CodeFest Hackathon 2025 - Project Summary For Team 12
IoT Based Early Flood Alert System

Team Information

Team Name: Team 12 (IoT Based Early Flood Alert System)

Team Members:
- Mr. Valentine – Electronics Expert
- Mr. Ekene Olum – Software Developer
- Mr. Oluwatimilehin Folarin – ML and Data Science Expert
- Mr. Emmanuel Nwite – Embedded system Engineer and Team Lead

Selected Challenge

Climate & Sustainability – Problem 3: Flood Alert System for Riverine Areas

Problem Statement and Local Context

Flooding is one of the most devastating natural disasters affecting riverine communities in Nigeria, causing loss of lives, property, and displacement. Many communities lack real-time warning systems that can alert residents before a flood occurs. The Early Flood Alert System is designed to address this challenge by providing real-time water level monitoring and SMS alerts to residents in vulnerable areas.

Description of the Solution

The Early Flood Alert System combines IoT technology, cloud data storage, and web visualization to deliver a comprehensive flood monitoring and warning platform. The system uses an ESP32 microcontroller connected to an ultrasonic sensor that continuously measures water levels in rivers or drainage channels. Data is transmitted to a Firebase Realtime Database, from where it is visualized on a web dashboard. When critical thresholds are reached, an automated SMS alert is sent to residents and local authorities, ensuring timely evacuation and response.

Technologies Used

- Hardware: ESP32 microcontroller, Ultrasonic Sensor, GSM Module (for SMS Alerts), 16x2 LCD with i2c and LED (for visual Alert), Buzzer for Sound.
- Power: 10w by 6v solar panel, 3.7v by 15,600mah battery
- Software: HTML, CSS, JavaScript, Firebase Realtime Database, Arduino IDE, Python
- Cloud: Google Firebase
- Programming: Arduino C++, JavaScript, python
- Tools: Proteus Simulation, VS Code, Node.js

Impact and Scalability

This solution provides a low-cost and easily deployable system for flood-prone areas in Nigeria and beyond. By integrating IoT sensors with cloud computing and SMS alerts, the system empowers local communities with real-time information that saves lives and property. It can be scaled by deploying multiple sensor nodes across riverine regions and integrating AI-based prediction models for enhanced flood forecasting.
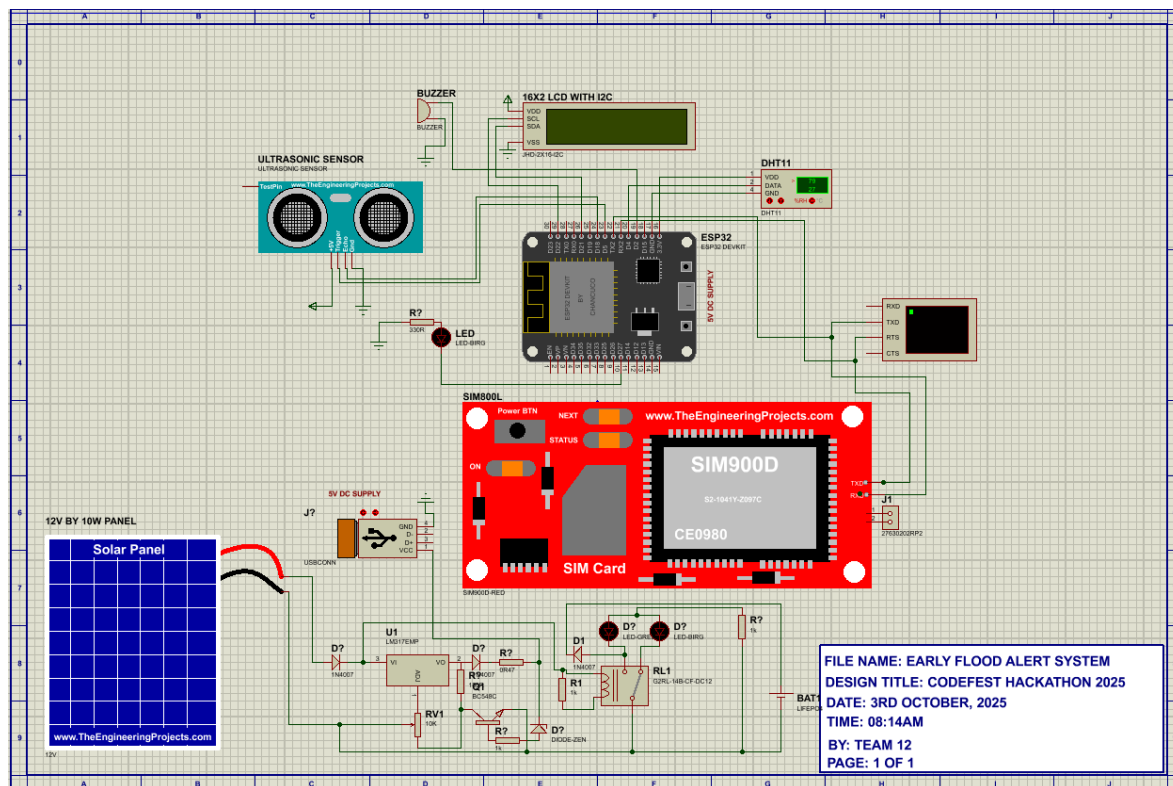
System Overview

Below is a conceptual diagram of the system architecture showing the data flow from sensors to Firebase, and then to the dashboard and SMS alert module.
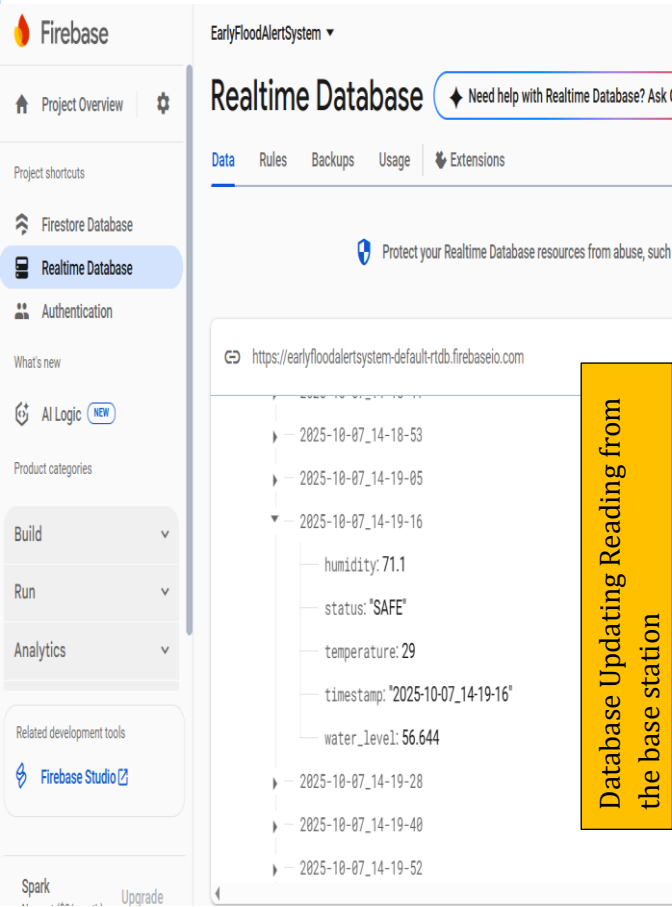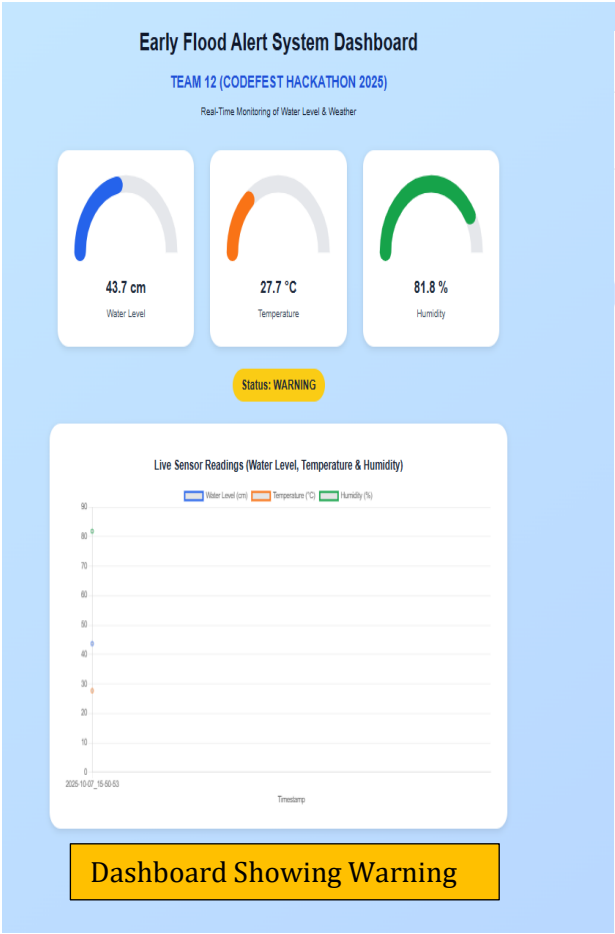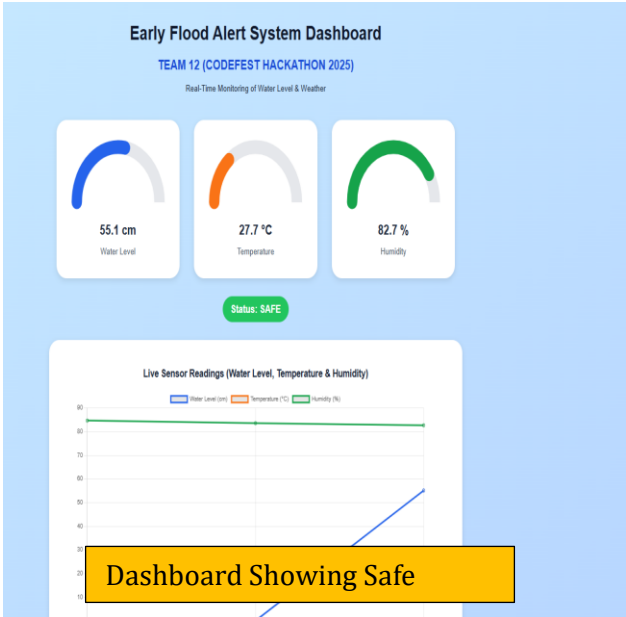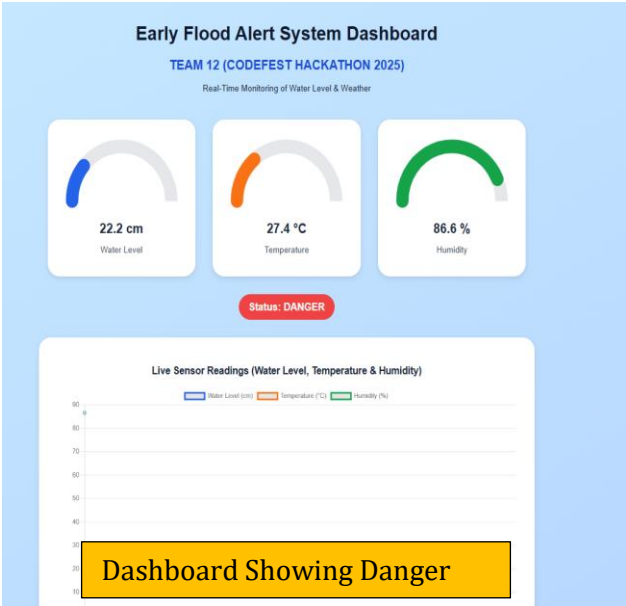
System Architecture
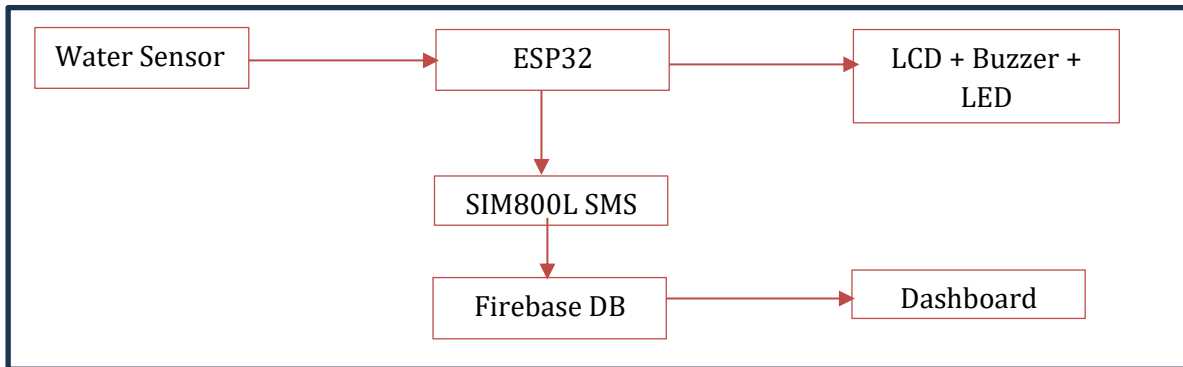
System Proteus Design

System Features

- Real-time water level detection (HC-SR04 ultrasonic sensor)
- Temperature & humidity monitoring (DHT11)
- Automatic SMS alerts via SIM800L when flood risk detected
- Local alarms (buzzer + LED indicator)
- LCD screen for on-site readings
- Data synced to Firebase with timestamps
- Web dashboard for real-time visualization

Test Results

Dashboard Showing Danger

Dashboard Showing Safe

Dashboard Showing Warning

Database Updating Reading from the base station

```
Main_Flood_Alert_System_For_Riverine_Communities.ino | Arduino IDE 2.3.6
File Edit Sketch Tools Help

ESP32 Wrover Module

Main_Flood_Alert_System_For_Riverine_Communities.ino.ino
1    /*
2     TEAM 12: Flood Alert System (Codefest Hackathon 2025)
3     Components:
4      - ESP32
5      - HC-SR04 (Ultrasonic)
6      - DHT11 – Temperature & Humidity
7      - SIM800L – SMS Alerts
8      - 16x2 LCD with I2C
9      - Firebase – Realtime Database
10   */
11
12   #include <Wire.h>
13   #include <LiquidCrystal_I2C.h>
14   #include <DHT.h>
15   #include <WiFi.h>
16   #include <Firebase_ESP_Client.h>
17   #include "addons/TokenHelper.h"
18   #include "addons/RTDBHelper.h"
19   #include <time.h>
20
21   // ------------------ WiFi & Firebase ------------------
22   #define WIFI_SSID "RIMTECH 2.4"
23   #define WIFI_PASSWORD "RaindropsRemmy01@@##"
24   #define API_KEY "AIzaSyC2VTPo6HFQ95sNJqCLzT1kvS90hI8Javc"
25   #define DATABASE_URL "https://earlyfloodalertsystem-default-rtdb.firebaseio.com"
26
27   // Firebase objects
28   FirebaseData fbdo;

Output    Serial Monitor ×
Not connected. Select a board and a port to connect automatically.

15:21:28.612 -> SMS Sent: Flood Alert: DANGER level reached!
15:21:28.612 -> Alert Triggered: DANGER
15:21:28.612 ->
15:21:28.612 -> Uploading data to Firebase...
```

Code being uploaded in the DB

Integration of the Hardware and power Units

Assembled Base station with Solar panel

Assembled Base station being tested on 7th Oct. 2025. By Emmanuel and Valentine