"SAMVED" HACKATHON 2026

TITLE PAGE

- **Problem Statement ID – 04**

- **Problem Statement Title-** Smart Safety and Assistance System for

  Sanitation Workers of Solapur Municipal Corporation

- **Theme- IoT + AI Smart Wearable Safety System (Hardware +**

  Software)

- **Team ID- 30336EBB**

- **Team Name- Elevate**

SmartWear-AI: Intelligent Safety & Rescue System for Sanitation Workers

PROPOSED SOLUTION
- **AI-enabled smart wearable wristband** with gas, temperature, heart-rate sensors & GPS
- **Mobile application with AI decision engine** for real-time analysis and decision-making
- **Continuous safety and health monitoring** with autonomous emergency response

How It Addresses the Problem
- **Real-time detection** of toxic gases, unsafe temperature, and abnormal heart rate
- **Live GPS tracking** with buzzer alerts during unsafe conditions
- **Automatic emergency escalation** if no response within 5 minutes, including alerts to authorities and ambulance with exact location
- **Eliminates dependency on manual reporting**

Innovation & Uniqueness
- **Zero-trust safety model**: no response triggers automatic escalation
- **Autonomous emergency handling** without human intervention
- **AI-based risk analysis** to predict unsafe conditions and support pre-deployment area safety assessment
- **Worker-centric design** focused on safety, dignity, and prevention
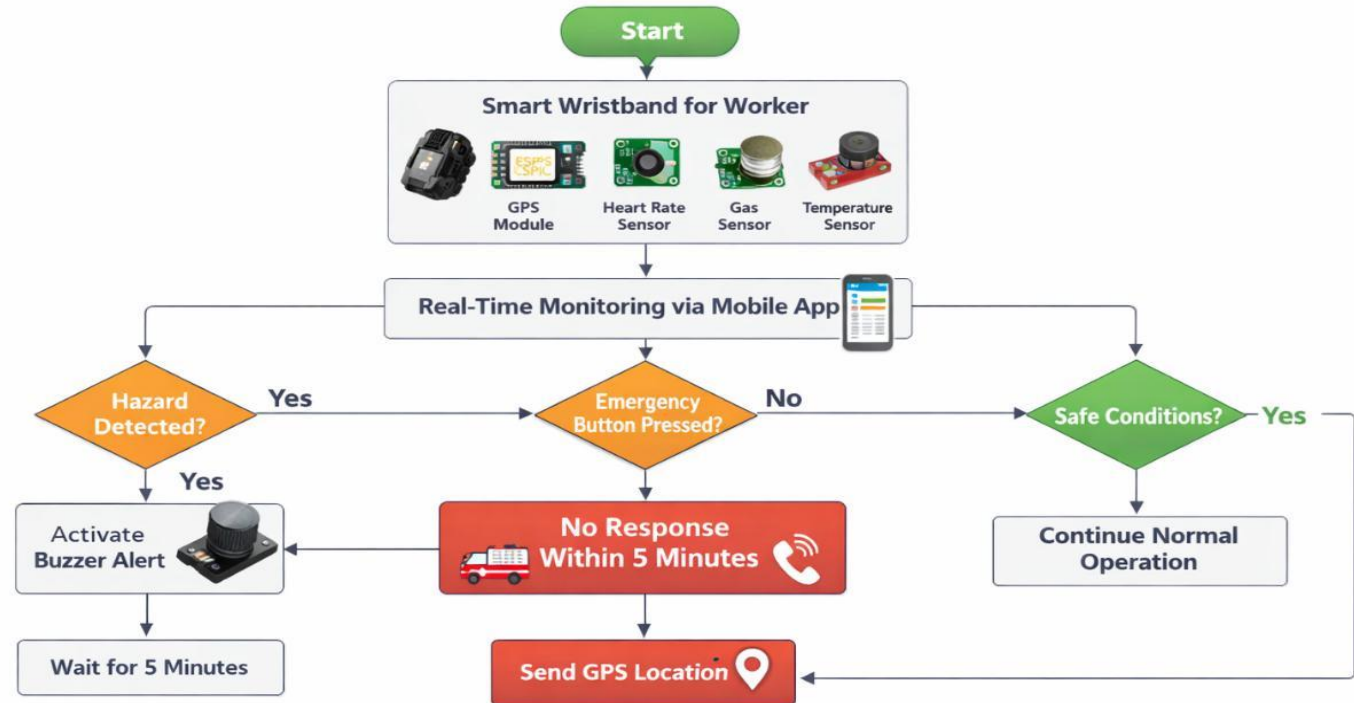
TECHNICAL APPROACH

Technologies Used

Hardware
- ESP32 Microcontroller
- Gas Sensor (toxic gas detection)
- Temperature Sensor
- Heart Rate Sensor
- GPS Module
- Emergency Push Button
- Buzzer / Alert Unit

Software
- Mobile Application
- Programming: Embedded C / Arduino,
- Python ,AI / ML for risk analysis
- Cloud / Database for real-time data storage

Smart Safety & Assistance System for Sanitation Workers

FEASIBILITY AND VIABILITY
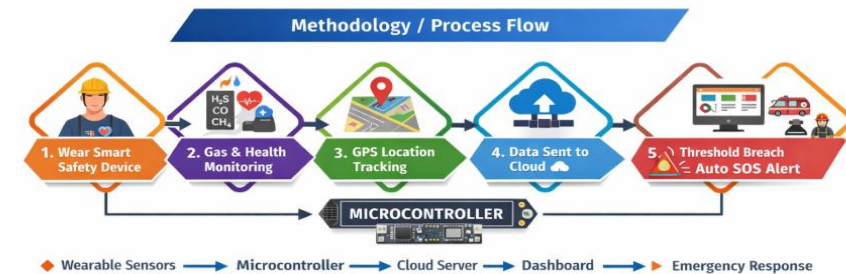
Feasibility Analysis

- **Low-cost, proven technologies**: ESP32, Android application, cloud database
- **No dependency on experimental hardware**, ensuring reliability
- **Scalable deployment** across multiple workers and locations
- **Suitable for real sanitation environments**

Potential Challenges & Risks

- **Sensor malfunction or noise** in harsh conditions
- **Network connectivity loss** in underground areas
- **Worker adoption concerns** and **data privacy risks**

Strategies to Overcome Challenges

- **Multi-sensor validation and calibration** to reduce false alarms
- **Local alert mechanisms** (buzzer/vibration) for offline safety
- **Offline data buffering with auto-sync** when connectivity is restored
- **Compact wearable design** with **encrypted data transmission**

IMPACT AND BENEFITS

Impact on Target Audience

- **Reduced worker fatalities** through real-time health and safety monitoring
- **Faster emergency response and rescue**, improving survival outcomes
- **Improved confidence, morale, and safety awareness** among workers
- **Enhanced supervision and decision-making** for authorities

Benefits of the Solution

- **Social**: Protects lives, promotes dignity, and supports humane sanitation systems
- **Economic**: Reduces medical and compensation costs, prevents accident-related delays, and offers high safety return at low cost
- **Environmental**: Enables safer waste management, prevents hazardous-zone accidents, and encourages sustainable sanitation practices

RESEARCH AND REFERENCES

Technology & Hardware References

- ESP32 Technical Documentation – Espressif Systems
- MQ Gas Sensors Datasheets (MQ-2, MQ-7, MQ-135)
- MAX30100 / MAX30102 Pulse Oximeter Sensor Docs
- DHT11 / DHT22 Temperature & Humidity Sensor Docs
- Google Maps API Documentation
- Firebase Realtime Database Documentation

Web & Learning Resources

- Arduino & ESP32 Community Forums
- GitHub Open-source IoT Safety Projects
- WHO Occupational Safety Guidelines
- Open Government Data (data.gov.in)