

AUTOMATED HYDROGEN SULPHIDE (H₂S) LEAK DETECTION AND FIRST-AID DRONE RESPONSE

Mohammed AlQahtani, Omar AlMesfer, Feras AlTurki, Saud AlHajri, Ahmed Badraiq, Salem AlWaeli,
Abdullah AlHajri
Coach: Dr.Muath AlMalki



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Introduction/Background

Hydrogen Sulphide (H₂S) is a hazardous and flammable gas found in industrial settings like oil & gas, wastewater, and chemical plants. Conventional methods depend on static sensors and manual checks, leading to delays and high risk. Our integrated system uses a mobile sensor belt for continuous pipeline monitoring and a drone for rapid sealing with chemical material. This minimizes human risk, speeds up response, and boosts safety.

Feature	Specification/Constraint
Detection Sensitivity	0–20 ppm
Drone Flight Time	≥5 minutes
Sealing Time	<30 seconds
Payload Capacity	≤ 15 kg
Temperature Range	-10°C to 50°C
Altitude Limit	≤ 120 meters
Drone Control	Manual

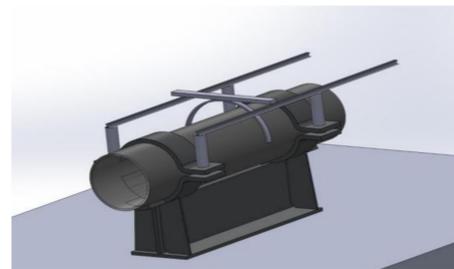
Cost analysis

Item	Cost (SAR)
Sensors & Control System	2,079
Drone Frame, Parts & Communication	2,341
Belt & Sealing Materials	751
Miscellaneous	350
Total	5,521

Our project's total cost amounted to SAR 5,521, well within the allocated university budget of SAR 7,900. Key expenses included sensors, drone components, communication modules, and power systems. We reduced costs significantly by utilizing blacksmith workshops and university resources, reusing available lab inventory, and selecting cost-effective components. This budget-conscious approach ensured financial feasibility without compromising system performance.

Prototype

• Initial Design



• Final Prototype



•**Sensor Belt:** A motorized belt travels on a mounted track along pipelines, scanning for H₂S leaks using MQ135 sensors with real-time readings.

•**Sensor Calibration:** Sensors were tested using butane gas for safe validation of response accuracy.

•**Sealing Drone:** A quadcopter drone equipped with epoxy mixed with zinc oxide for temporary sealing, manually deployed to leak points.

•**Drone Flight Performance:** Drone was successfully tested in multiple flight scenarios, including hovering and stability under payload.

Testing / Validation



- Individual components tested for functionality
- Sensors has been installed and tested successfully in KFUPM EE labs using butane gas for safety and response confirmation
- Chemical sealing validated through safe lab simulation of H₂S using Na₂S + HCl
- Sensor responsiveness confirmed within 5 seconds
- Drone successfully assembled and tested in flight
- Motorized belt has been validated through experiment

Conclusion

Our low-cost prototype improves H₂S leak detection and response by enhancing safety and reducing delays. Future work includes field trials, drone autonomy, onboard cameras, and AI-based leak detection to move our project into field of Oil & Gas industry.