TEXAS INSTRUMENTS

F.L.O.O.D.

FLOOD LEVEL OBSERVATION & OUTBREAK DETECTION

Group 3

Anushka Gupta
Ashna Chopra
Subham Jain
Sanya Saxena
Meghana Potharaveni

Guided by:

Akashdeep Kaur
Aditya Dholakia

Overview

1. Empathise
2. Problem Statement
3. Existing Models
4. Improvisation
5. Visualisation
6. Workflow
7. Cost & Battery Life
8. References

CASE STUDY

Assam flood : July 2023

People affected : 5.4 lakh+
Villages : 2800+
Casualities : 35+

Cause : Delayed alerts

Result : Severe damage to homes,crops and livelihood

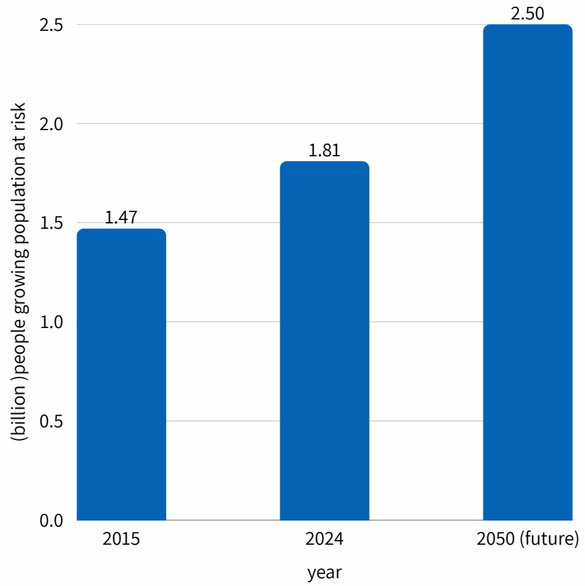
RISING WATER , RISING TOLLS

2373

Global flood deaths in 2024

895

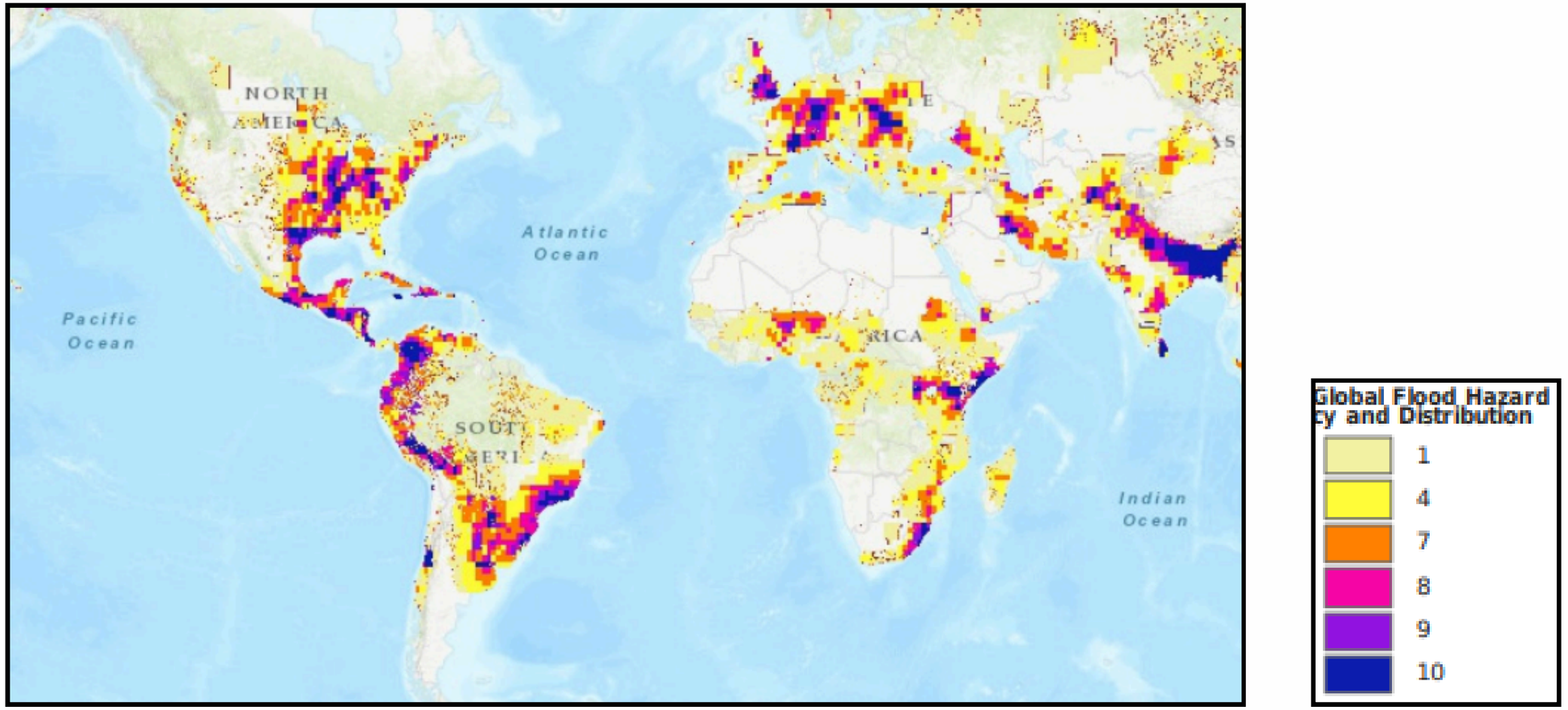
India flood deaths in 2024



Casualities

Flood risk

FLOOD EXPOSURE IS RISING
‘THE GLOBAL PICTURE’

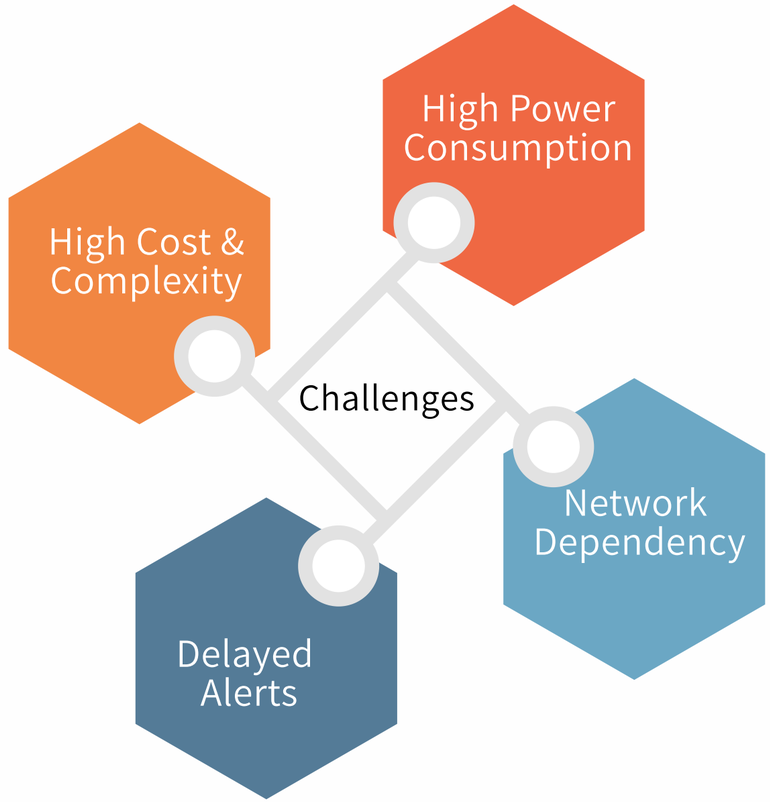


PROBLEM STATEMENT

Flooding due to poor drainage and heavy rain

Delayed alerts due to real time monitoring

Lack of low cost,low power IOT device



EXISTING FLOOD DETECTION MODELS

FLOODNET (UK Environment Agency)

- **How it works:** Network of water level and rainfall sensors.
- **Uses:** River monitoring, urban flood warnings.
- **Technology:** GSM, data loggers, web dashboards.
- **Impact:** Provides real-time alerts for quick response and evacuation.

Delft-FEWS (Netherlands, Bangladesh,etc.)

- **How it works**: Integrates rainfall data and models for flood prediction
- **Uses**: Supports flood response in 40+ countries
- **Technology**: Sensor data, modeling, visualization
- **Impact**: Timely, accurate flood forecasts for better preparedness

IMPROVISATION

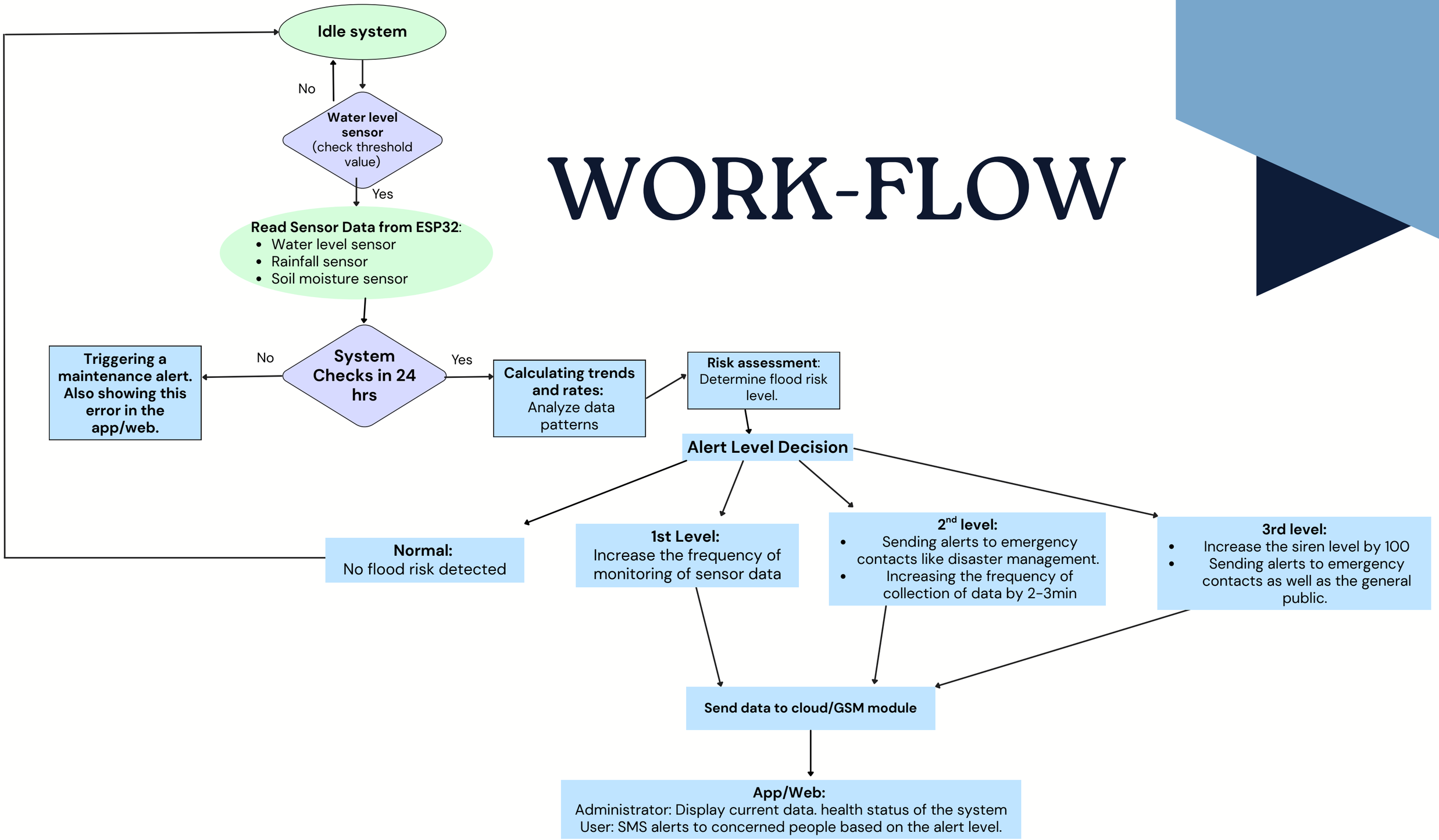
Low Power Modes: Deep sleep / interrupt-based sensor activation to minimize energy use.

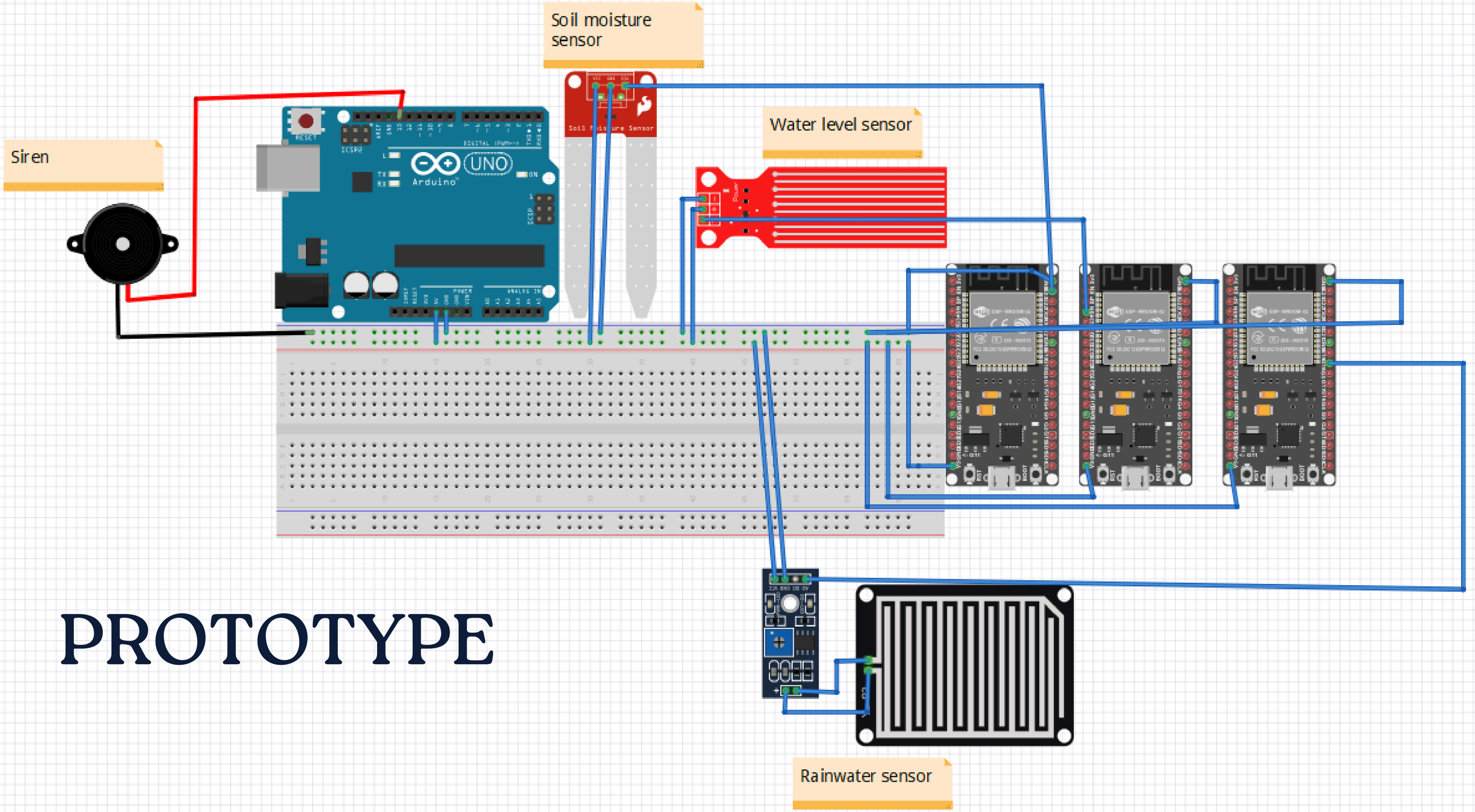
Multi-Sensor Fusion: Combines rain, soil, and water level data for more accurate prediction.

Data Logging with Conditional Transmission: Sends data only when flood risk detected — saves power and bandwidth.

Awareness: integrated a localized siren system. So even in areas with no internet or mobile coverage, people can receive instant, audible alerts.

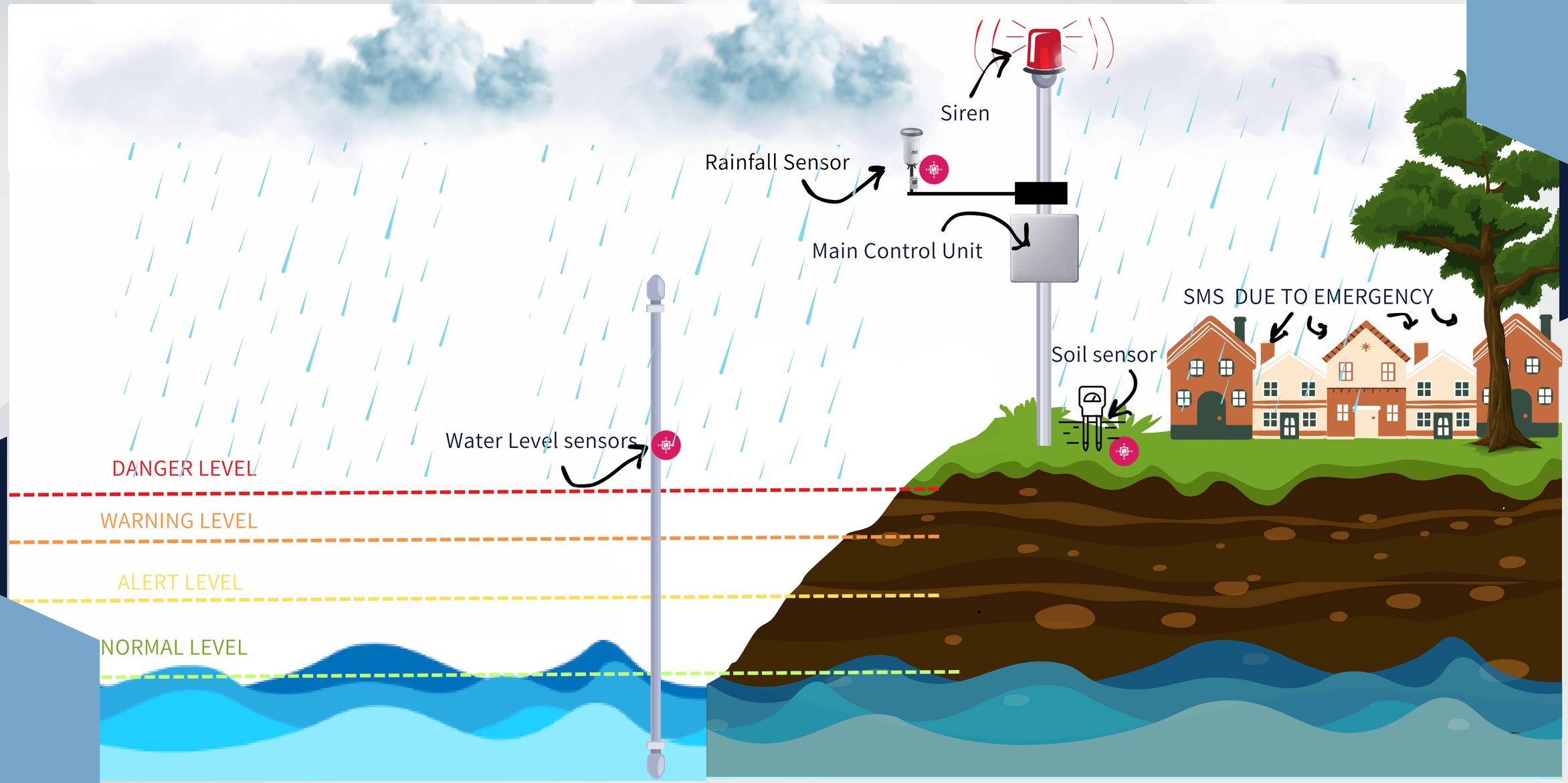
WORK-FLOW


Idle system
No
Water level sensor (check threshold value)
Yes
Read Sensor Data from ESP32:
Water level sensor
Rainfall sensor
Soil moisture sensor
System Checks in 24 hrs
No
Triggering a maintenance alert. Also showing this error in the app/web.
Yes
Calculating trends and rates: Analyze data patterns
Risk assessment: Determine flood risk level.
Alert Level Decision
Normal: No flood risk detected
1st Level: Increase the frequency of monitoring of sensor data
2nd level:
Sending alerts to emergency contacts like disaster management.
Increasing the frequency of collection of data by 2-3min
3rd level:
Increase the siren level by 100
Sending alerts to emergency contacts as well as the general public.
Send data to cloud/GSM module
App/Web:
Administrator: Display current data. health status of the system
User: SMS alerts to concerned people based on the alert level.


Soil moisture sensor
Siren
Water level sensor
Rainwater sensor

PROTOTYPE

WHAT WE VISUALISE



GEOGRAPHICAL SENSOR PLACEMENT

1. **Yl-83 sensor(rainfall intensity detector)**- placed on exposed areas,rooftops
2. **YL-69 sensor(soil moisture)**- Buried slightly in soil(~10 cm)
3. **Water level sensor**-On poles ,secured on fixed heights to calculate water level rising rate.

NOTE*:All the respective sensors are connected to Esp32 which is connected to main MCU(arduino in this case)

IDEATION

- Threshold values are set for each sensor to ensure a trigger occurs every time the threshold is crossed.

Rain fall sensor

Risk Level	Threshold
Low	< 50.8 mm/h
Medium	50.8–76.2 mm/h
High	> 76.2 mm/h

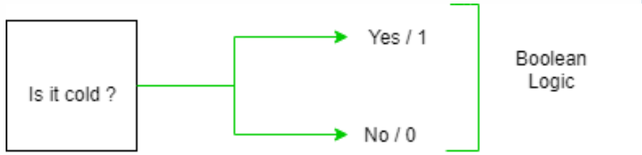
Water level sensor

Risk Level	Threshold
Low	< 5 cm/h
Medium	5–10 cm/h
High	> 10 cm/h

Soil sensor

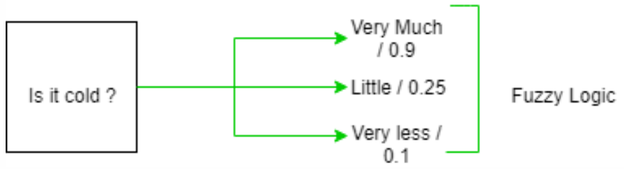
Risk Level	Threshold
Low	< 40%
Medium	40–80%
High	> 80%

IDEATION



Integration of 3 grade level on the basis of severity of the floods:

- Grade 1 -Precautionary alert
- Grade 2-Minor floods
- Grade 3-Moderate to major floods(widespread risk)



By executing a **Fuzzy logic System** (FLS) we are able to get more accurate prediction of flood occurance.

ALERT DISSEMINATION SYSTEM

GSM Module

LOCALISED SIRENS

SYSTEM CHECK

Function Monitoring and Reporting (FMR):

A testing mechanism, a software module often interacts with hardware components to ensure key system functions.It belongs to embedded system software architecture.

TEST CASE 1:

Sensor Health Check

FMR detects sensor issues like disconnection, invalid, or frozen data.

Overcome : Implement time out checks , data validation, and flags for no change over time.

TEST CASE 2:

Alert Trigger Check

Alerts are generated when real thresholds are crossed.

Overcome : Add clear trigger conditions.

TEST CASE 3:

Power Monitoring

FMR detects low battery or voltage drop and issues a warning or enters power-saving mode

Overcome : Continuously monitor supply voltage and enable energy-saving features or power backups.

BATTERY LIFE

Component	Avg Current	Consumption
ESP32 (sleep)	10 µA	~0.24 mAh
ESP32 (active)	160 mA	~5.33 mAh
Arduino	40 mA	~1.67 mAh
GSM SIM900A	500 mA	~4.17 mAh
YL-69 + YL-83	40 mA	~1.33 mAh

Battery Life (days) = 2000 / 12.74 ≈ **180.7 days ≈ 5 months**
If we use a 5000 mAh battery, it could last over a 13 months

(Battery life (in hours) = Battery Capacity (mAh) / Average Current (mA))

Total Daily Consumption ≈ ~12.74mAh

COST ANALYSIS

ESP32 microcontroller x 3-	Rs. 475/- x 3
GSM SIM 900A Module -	Rs.444/-
Soil moisture sensor -Yl-69 -	Rs.60/-
Rainfall sensor-Yl 83-	Rs.32/-
Li-ion battery-	Rs.360/-
Arduino	Rs.350/-
water level sensor	Rs.30/-
5v DC battery Adapter	Rs.292/-
3.3v-5.5v active alarm buzzer	Rs.25/-

Overall - Approximately Rs. 3018/-

References

[1] C. K. Khuen and A. Zourmand, "Fuzzy Logic-Based Flood Detection System Using Lora Technology," 2020 16th IEEE International Colloquium on Signal Processing & Its Applications (CSPA), Langkawi, Malaysia, 2020, pp. 40-45, doi: 10.1109/CSPA48992.2020.9068698

[2]S. Balaji, V. A. Kandaswamy, U. M. S, K. S. Kumar, S. Sujatha and G. K. Reddy, "Artificial Intelligence Assistive Iot Based Flood and Disaster Rescue Management System Using ESP8266 WiFi Controller," 2024 4th Asian Conference on Innovation in Technology (ASIANCON), Pimari Chinchwad, India, 2024, pp. 1-6, doi: 10.1109/ASIANCON62057.2024.10838128.

[3]M. E. Deowan, S. Haque, J. Islam, M. Hanjalayeamin, M. T. Islam and R. Tabassum Meghla, "Smart Early Flood Monitoring System Using IoT," 2022 14th Seminar on Power Electronics and Control (SEPOC), Santa Maria, Brazil, 2022, pp. 1-6, doi: 10.1109/SEPOC54972.2022.9976434.

[4]Darwis, Muhammad & Banna, Hafiizh & Aji, Setiawan & Khoirunnisa, Dinda & Natassa, Nakia. (2023). IoT Based Early Flood Detection System with Arduino and Ultrasonic Sensors in Flood-Prone Areas. JURNAL TEKNIK INFORMATIKA. 16. 133-140. 10.15408/jti.v16i2.32161.

THANK YOU