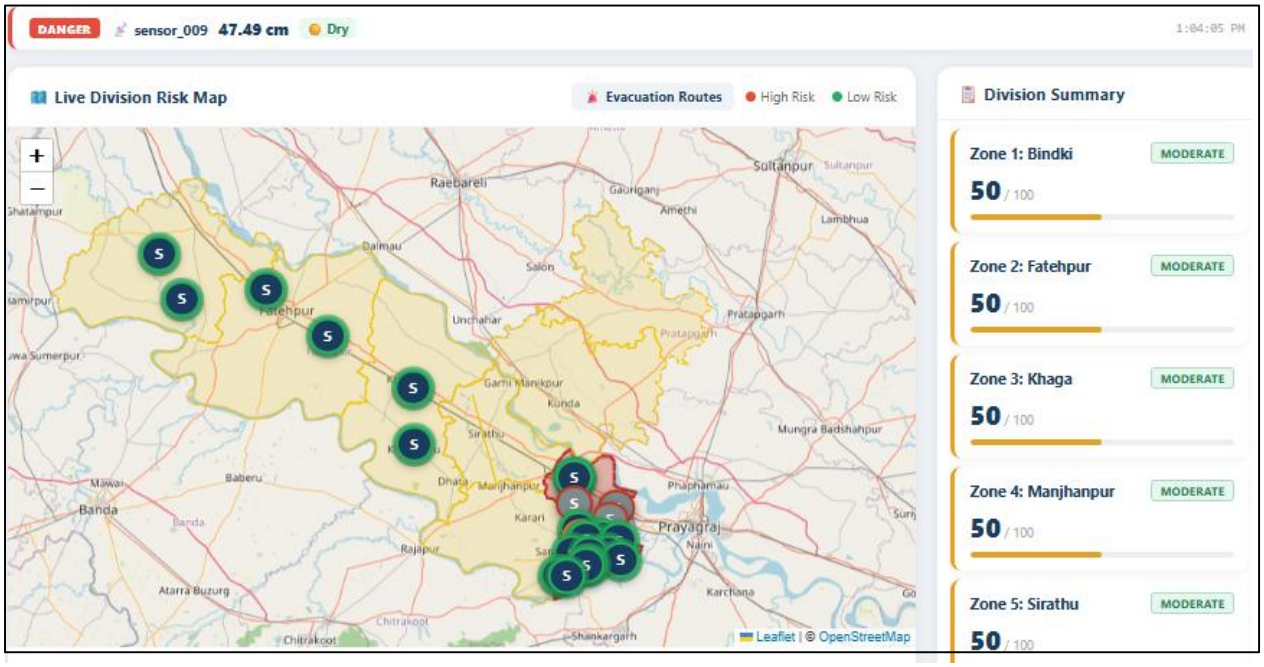
8. Firmware Architecture



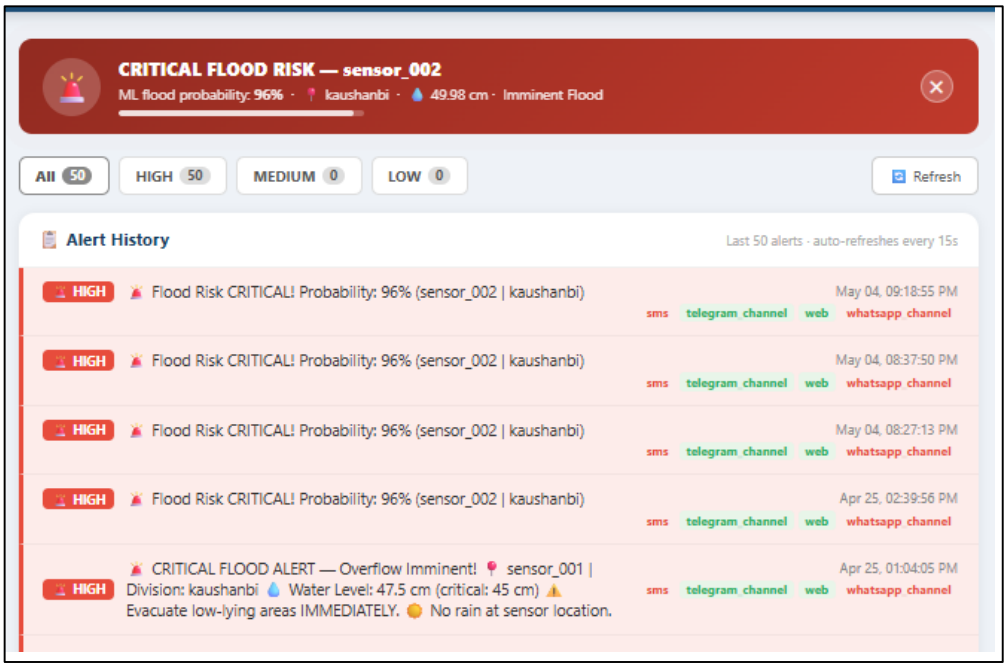
9. Dashboard Page



10. Map View Component



11. Alert Components



12. Business Model

Target Customers:

- Municipal Corporations
- Smart City Projects
- Disaster Management Authorities
- Housing Societies
- Commercial Complexes
- Hospitals and Hotels

Revenue Sources:

- Hardware Sales
- Annual Software Subscription
- Installation Services
- Annual Maintenance Contracts
- Data Analytics Services

13. Benefits

For Citizens:

• Early flood warning
• Ward-specific alerts
• Multi-platform notifications
• Increased safety

For Government Authorities:

• Real-time monitoring
• Data-driven decision making
• Faster emergency response
• Improved disaster management

For Property Owners:

• Protection against water damage
• Reduced maintenance costs
• Enhanced operational safety

14. Advantages Over Existing Products

- ✓ Low-cost deployment
- ✓ Real-time updates every 5 seconds
- ✓ Machine learning-based prediction
- ✓ Multi-channel alert system
- ✓ Open-source architecture
- ✓ Ward-level flood monitoring
- ✓ Offline data buffering
- ✓ Easy scalability

CONCLUSION

Urban Flood Web is a low-cost, scalable, and intelligent flood monitoring platform designed specifically for Indian cities. By combining IoT, machine learning, and real-time communication technologies, the system provides timely flood alerts, improves disaster preparedness, and helps protect lives and infrastructure.

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