“SAMVED” HACKATHON 2026

TITLE PAGE

- **Problem Statement ID –** ID-04
- **Problem Statement Title-** Smart Safety and Assistance System for Sanitation Workers of Solapur Municipal Corporation
- **Theme-** Technology That Breathes Safety into Sanitation Work
- **Team ID-** ID: 302B12D7
- **Team Name :** Pandavas

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TRISHIELD

❖ Proposed Solution

Detailed explanation of the proposed solution

- Our **Core Idea** is **Handheld smart safety system** for sanitation workers which detects **toxic gases in real time** and a **Eco friendly mask** provides **instant, easy-to-understand alerts** and it prevents unsafe entry into confined spaces.

How it addresses the problem

- **TriShield** prevents unsafe sewer entry by providing real-time toxic gas detection with simple color alerts and alarms, enabling early evacuation, reducing manual exposure, saving lives, and improving sanitation worker safety and dignity.

Innovation and uniqueness of the solution

- A **novel, offline**, tri-color gas alert device with **eco-friendly masking** that enables instant safety decisions without training or infrastructure.

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TECHNICAL APPROACH

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Technologies to be used

- Arduino Nano, MQ-series gas sensors, Embedded C/C++, RGB LEDs, buzzer, rechargeable battery, and eco-friendly filtration materials.

Methodology and process for implementation

- The implementation involves integrating MQ gas sensors with an Arduino Nano, defining safety thresholds, and programming real-time alert logic. The assembled components are enclosed in a handheld prototype. During operation, the device continuously senses gas levels and provides visual and audio alerts for safe decision-making.

Fig.1. Original 3D Generated Detector named TriShield (Both Front & Back)

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FEASIBILITY AND VIABILITY

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Analysis of the feasibility of the idea

- The solution is highly feasible using low-cost, readily available components. Simple hardware design, offline operation, and minimal training requirements make it practical for large-scale deployment by municipal sanitation departments.

Potential challenges and risks

- Sensor calibration drift affecting accuracy
- False alarms due to humidity and temperature
- Battery drainage during long field operations
- Device damage in wet and corrosive environments
- Limited gas selectivity in mixed-gas conditions

Strategies for overcoming these challenges

- Regular sensor calibration, protective waterproof casing, battery status indicators, periodic maintenance schedules, and field testing under real working conditions ensure reliable performance and long-term usability.

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IMPACT AND BENEFITS

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Potential impact on the target audience

- The solution significantly improves sanitation worker safety by preventing hazardous gas exposure, reducing fatalities and health risks. It builds worker confidence, enables safer decision-making, and enhances operational efficiency for municipal sanitation departments.

Benefits of the solution

- **Social Benefits**

Prevents fatalities and serious health risks

Enhances dignity and safety of sanitation workers

- **Economic Benefits**

Low-cost solution suitable for mass deployment

Reduces medical, compensation, and accident-related costs

- **Environmental Benefits**

Uses eco-friendly, biodegradable mask materials

Promotes sustainable and responsible safety practices

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RESEARCH AND REFERENCES

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1. AI Robotics to Replace Hazardous Human Work

Kerala launched an **AI-powered robotic canal cleaner** to remove waste and reduce human exposure to dangerous sanitation tasks after a worker's death.

2. Gurgaon Mandates Safety Gear & Reduces Manual Entry

Gurugram civic body now **prohibits manual sewer entry**, requiring gas detectors, oxygen kits, and training for sanitation workers to improve safety.

3. Robotic Sewer Cleaning Marks Progress in Chennai

Chennai completes one year of using **Bandicoot Mobility+ sewer cleaning robots** to avoid risky manual entry in confined spaces.

4. Toxic Gas Incident Kills Sanitation Worker in Delhi

A sanitation worker died and others were hospitalized after inhaling **toxic gas in a sewer**, highlighting the danger of gas exposure during manual cleaning.