System Proposal

System Title: Drainage Level Monitoring and Early Warning System for Barangay Poblacion 1, Balangiga Eastern Samar
Date: October 6, 2025

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Brief Description:

The Drainage Level Monitoring and Early Warning System is a proposed project that focuses on solving one of today's most common urban problems—hidden or covered drainage and canals that easily get clogged with trash and cause flooding. Since most drainage systems are no longer visible to the public, it is difficult to know when they are full or blocked until flooding has already happened.

This system makes use of sensors such as ultrasonic and turbidity sensors that can detect the water level, flow, and waste buildup inside drainage canals. The data will be sent wirelessly to a dashboard or mobile app, which can be accessed by local government units (LGUs) and maintenance staff. With this, problems can be identified earlier, and preventive measures can be done before the situation worsens.

In short, the Drainage Level Monitoring and Early Warning System provides real-time monitoring, quick alerts, and reliable data that can help reduce flooding risks, improve drainage maintenance, and keep communities safer.

Scope and Limitations

The Drainage Level Monitoring and Early Warning System is designed to keep track of water levels in drainage systems and detect trash or blockages through turbidity and flow sensors. It sends real-time alerts via SMS, dashboard notifications, or a mobile app so issues can be addressed quickly. On top of that, it records data for reporting and trend analysis, which helps with long-term planning. To make it sustainable, the system uses a rechargeable battery and can also run on solar power. Everything is enclosed in a waterproof casing so it can handle tough outdoor conditions.

Of course, the system has its limits. It needs GSM (Global System for Mobile Communications) or internet connectivity to send out alerts, and the sensors have to be checked and calibrated from time to time to stay accurate. It can only detect problems—it won't actually clear out trash or blockages. Since one unit covers just a small section, multiple devices are needed for larger drainage networks. And because it's exposed to the environment, extreme weather like heavy rain or too much debris can affect its performance.

Functionalities:

Water Level Monitoring Continuously measures drainage water depth using ultrasonic sensors.	Ensures early detection of rising water levels to prevent flooding.
Blockage and Waste Detection Uses turbidity and flow sensors to identify clogs or trash buildup.	Helps maintenance teams respond quickly before canals overflow.
Real-Time Alerts Sends notifications via SMS, dashboard, or mobile app when abnormal conditions are detected.	Reduces delays in response time and minimizes flooding risks.
Data Logging and Reporting Records water levels, turbidity, and flow data into a central database.	Provides historical data for long-term analysis and drainage planning.
Power Management Operates on rechargeable batteries with solar panel integration.	Keeps the system running even during power outages or bad weather.
Durability and Safety Encased in waterproof, corrosion-resistant housing.	Protects the device from harsh drainage conditions and extends lifespan.

System and Hardware Requirements:

Software / Firmware Requirements:

- Arduino IDE (C/C++)
- Web dashboard for monitoring.
- Database: MySQL
- Supported OS: Windows, macOS, or Linux.
- Optional mobile app for Android/iOS.

Hardware Requirements:

- **Microcontroller:** ESP32 or Arduino Mega with Wi-Fi/GSM module.
- **Sensors:**
  - Ultrasonic sensor for water level.
  - Turbidity sensor for water quality/trash buildup.
  - Flow sensor for drainage flow rate.
- **Power System:**
  - 12V rechargeable battery.
  - 20–50W solar panel with charge controller.
- **Communication:** GSM/LoRa module for long-range, Wi-Fi if available.
- **Protective Housing:** Waterproof, corrosion-resistant casing (IP67 rated).

DATA DICTIONARY								
Entity Name	**Attribute Name**	**Data Type**	**Field Size**	**Constraint**	**Input Mask**	**Validation Rule**	**Validation Text**	**Description**
DrainageUnit	DrainageID	INT	N/A	PRIMARY KEY, AUTO INCREMENT	N/A	N/A	N/A	Unique identifier for each monitoring device installed in a drainage system
	Location	VARCHAR	100	NOT NULL	N/A	Must not be empty	Location required	Street, canal, or landmark where the device is installed
	WaterLevel	FLOAT	N/A	NULL	N/A	≥0	Must be non-negative	Current depth of water measured in centimeters
	Turbidity Value	FLOAT	N/A	NULL	N/A	≥0	Must be non-negative	Water clarity/quality reading to detect trash buildup
	FlowRate	FLOAT	N/A	NULL	N/A	≥0	Must be non-negative	Measures how fast the water flows through the drainage
	BatteryLevel	INT	3	NULL	N/A	0–100	Must be between 0–100	Current battery percentage of the monitoring device
AlertLog	AlertID	INT	N/A	PRIMARY KEY, AUTO INCREMENT	N/A	N/A	N/A	Unique identifier for each system-generated alert
	DrainageID	INT	N/A	FOREIGN KEY	N/A	N/A	N/A	Links the alert to the specific drainage unit
	AlertType	VARCHAR	50	NOT NULL	N/A	{Flood Risk, Blockage, Power Issue}	Invalid entry	Defines what type of issue triggered the alert

	Timestamp	DATETIME	N/A	NOT NULL	N/A	Must be valid datetime	Invalid date/time	Date and time the alert was triggered
Maintenance	TaskID	INT	N/A	PRIMARY KEY, AUTO INCREMENT	N/A	N/A	N/A	Unique identifier for each maintenance activity
	DrainageID	INT	N/A	FOREIGN KEY	N/A	N/A	N/A	Refers to the drainage unit being serviced
	TaskType	TEXT	N/A	NOT NULL	N/A	{Sensor Cleaning, Battery Check, Repair}	Invalid entry	Type of maintenance work performed
	Notes	VARCHAR	255	NULL	N/A	N/A	N/A	Additional remarks or findings from maintenance