🌊 Smart Sewage Sentinel

Smarter Sewage, Safer Cities.\ An open-source IoT platform that detects toxic gases and rising water levels in real-time, protecting underground workers and urban infrastructure.

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Why this Project?

Underground sewage networks are harsh, confined environments where toxic gases build up and water levels change rapidly. Traditional periodic inspections leave workers exposed to invisible dangers.

`Smart Sewage Sentinel` offers always-on monitoring, instant SMS alerts, and a live cloud dashboard—turning an invisible threat into actionable data.

Key Features

- **Multi-Gas Detection** — CO_2, CH_4, H_2S, NH_3 monitored every few seconds.
- **Overflow Guard** — Ultrasonic sensor detects rising water before it floods.
- **Dual Alerting** — Loud local buzzer *and* SMS via GSM for remote teams.
- **Plug-and-Play Cloud** — Auto-publishes to ThingSpeak for graphs & history.
- **On-Site LCD** — 16×2 display scrolls live readings and status.
- **Runs on ESP32 or Arduino** — Choose Wi-Fi or GSM-only connectivity.

System Overview

```
flowchart TD
    Sensors((Gas & Env Sensors)) -->|Analog/Digital| MCU[ESP32 / Arduino]
    MCU -->|Wi-Fi| Cloud[ThingSpeak Channel]
    MCU -->|Serial AT| GSM[SIM900A]
    MCU --> LCD[16×2 LCD]
    MCU --> Buzzer[Buzzer]
    GSM -->|SMS| User[Safety Officer 📱]
```

Hardware

Qty	Component	Part No. / Example
1	**ESP32 DevKit-C** (or Arduino Uno)	DOIT ESP32 DEVKIT V1
1	**CO_2 Sensor**	MG-811
1	**CH_4 Sensor**	MQ-4
1	**H_2S Sensor**	MQ-136
1	**NH_3 Sensor**	MQ-137
1	**Temp/Humidity**	DHT22 (or DHT11)
1	**Ultrasonic**	HC-SR04
1	**GSM Module**	SIM900A
1	**LCD 16×2**	w/ I^2C adapter recommended
1	**Buzzer**	Passive 5 V
—	Misc	Breadboard, jumper wires, 5 V @2 A supply

Tip: A full Fritzing wiring diagram lives in `docs/wiring.fzz`.

Quick Start

📥 Clone & Open

```
git clone https://github.com/your-username/sewage-sentinel.git
cd sewage-sentinel/firmware
```

Open `or` sketch (choose one) in Arduino IDE.

2️⃣ Install Libraries

```
LiquidCrystal  |  DHT sensor library
ThingSpeak     |  WiFi (ESP32 only)
```

Install via **IDE → Library Manager**.

3️⃣ Configure

- **Wi-Fi SSID / PASS** — for ESP32 (`secrets.h`).
- **ThingSpeak** — channel ID & write API key.
- **SMS Numbers** — replace default placeholders in `gsm.cpp` .

4️⃣ Upload & Enjoy

Select the correct board & port → **Upload**.\ LCD should print *Project Ready*, and your ThingSpeak graphs will start drawing.

Cloud Dashboard

Create a free ThingSpeak channel with these fields:

Field	Data
1	CO_2 (ppm)
2	CH_4 (ppm)
3	H_2S (ppm)
4	NH_3 (ppm)
5	Water Level (cm)
6	Temperature (°C)
7	Humidity (%)

> **Pro-Tip:** Enable “Public View” to share live charts with city engineers.

Alert Rules & Thresholds

Gas	Threshold	Action
CO_2	> 300 ppm	Buzzer + SMS
CH_4	> 300 ppm	Buzzer + SMS
H_2S	> 500 ppm	Buzzer + SMS
NH_3	> 300 ppm	Buzzer + SMS
Water Level	< 20 cm from top	Buzzer + SMS

Thresholds live in `config.h` — tweak for your deployment.

Roadmap

-

Have an idea? Open an issue or PR!

Contributing

1. Fork
2. Create a feature branch
3. Commit & push with clear messages
4. Open a Pull Request — we love collaboration

Please follow the **Conventional Commits** spec.

License

`Smart Sewage Sentinel` is released under the **MIT License** — see `LICENSE` for details.

Author & Contact

Built with by **Your Name**.\ Questions, feedback or deployments? Reach me on LinkedIn or open an issue.