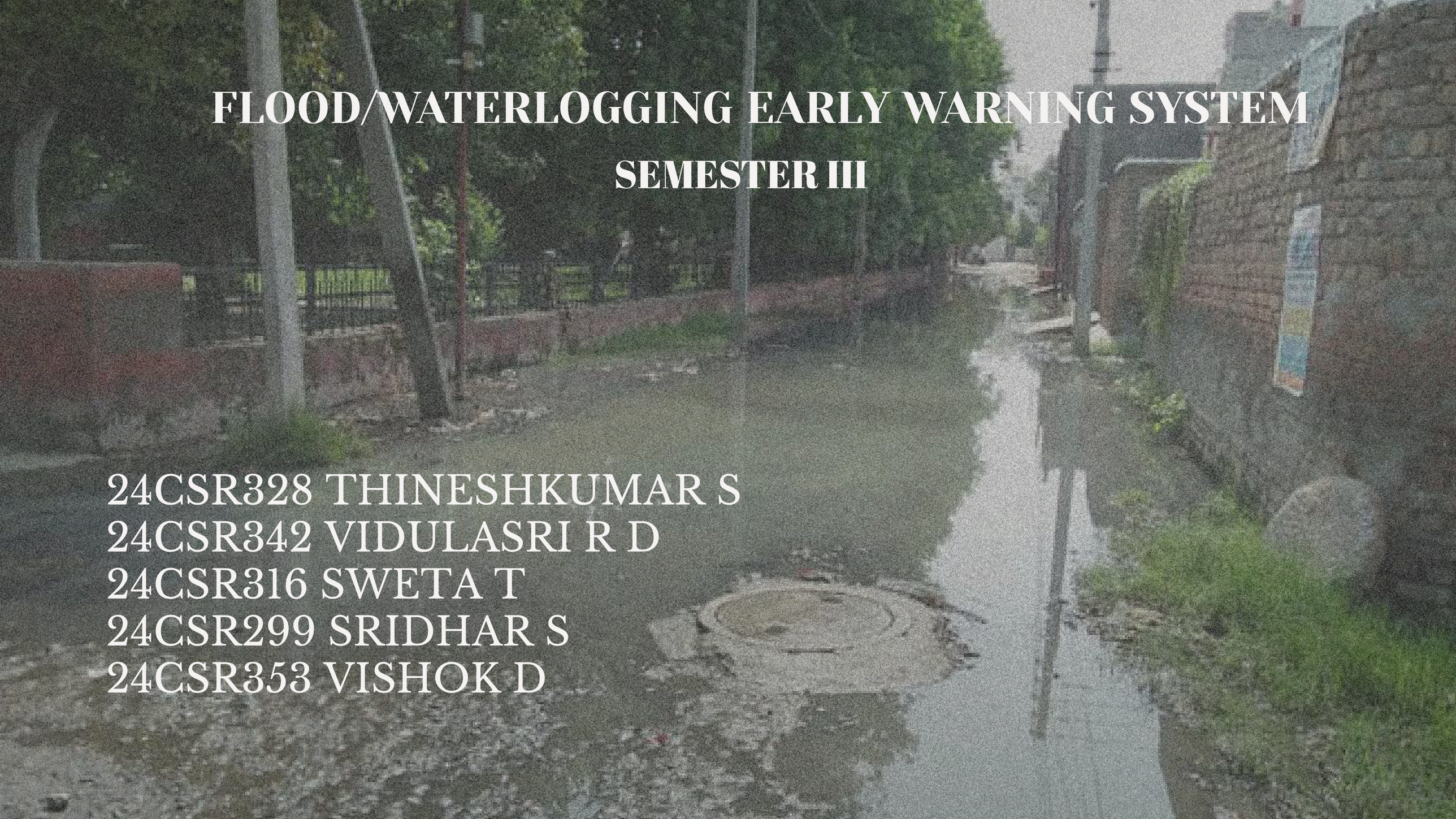


FLOOD/WATERLOGGING EARLY WARNING SYSTEM

SEMESTER III

24CSR328 THINESHKUMAR S
24CSR342 VIDULASRI R D
24CSR316 SWETA T
24CSR299 SRIDHAR S
24CSR353 VISHOK D

PHASE 1 : EXPLORE

T1: SCOPE TOOLS

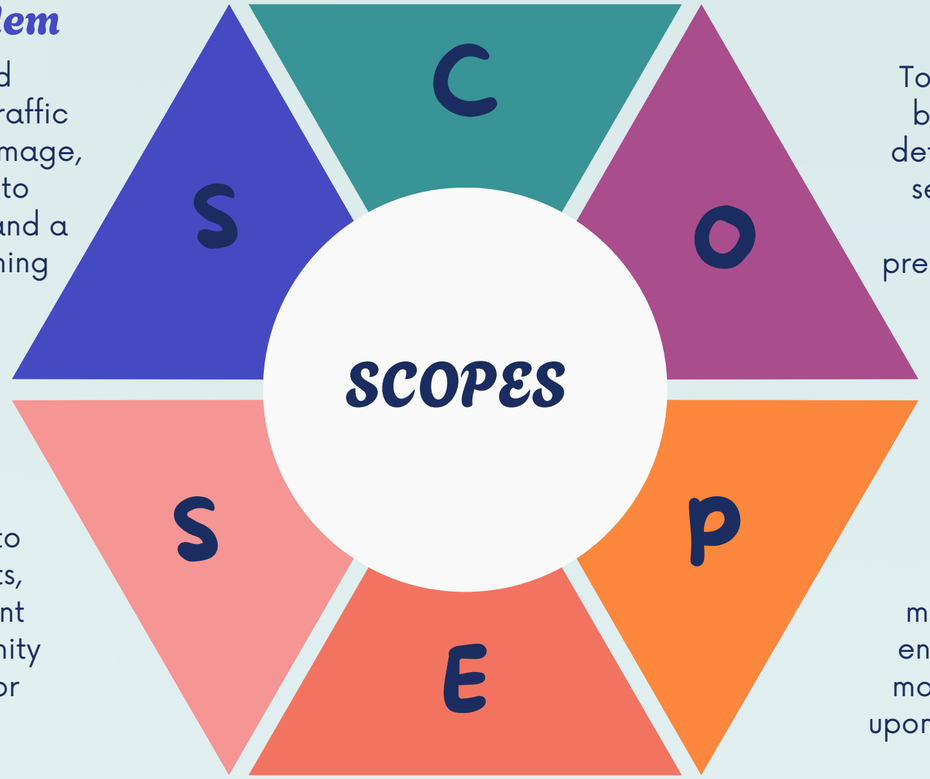
T1 : SCOPE Tools

Constraints

Limited budget, unreliable internet in rural areas, sensor calibration issues and maintenance challenges restrict large-scale deployment of real-time IoT monitoring systems.

Situation / Problem

Frequent floods and waterlogging lead to traffic disruptions, property damage, and health risks due to inadequate drainage and a lack of real-time warning systems.



Objectives

To design a low-cost IoT-based alert system that detects rising water levels, sends instant alerts and improves disaster preparedness and response efficiency

Scope

The system can expand to rural flood-prone districts, integrate with government apps and support community awareness campaigns for long-term resilience

People

Residents, municipal authorities, disaster management teams and engineers collaborate to monitor, interpret, and act upon system alerts effectively.

Estimates

Hardware: ESP32, ultrasonic sensor,, power supply
Software: IoT dashboard, aurdino alert system

T2 : STEEP Trends analysis

S

SOCIAL

1) Increased urbanization and population density in low-lying areas.
2) Growing public demand for climate resilience and safety measures

T

TECNOLOGICAL

1) Advancements in IoT for real-time data collection.
2) AI and ML for predictive modelling.
3) Expansion of internet for a reliable communication infrastructure.

E

ECONOMIC

1) Rising costs of climate-related disasters.
2) Global supply chain disruptions affecting hardware.
3) Opening up non-government funding sources and expertise for system deployment

E

ENVIRONMENTAL

1) Poor drainage, deforestation, and encroachments worsen waterlogging sustainability.
2) Water management, restoring wetlands and promoting rainwater harvesting can improve ecological balance

P

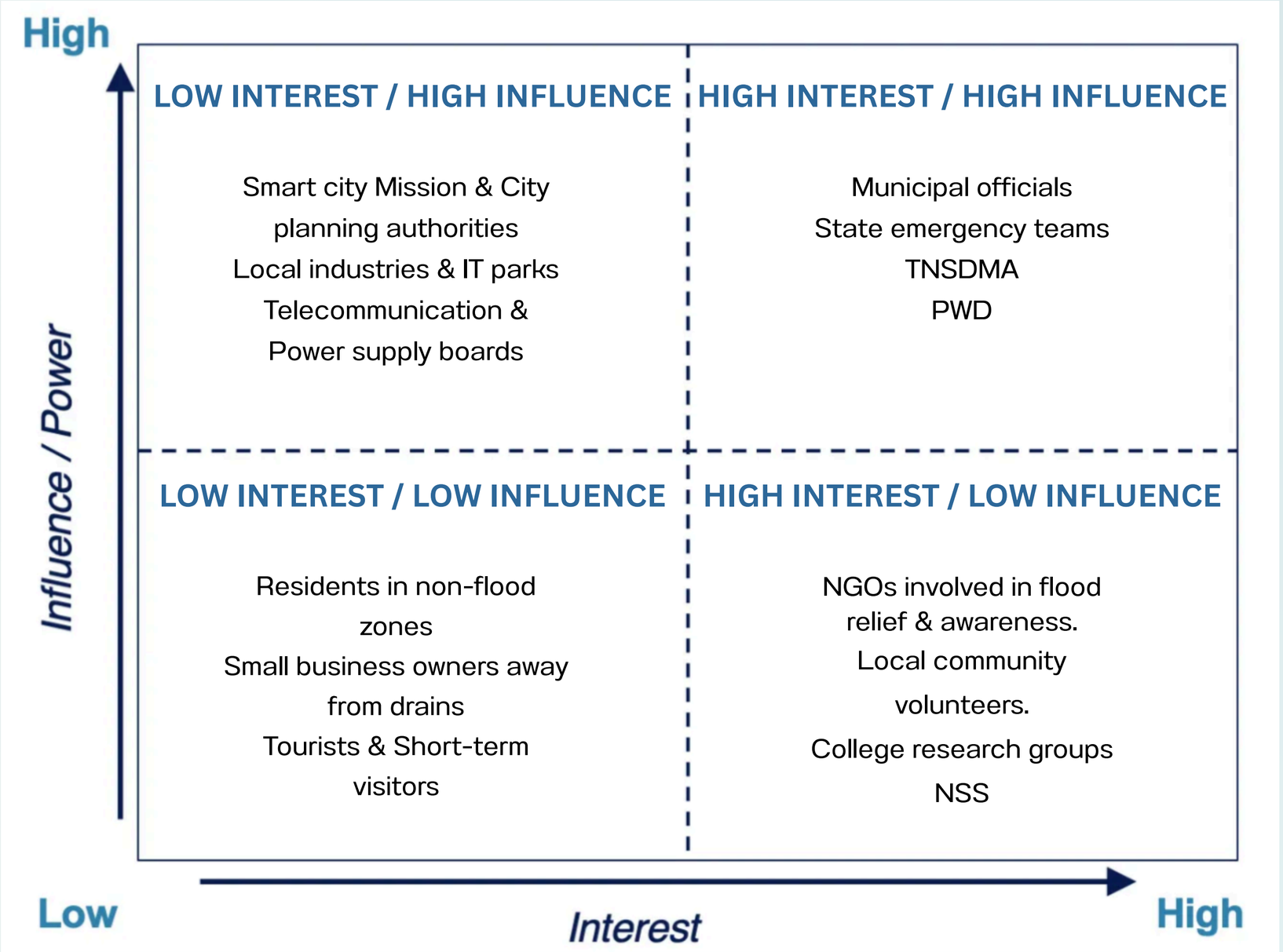
POLITICAL

1) Tamil Nadu's government supports disaster preparedness through initiatives by TNSDMA and smart city projects.

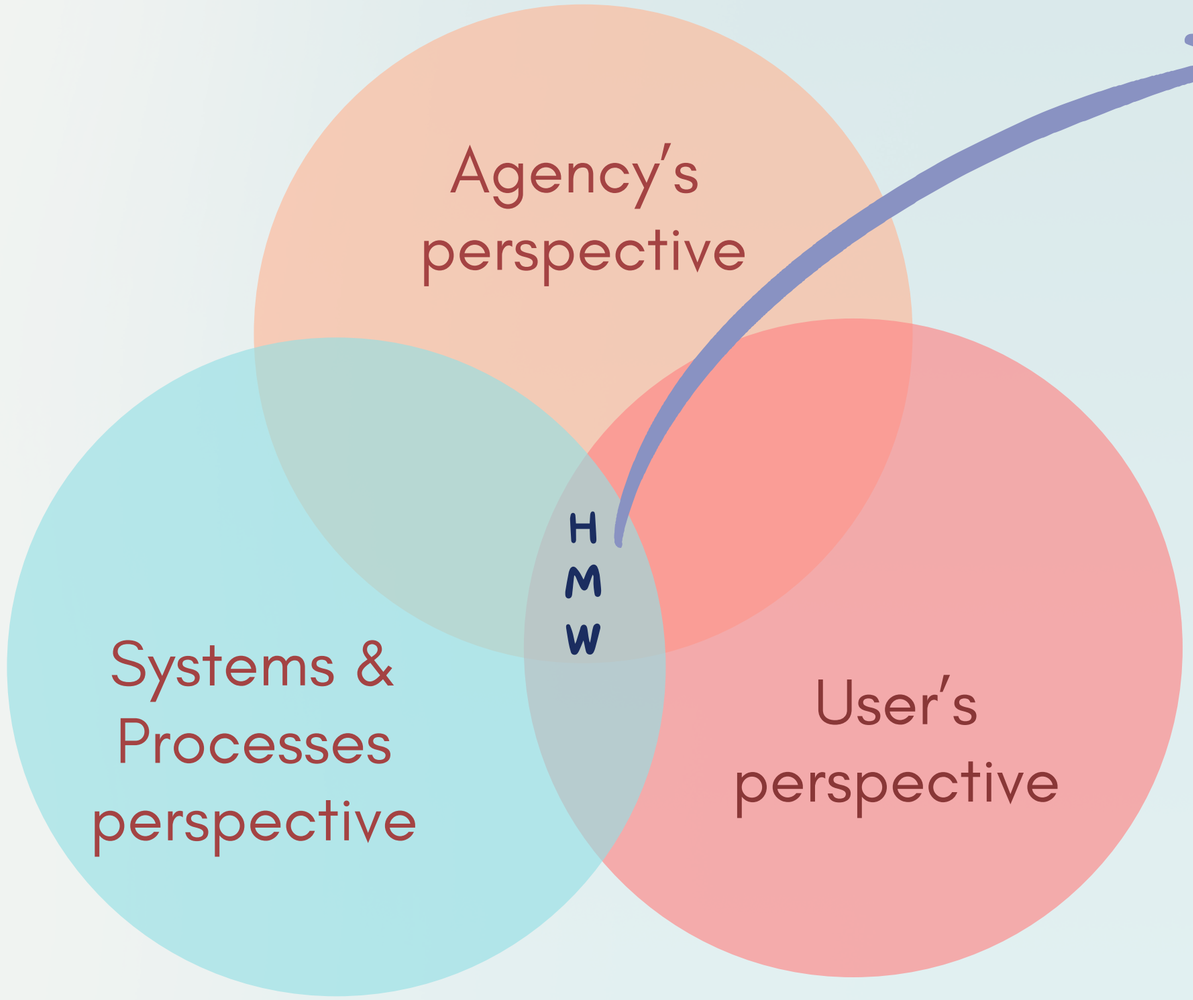
T3 : Strategic Priorities Matrix

	URGENT	LESS URGENT
IMPORTANT	Issue immediate SMS alerts when predicted water levels reach critical thresholds.	Schedule regular maintenance of drainage systems; Develop and refine the AIML training;
LESS IMPORTANT	Delegate sensor network monitoring(checking for faults, calibration)to the maintenance team. Delegate the compilation of post-event damage reports(can be done by someone else)	Avoid redundant manual reporting systems. Eliminate outdated alarm methods Skip duplicate data collection tasks

T4: Stakeholder Mapping Matrix



T5: Reframing the Opportunities



HOW MIGHT WE DEVELOP A FLOOD DETECTOR ?

1) How might we create a low-cost IoT-based system to detect and alert flood-prone areas in real time?

2) How might we ensure timely communication of flood warnings to residents, authorities and emergency teams for quick response?

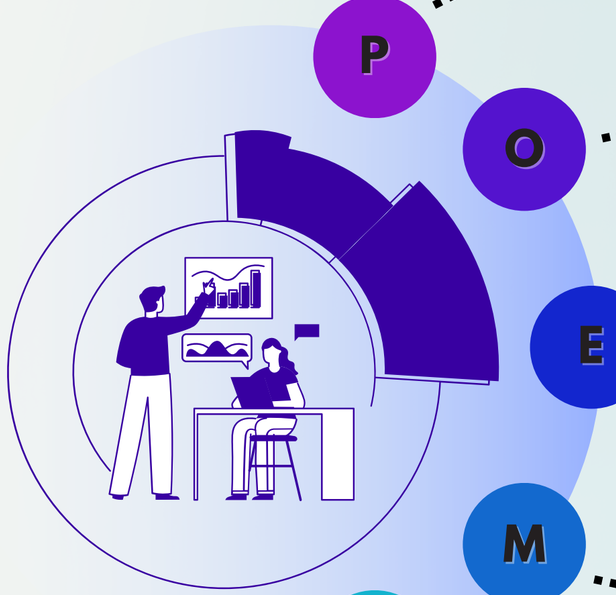
3)How might we engage local communities and officials in maintaining and interpreting flood alert data effectively?

4) How might we integrate rainfall, drainage and water-level data to predict potential flooding before it occurs?

PHASE 2 : EMPATHISE

T6 : POEMS FRAMEWORK

T6 : POEMS Framework



Understanding Audience Sentiment

Local authorities and Municipal Corporations
Residents in flood – prone areas
NGOs and rescue volunteers
Disaster Management

Identifying Trends and Opportunities

Water-level Sensors
IoT gateway devices
Communication systems

Enhancing Customer Engagement

Low-lying areas, riverbanks, urban stormwater zones
Poor drainage / blocked sewage areas
Urban roads prone to waterlogging

Managing Brand Reputation

Mobile alerts, social media updates, News, radio
Evacuation guidance messages

Analyzing Competitor Activity

Real-time monitoring and alerting, Emergency evacuation support,
Tracking water pump operations and drain clearance
Rescue assistance and post-flood support

T7 : Empathy Map

THINK & FEEL

1) What worries the user during heavy rainfall or floods?
2) How does the user feel about their safety and surroundings?
3) What does the user truly need to feel secure?
4) What are their main thoughts about govt alerts and responses?

HEAR

1) Who does the user hear from during floods?
2) What type of alerts or messages reach the user first?
3) What advice or information do they receive from others?
4) How do these messages shape the user's decisions?

SEE

1) What does the user see happening during floods?
2) Who or what influences the user's awareness about flooding?
3) What solutions or tools does the user notice around them?
4) What problems do they observe in their environment?

SAY & DO

1) What does the user say about floods and waterlogging issues?
2) How does the user react during an emergency?
3) What actions does the user take to protect their belongings?
4)What kind of discussions do they have with neighbours or family?

PAIN

1) What are the user's biggest frustrations during floods?
2) What barriers prevent them from staying safe?
3)What losses or damages do they experience?

GAIN

1) What makes the user feel happy or secure?
2) What benefits do they expect from an early warning system?
3) How does timely information improve their confidence?

T8 : Journey Map

1. Flood-prone areas face severe waterlogging due to poor drainage and lack of timely alerts during heavy rains
2. Real-time IoT-based flood alert system is needed to monitor floods and warn citizens early.
3. Analyze rainfall, drain blockages, and water-level rise using ultrasonic and rainfall sensors
4. Local authorities, engineers and residents collaborate to ensure accurate alerts and faster action
5. ESP32 and sensors detect water levels and transmit real-time data through Wi-Fi
6. A mini-drain model simulates rainfall to test the system's response and accuracy
7. Sensor data is sent to an IoT cloud dashboard for live monitoring and alerts
8. Test system accuracy, reliability and response time under different rainfall conditions
9. Demonstrate to authorities; launch awareness apps and programs to educate citizens

T9 : Post Interview Discussion : DE-Brief Presentation

Interviewee's Goals or Motivation:	**Interviewee's Aspirations:**
The main goal is to create awareness among residents about flood preparedness and safe response actions.	Hope to reduce the number of people affected by sudden flooding by ensuring early warnings reach everyone.
Interviewee's Current Experience:	**Interviewee's Challenges/Pain:**
Has experienced multiple flooding situations and assisted families during waterlogging emergencies.	Struggles to communicate evacuation instructions on time due to power outages, network issues and panic among people.
3 most Memorable things about the Interviewee:	**User insights or Needs:**
Very motivating and shared real-life experiences of flood response. Spoke passionately about saving lives and helping communities.	They believe that a reliable early-alert system would highly support communities in taking timely action.

T10: Sample Need Statements

Early detection of rising water levels to prevent flooding.	Real-time water-level monitoring using IoT sensors in flood-prone zones.
Immediate alert systems for communities at flood risk.	Multi-channel emergency alert system (SMS).
Environmental monitoring to assess flood-triggering conditions.	Continuous monitoring of rainfall intensity, drainage blockage, and ground saturation.
Real-time monitoring of drainage levels and overflow points.	Dashboard for live tracking of drain conditions and water accumulation hotspots.
Integrated safety system for community emergency response.	Centralised evacuation and rescue coordination system connecting the public and authorities.

T11: Persona Canvas

PERSONA CANVAS

Persona Name: **RAVI KUMAR**

Demographic Profile:

Age: **34**

Gender: **MALE**

Home: **TANJAVUR**

Family: **3 MEMBERS**

Education Background: **DIPLOMA IN ELECTRICAL ENGINEERING**

Goals:

KEEPS HIS FAMILY AND NAME SAFE HEAVY RAINS , WARN NEIGHBOURS ACTIVELY

Deep Need Statement:

I NEED A SIMPLE AND AFFORDABLE SYSTEM THAT CAN WARN ME BEFORE FLOODING STARTS

Motivation/Aspiration:

LOOKING FOR A LASTING SOLUTION ,INSTEADN OF DEPENDING ONLY ON GOVERNMENT ALERTS

Diversity of Needs:

Hobbies/Likes/Dislikes:

HE IS INSERTED IN SIMPLE SAFETY GADGETS THAT ACTUALLY WORKS LIKES WORKING ON SMALL SKILLS TO IMPROVE HIS LIFESTYLE

Challenges/Pain Points:

SUDDEN FLOODING WITHOUT EARLY WARNING NO LOW COST OR TRUST-WORTHY ALERT SYSTEM AVAILABLE

Social & Family Lifestyle:

HE TRIES WITH HIS PARENTS AND ACTIVELY TAKES PART IN LOCAL COMMUNITY SAFETY MEETINGS

Behavior:

HARDWORKING, FRIENDLY, PUNCTUAL

PHASE 3 : EXPERIMENT

T12 : SCAMPER WORKSHEET

T12 : SCAMPER

S	C	A	M	P	E	R
SUBSTITUTE	**COMBINE**	**ADAPT**	**MODIFY**	**PUT TO OTHER USES**	**ELIMINATE**	**REARRANGE**
What elements of the idea could be substituted to create a new possibility?	Can two existing ideas be combined to create a new one?	Can an existing idea be adapted to a new situation?	Can the idea be changed to create something new or improve it?	Can the same idea be used for other purposes?	Are there any elements of the idea that can be eliminated?	Can the order of the components of the idea be rearranged?
Replace manual checking with automatic level sensors. Replace traditional sirens with mobile alerts, chatbot. Substitute human alerts with SMS	Combine rainfall data + water level sensors. Combine mobile alerts + siren system + LED warning boards	Adapt weather alert systems. Use Google MAPS - style location warning for flood areas.	Improve alert messages to show danger levels. Make system solar powered for rainy days	Use during heavy rain in cities	Remove manual field checking	Reverse alert order: Send alert early, not after flood

PHASE 4 : ENGAGE

Stoyrboard – Flood Early Warning Process

Normal Day / Clouds Gathering

Clouds gather & rainfall begins in the area.

Water Level Rises Slowly

Water level starts rising and drains struggle stugle handle flow.

Sensor Detects Water & Blockage

Sensor detects rising water & drain blockace in real-time.

Alert System Activated

Automatic alerts sent to citizens & authorities.

Public Response

Residents follow safe routes & avoid waterlogged areas.

Emergency Team Action

Fooldipal prevemds quickly waterlogged areas.

Situation Controlled

Municipal team responds — quickly clear drail disturbance.

Community Feedback

Community aprreciates the quick alert system.

T8 : Concept Synthesis

DESIGN CHALLENGE

How might we develop an early warning flood & waterlogging system ?

SOLUTION CONCEPT

A sensor-based flood detection system integrating river-level sensors, rainfall data and multi-channel alert distribution

PERSONA

1.Local authorities and Municipalities

2.Emergency responders

3.Meteorologists

4.Government agencies

5.Residents in flood-prone zones

GAINS

1.Timely evacuations and response

2.Saving lives

3. Protection of assets

GAIN CREATOR

1.Sensors

2.Communication Systems

VALUE PROPOSITION TO TARGET USERS

A reliable, cost-effective early warning flood system that detects rising water-levels early and accurately

USER NEED

1.Reliable alerts to evacuate safely before a flood occurs.

2.Effective communication of alerts to all users.

3.Continuous updates.

4.Enhance safety and preparedness.

PAINS

1.Delayed flood detection

2.Loss of life and property

PAIN RELEIVER

1.Warning System

2.Monitoring systems

VALUE PROPOSITION TO ORGANIZATION

Efficient solution that enhances disaster preparedness and safety

What is this Quick win(1) about?	Provides immediate improvements in early warning accuracy and system reliability.
What are the success indicator(s)?How would it be measured?	The success indicator will be the decreased life and property loss.
What are the resources/staff trainings needed?	Ultrasonic sensor JSN-SRO4T.
Who will lead this quick win implementation?	The project will be led by the technical team specializing in meteorological monitoring and early warning systems.
What are the key steps needed to implement this Quick Win? What is the timeline till competition?	Local people awareness and their support will be highly useful in implementing quick win.
When will be the status or progress update?	The status will be updated during the progress and completion of progress.
When will this be completed?	The project is expected to be completed within 1 to 2 months.
How would the success be communicated?	Success will be communicated through the decrease in life damage and property damage rate. And those info will be received from the informers and local people , authorities.

Idea What idea for implementation?	Objectives Why is this idea important? Values and benefits?	Responsibility Who will lead this?	Implementation How will this be implemented?	Resources What capability and resources are needed?	Completion When will this be completed?
To identify Flood prone areas.	To save property loss and life.	Civil groups and NGO’s	By historical data	Past data must be more precise	Week 1
Placing Sensors	To obtain higher precision data and analyzed to prevent it.	Meteorologist	Ultrasonic sensor is placed at two different levels.	Ultrasonic sensors that are waterproof with high detecting accuracy.	Week 2-3
Alert and Notification system	For warning residents and to safeguard them.	Software Team	Collects data via wireless protocol to cloud or database .	In lack of tower , one can use Wireless protocol.	Week 4 – 6

Thank You