International Journal of Creative and Open Research in Engineering and Management
ISSN: 3108-1754 (Online)
Volume 02 Issue 11 November-2026 | Impact Factor: 3.5



SUSPENSE: The Smart Exploration Rover

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How to Cite this Article:

Tabassum, J., Khan, P. S., Hussain, S. A. & Fatima, S. G. (2026). SUSPENSE: The Smart Exploration Rover. International Journal of Creative and Open Research in Engineering and Management, 02(11), 1-9. https://doi.org/10.55041/ijcope.v2i11.101

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https://doi.org/10.55041/ijcope.v2i11.101

Abstract

Exploration of unknown, inaccessible and potentially hazardous environments presents significant challenges to human safety. Underground tunnels, mines, caves, disaster-affected areas and remote locations may contain obstacles, hazardous gases and unpredictable environmental conditions. Direct human inspection in such environments can expose personnel to considerable risks. This paper proposes SUSPENSE (Smart Unmanned Surface Patrol for Exploration, Navigation, Safety and Environmental Monitoring), a low-cost, four-wheeled autonomous exploration rover designed to support preliminary inspection and environmental monitoring.

The proposed system uses a Raspberry Pi as its main processing unit, ultrasonic or time-of-flight distance sensors for obstacle detection, a camera for visual monitoring, a BME280 sensor for temperature, humidity and atmospheric pressure measurement, and a separate gas sensor for detecting selected hazardous gases. The rover is designed to perform autonomous movement and basic obstacle avoidance while transmitting live video, environmental readings, alerts and system information to a laptop through Wi-Fi.

Additional functionalities include event-based video recording, battery monitoring and a proposed low-battery return-to-station procedure. When an important event occurs, such as obstacle detection or a gas-level threshold being exceeded, the system is intended to generate an alert and save a corresponding video clip. The laptop acts as a monitoring and supervisory station rather than a continuous manual driving controller.

SUSPENSE is intended to support preliminary inspection in disaster-related environments, underground locations, industrial sites and terrestrial research related to planetary exploration. This paper presents the proposed architecture, hardware requirements, software design, methodology, expected functionality and future evaluation plan. The system is currently at the design stage and requires hardware implementation and experimental validation.

Keywords— Autonomous Rover, Environmental Monitoring, Disaster Inspection, Obstacle Avoidance, Raspberry Pi, Wireless Communication, Event-Based Recording, Battery Management.



I. INTRODUCTION

Autonomous mobile robots are increasingly being considered for exploration and inspection tasks in environments where direct human access is difficult or potentially dangerous. Such environments include underground mines, tunnels, caves, industrial facilities, disaster-affected locations and remote exploration areas. During natural disasters, structural collapses and industrial accidents, inspection teams may encounter unstable structures, restricted visibility, obstacles and hazardous atmospheric conditions. Sending personnel directly into such locations before understanding the surrounding conditions can increase operational risks. Autonomous robotic platforms can assist by collecting visual and environmental information from accessible areas. Research has demonstrated the use of autonomous robots for underground environmental monitoring, disaster inspection and planetary exploration. Kim and Choi developed an autonomous environmental-monitoring robot for underground mines, demonstrating the potential of combining mobile robotic platforms with environmental sensors [1]. Their later work further investigated autonomous patrol robots for improving underground mine safety [2]. Environmental monitoring systems have also been developed using low-cost networked devices capable of collecting and transmitting field information [3], [4]. Raspberry Pi-based robotic systems have demonstrated the integration of cameras, motor control and wireless communication for surveillance applications [5], [6].

Based on these developments, this paper proposes **SUSPENSE – The Smart Exploration Rover**, a four-wheeled autonomous rover designed to combine navigation, obstacle detection, environmental monitoring, live video transmission, event-based recording and battery management.

Unlike systems designed exclusively for planetary exploration, SUSPENSE is intended as a multi-environment research platform. Its potential applications include preliminary inspection of disaster-affected areas, underground tunnels, mines, caves, industrial locations and terrestrial environments used for planetary rover research. The proposed prototype is designed for accessible terrain. It is not intended to enter narrow rubble spaces, perform physical rescue operations or replace specialized rescue equipment.

II. MOTIVATION AND PROBLEM STATEMENT

A. Motivation

Several real-world applications demonstrate the importance of robotic inspection in hazardous environments. The 2025 Srisailam Left Bank Canal tunnel collapse in Telangana highlighted the difficulties associated with underground rescue and inspection operations. Reports described the use of robotic equipment and camera-based systems during the response [9], [10]. Similarly, research on disaster-response robotics has demonstrated how ground and aerial robotic platforms can support the inspection of damaged buildings and hazardous locations [11], [12]. These systems can provide useful information to response teams while reducing the need for immediate human entry. Underground mining is another important application. Autonomous inspection robots have been investigated to monitor environmental conditions and reduce workers' exposure to hazardous locations [1], [2]. Planetary exploration also provides motivation for developing autonomous rovers. Research on planetary rover navigation highlights the importance of onboard decision-making when communication with a remote station is limited [19]–[23]. These applications motivate the development of an affordable autonomous rover capable of preliminary exploration, environmental monitoring and wireless information transmission.

B. Problem Statement

Unknown and potentially hazardous environments create difficulties for conventional human-based inspection. Obstacles, restricted access, poor visibility and hazardous gases can make preliminary assessment challenging. There is a need for a compact and affordable autonomous rover that can:

1. Move autonomously through accessible unfamiliar environments.
2. Detect nearby obstacles and avoid collisions.
3. Monitor temperature, humidity, atmospheric pressure and selected gas levels.
4. Transmit live video and sensor readings to a monitoring station.
5. Automatically record important events.
6. Monitor battery condition and initiate a low-battery response.



SUSPENSE proposes an integrated system to address these requirements using a Raspberry Pi-based four-wheeled platform.

III. LITERATURE REVIEW

Previous research in autonomous robotics, environmental monitoring, wireless communication, disaster response and planetary exploration provides the foundation for the proposed system.

A. Autonomous Exploration and Environmental Monitoring

Kim and Choi [1] investigated an autonomous robot for environmental monitoring in underground mines. Their work demonstrated autonomous movement and the collection of environmental measurements. Their subsequent study developed an autonomous patrol robot for improving underground mine safety [2]. Sethi et al. [3] presented a low-cost networked monitoring device for autonomous ecosystem observation. Their work demonstrated the importance of continuous environmental data collection and remote information access. Ishii et al. [4] reviewed autonomous mobile robots for environmental monitoring, particularly their use in outdoor and rough-terrain applications. These studies support the integration of mobility and environmental sensing in SUSPENSE.

B. Raspberry Pi-Based Robotic Systems

Joy et al. [5] presented a Raspberry Pi-based security patrol robot incorporating a camera, motor control and wireless communication. Their work demonstrates the suitability of Raspberry Pi platforms for mobile surveillance. Bokade and Ratnaparkhe [6] developed a video-surveillance robot using a Raspberry Pi and wireless communication. Their work demonstrated remote video transmission through a network connection. Research on wireless sensor network systems using Raspberry Pi and Arduino platforms has also demonstrated the use of affordable computing hardware for environmental monitoring applications [17]. These studies provide a foundation for selecting Raspberry Pi as the main processing unit of SUSPENSE.

C. Obstacle Detection and Avoidance

Obstacle detection is an important requirement for autonomous mobile robots. Yasin et al. [7] investigated a low-cost ultrasonic-based object detection and collision-avoidance method for autonomous robots. Their work demonstrated the application of distance sensing for collision prevention. Navaratnam [8] presented an autonomous obstacle-avoidance robot using ultrasonic sensors. The study highlighted the use of distance measurements and basic movement decisions to avoid obstacles. Additional studies have investigated ultrasonic sensing for mobile robot navigation and obstacle avoidance [26]–[28]. Based on these approaches, SUSPENSE proposes distance sensors to detect nearby obstacles and support basic autonomous navigation.

D. Disaster Response and Inspection Robotics

Delmerico et al. [9] reviewed the current state and future direction of rescue robotics, discussing the potential of robotic systems in disaster-response operations. Surmann et al. [10] presented lessons from robot-assisted disaster-response deployments by the German Rescue Robotics Center. Their work highlighted the importance of testing robotic platforms under realistic operational conditions. Wang et al. [11] developed a search-and-rescue robot system for underground building environments. Their research demonstrated the use of robotic systems for inspecting difficult underground locations. Zhai et al. [12] investigated a wheel-legged rover structure for search-and-rescue applications. Chen et al. [13] reviewed search-and-rescue robots operating in complex environments, highlighting challenges related to terrain, communication and autonomous exploration. These studies demonstrate the importance of robotic inspection in disaster-related applications. SUSPENSE focuses on preliminary inspection of accessible areas using a simpler four-wheeled platform.

E. Wireless Communication and Environmental Data Transmission

Adu-Manu et al. [14] reviewed wireless sensor network protocols and security challenges in environmental monitoring applications. Their research discussed communication reliability and energy-related considerations.Adu-Manu et al. [15] examined wireless sensor network architectures for environmental monitoring, explaining how distributed sensors transmit measurements to a central monitoring location. Rana et al. [16] reviewed energy-efficient communication protocols for environmental monitoring networks.



These studies support the importance of wireless data transmission and efficient communication in SUSPENSE.

F. Battery Management

Battery management is essential for autonomous mobile robots because their operation depends on available electrical energy. Lin et al. [24] reviewed task-centric battery management approaches for robotic systems. Their work highlighted the relationship between battery condition, energy consumption and task execution. Research on lithium-ion batteries for autonomous mobile robots also discusses battery requirements and operating-duration considerations [25]. SUSPENSE incorporates battery monitoring to identify low-power conditions and initiate a proposed return-to-station procedure.

G. Planetary Exploration

Planetary rover research provides important background for autonomous exploration. Zhang et al. [19] reviewed autonomous path-planning methods for planetary rovers. Miao and Wei [20] presented a comprehensive review of path-planning algorithms for planetary exploration. Gerdes et al. [21] investigated efficient autonomous navigation for planetary rovers operating with limited resources. Schuster et al. [22] presented the Lightweight Rover Unit and its development towards autonomous planetary exploration. Swinton et al. [23] investigated autonomous mission planning for planetary surface exploration using multiple micro-rovers. These studies demonstrate the importance of autonomy, efficient movement and resource management in exploration robots. SUSPENSE uses these concepts as research inspiration while maintaining a simpler Earth-based prototype design.

H. Identified Research Opportunity

The reviewed studies demonstrate that autonomous movement, environmental monitoring, mobile surveillance, wireless communication and battery management have been investigated in different robotic systems.

The proposed SUSPENSE project focuses on integrating these selected functions into a single four-wheeled platform:

1. Autonomous navigation using distance sensors.
2. Environmental monitoring using BME280 and a separate gas sensor.
3. Live camera streaming.
4. Event-based video recording.
5. Wi-Fi-based monitoring through a laptop.
6. Battery monitoring and a proposed return-to-station response.

The objective is to develop and evaluate this configuration rather than claim that each individual function is entirely new.

IV. OBJECTIVES OF SUSPENSE

The project objectives are represented through the SUSPENSE acronym.

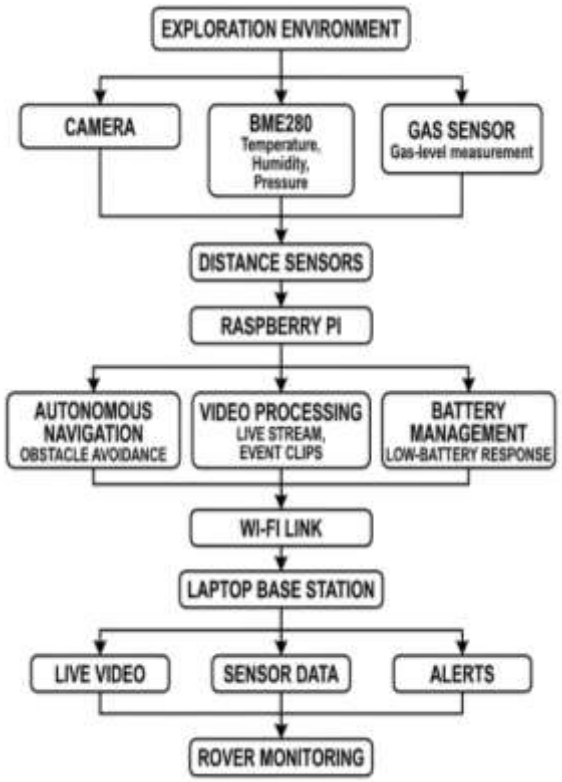
- **S – Smart Exploration:** Explore unfamiliar and potentially hazardous environments.
- **U – Unmanned Operation:** Operate autonomously without continuous manual driving.
- **S – Safety Monitoring:** Monitor environmental conditions and generate alerts when hazardous conditions are detected.
- **P – Patrol and Inspection:** Perform preliminary inspection in inaccessible or potentially dangerous locations.
- **E – Event-Based Recording:** Record video clips automatically when configured events occur.
- **N – Navigation:** Detect obstacles and perform autonomous obstacle avoidance.
- **S – Secure Communication:** Establish wireless communication with the monitoring station for transmitting live video and sensor data.
- **E – Energy Management:** Monitor battery status and initiate low-battery recovery procedures.

V. PROPOSED SYSTEM ARCHITECTURE

SUSPENSE consists of an exploration platform, onboard sensors, a Raspberry Pi processing unit, communication functionality and a laptop monitoring station. The camera and environmental sensors collect information from the surroundings. Distance sensors provide measurements for obstacle detection. The Raspberry Pi processes the collected information and controls the rover's movement through a motor driver. The camera supports live video streaming and event-based recording. Environmental readings are compared with configured thresholds to generate alerts. The collected information is transmitted through Wi-Fi to a

laptop, where the operator can monitor the rover's status, sensor readings, alerts and video.

Fig. 1. Proposed System Architecture



The laptop acts as a monitoring and supervisory station. It does not continuously control the rover's movement.

VI. HARDWARE REQUIREMENTS

The proposed hardware components are summarized in Table I.

Table I. Hardware Components and Their Functions

Component	Function
Raspberry Pi 4/5	Main processing and control unit
Four-wheel chassis	Rover movement
DC geared motors	Mechanical propulsion
Motor driver	Controls motor direction and speed
Ultrasonic/ToF sensors	Detect nearby obstacles
Raspberry Pi Camera/USB Camera	Visual monitoring and video recording
BME280 sensor	Temperature, humidity and atmospheric pressure
Gas sensor	Detects selected hazardous gas levels
INA219/INA226	Battery voltage and current monitoring
Rechargeable battery	Supplies electrical power
Wi-Fi	Wireless communication with laptop

The BME280 sensor measures temperature, relative humidity and atmospheric pressure. It does not measure gas concentration. Therefore, a separate gas sensor must be selected according to the intended application. The motor driver must be selected according to the motors' operating and stall-current requirements.

VII. SOFTWARE REQUIREMENTS

The proposed software environment includes:

Table II. Software/Technology and Their Functions

Software/Technology	Function
Raspberry Pi OS	Operating system
Python	Main programming language
OpenCV	Camera processing and video handling
GPIO libraries	Interface with motors and sensors
Flask/Streamlit	Laptop monitoring dashboard
MQTT/WebSocket	Wireless data communication
SQLite	Local storage of sensor readings and events
Picamera2/V4L2	Camera access, depending on camera type

The final selection between Flask and Streamlit, and between MQTT and WebSocket, will be made during implementation. The proposed software does not depend on ROS, SLAM, 3D mapping or machine-learning-based object recognition.

VIII. WORKING METHODOLOGY

The proposed working methodology consists of the following stages.

A. System Initialization

The Raspberry Pi initializes the camera, environmental sensors, distance sensors, motor driver, battery monitor and Wi-Fi connection. The system checks the availability of essential components before beginning exploration.

B. Autonomous Exploration

After initialization, the rover begins moving through the designated accessible area. The Raspberry Pi processes distance measurements and determines whether forward movement is possible.



C. Obstacle Detection and Avoidance

Ultrasonic or ToF sensors measure the distance between the rover and nearby objects. When an obstacle is detected within the configured stopping range, the rover stops and evaluates an available direction.

If a clear direction is detected, the rover performs a turning action. If no safe direction is available, it remains stopped.

D. Environmental Monitoring

The BME280 sensor continuously collects temperature, humidity and pressure readings. A separate gas sensor monitors the selected gas concentration. The Raspberry Pi compares these readings with configured thresholds and generates alerts when abnormal conditions are detected.

E. Live Video Transmission

The onboard camera captures the surrounding environment. The Raspberry Pi processes the video and transmits it to the laptop through Wi-Fi. This allows the operator to observe the rover's surroundings during exploration.

F. Event-Based Video Recording

The system is designed to record short video clips when specific events occur.

The proposed recording triggers include:

- Obstacle detection.
- Gas concentration exceeding the configured threshold.
- Abnormal temperature, if enabled.
- Recording request from the laptop.

The live video stream and event-based recording are intended to operate simultaneously.

G. Wireless Communication

Sensor readings, alerts, battery status, rover information and video are transmitted to the laptop. The laptop dashboard displays the received information for monitoring and supervisory purposes.

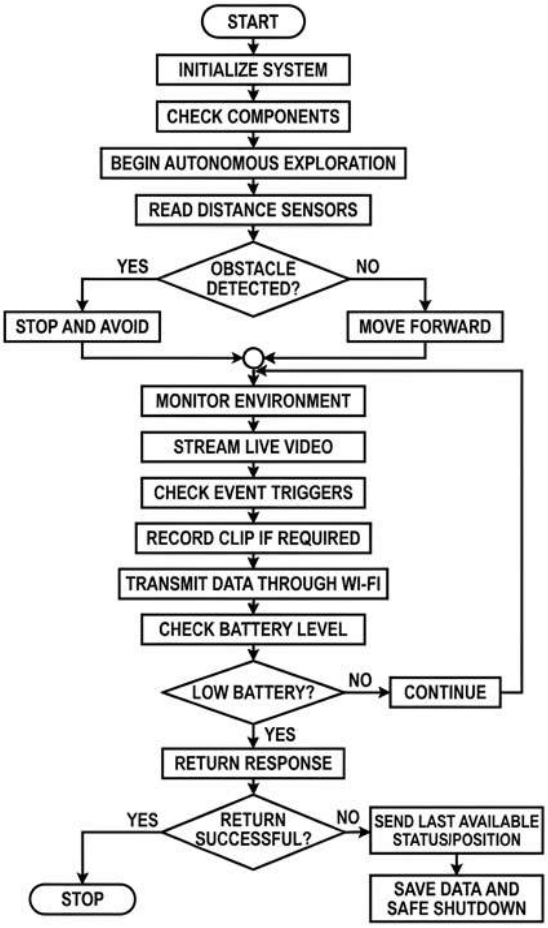
H. Battery Monitoring

The battery monitoring module measures battery voltage and current using an appropriate monitoring circuit.When the estimated battery level reaches the configured return threshold, the rover stops further exploration and initiates the proposed return-to-station response.

I. Emergency Recovery

If the rover cannot complete its return procedure, it is intended to preserve its latest available position or status information, transmit it when communication is available, save essential data and perform a safe shutdown.

Fig. 2. Overall Working Flowchart



IX. ENVIRONMENTAL MONITORING AND THRESHOLD LIMITS

Environmental monitoring is an important feature of SUSPENSE. The proposed system measures environmental conditions and generates alerts when readings exceed configured limits.

Table III. Proposed Environmental Monitoring Parameters



Parameter	Sensor	Ideal Range	Alert Condition
Temperature	BME280	15–35°C	Above 40°C
Humidity	BME280	30–70% RH	Below 20% or above 80%
Atmospheric Pressure	BME280	950–1050 hPa	Outside configured reference range
Gas Concentration	Separate gas sensor	Gas-specific calibrated range	Above selected gas threshold
Obstacle Distance	Ultrasonic/ToF	Above 50 cm	Below configured stopping distance
Battery Level	INA219/INA226	Above 40%	Around 25%: return response

These values are initial prototype settings, not universal safety standards. The thresholds must be adjusted according to sensor specifications, calibration and the intended testing environment. Gas thresholds must be selected according to the particular gas being measured. A general-purpose gas sensor cannot be treated as a certified atmospheric safety instrument.

X. EVENT-BASED VIDEO RECORDING

The proposed event-based recording system is designed to capture important situations automatically. The camera continuously supplies video for live monitoring. When a configured event occurs, the recording module saves a short clip with its timestamp and event information.

Table IV. Event Detection and System Response

Event	Proposed System Response
Obstacle detected	Stop/avoid obstacle and record a short clip
Gas threshold exceeded	Generate alert and record a short clip
Abnormal temperature	Generate alert and record a clip, if enabled
Laptop recording request	Start video recording
Low battery	Generate warning and initiate return response
Return unsuccessful	Preserve and transmit last available position/status, if available

The saved clips allow operators to review important events without depending only on continuous live-video observation.

XI. BATTERY MANAGEMENT

Battery management is required to monitor the rover's available electrical power during exploration. The proposed system uses an INA219 or INA226 module to measure battery voltage and current. These measurements help monitor electrical consumption.

The instantaneous power can be estimated as:

$$P = V \times I$$

Where:

- (P) = Electrical power in watts.
- (V) = Battery voltage in volts.
- (I) = Current in amperes.

The proposed battery response uses configured thresholds:

- Above 40%: Normal operation.
- 40–25%: Low-battery warning.
- Around 25%: Stop exploration and initiate the return response.

These are example settings and must be adjusted according to the selected battery, usable capacity and safe discharge limits. If the return procedure cannot be completed, the rover is intended to send its last available position or status information before shutting down safely, provided communication and location information are available.

XII. APPLICATIONS

SUSPENSE is proposed as a multi-environment exploration and monitoring platform.

A. Disaster-Affected Areas

The rover can support preliminary visual inspection of accessible disaster-affected locations. It can transmit live video and environmental information to help operators understand surrounding conditions.



B. Underground Mines and Tunnels

The rover can be used for preliminary inspection of traversable underground routes and monitoring of selected environmental parameters.

C. Caves and Confined Environments

The platform may assist in inspecting accessible cave routes and collecting environmental information without immediately sending personnel into the area.

D. Industrial Hazardous Locations

The rover may support preliminary visual inspection and monitoring in selected industrial environments, subject to equipment suitability and site safety approval.

E. Space and Planetary Exploration Research

The project provides an Earth-based platform for studying autonomous rover movement, obstacle avoidance, environmental sensing and remote monitoring concepts relevant to planetary exploration. Actual extraterrestrial deployment would require a substantially different, mission-qualified design.

F. Remote Environmental Monitoring

The rover can collect temperature, humidity, pressure and selected gas measurements from accessible remote locations and transmit them to a monitoring station.

XIII. EXPECTED RESULTS AND PERFORMANCE EVALUATION

Since SUSPENSE is currently at the design and planning stage, experimental results are not yet available. The expected outcome is an integrated prototype capable of performing the proposed functions. The following parameters will be evaluated during the implementation and testing phase.

Table V. Proposed Performance Evaluation

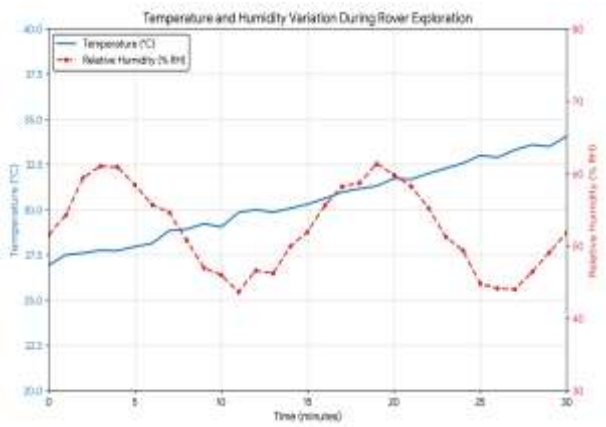
Evaluation Parameter	Testing Method
Obstacle Detection	Test detection at different distances
Obstacle Avoidance	Evaluate movement around controlled obstacles
Temperature Accuracy	Compare BME280 readings with a reference instrument
Humidity Accuracy	Compare sensor readings with a reference instrument
Gas Detection	Test against an appropriate calibrated reference
Live Video Performance	Measure frame rate and transmission delay
Event Recording	Verify whether configured events produce valid clips
Battery Monitoring	Compare voltage/current readings with reference instruments
Return Response	Test the low-battery return procedure under controlled conditions

Graphical Representation of Expected System Performance

The following graphs represent the expected behaviour and performance of the proposed SUSPENSE rover during exploration.

A. Temperature and Humidity Variation vs Time

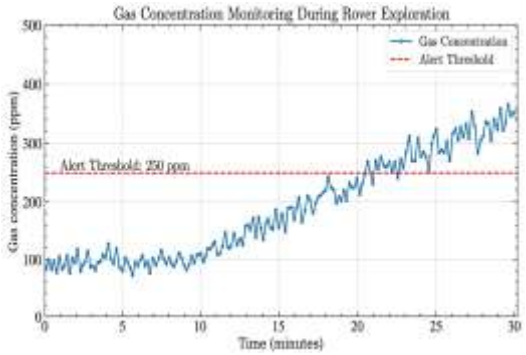
Fig. 3. Temperature and Humidity Variation During Rover Exploration.



This graph represents the expected variation in temperature and relative humidity over a 30-minute exploration period. Temperature is expected to increase gradually from approximately 27°C to 34°C, while humidity fluctuates between 45% and 60% RH.

B. Gas Concentration vs Time

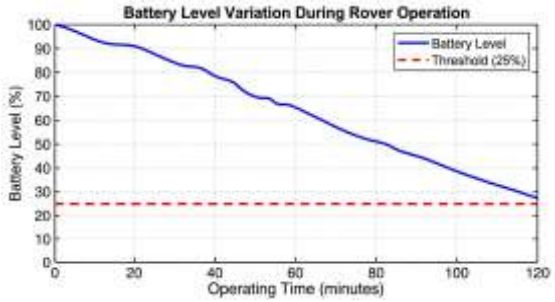
Fig. 4. Gas Concentration Monitoring During Rover Exploration.



This graph illustrates the expected gas concentration detected by the rover during exploration. The concentration initially remains around 80–120 ppm and gradually increases towards 350 ppm. A horizontal threshold line at 250 ppm represents the configured alert level. When the detected concentration exceeds this threshold, the system is expected to generate an alert and initiate event-based video recording.

C. Battery Level vs Operating Time

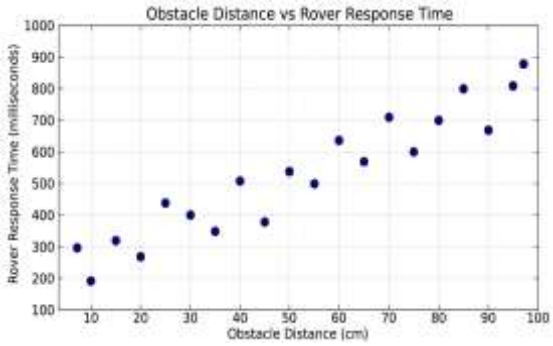
Fig. 5. Battery Level Variation During Rover Operation.



This graph illustrates the expected reduction in battery level during continuous rover operation over 120 minutes. The battery level starts at 100% and gradually decreases to approximately 25–30%. A reference line at 25% represents the configured low-battery threshold. When the battery reaches this level, the system is expected to initiate its low-battery response, including an attempt to return to the starting station.

D. Obstacle Distance vs Rover Response Time

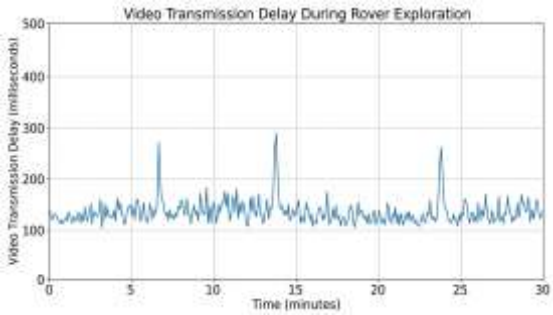
Fig. 6. Obstacle Distance vs. Rover Response Time.



This scatter plot demonstrates the relationship between the distance of detected obstacles and the rover's response time. Approximately 20 data points represent different obstacle detection conditions. The graph helps illustrate how the rover responds to obstacles at varying distances by processing sensor readings and executing appropriate navigation actions, such as stopping or changing direction.

E. Video Transmission Delay vs Time

Fig. 7. Video Transmission Delay During Rover Exploration.

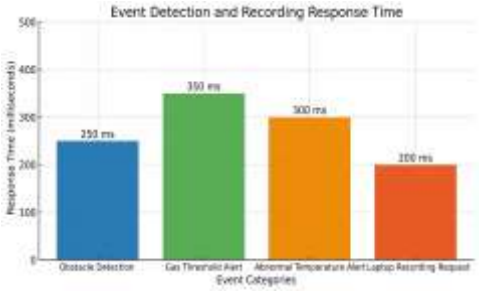


This graph represents the expected variation in video transmission delay during a 30-minute exploration period. Typical delay values remain around 100–180 milliseconds, with occasional peaks reaching 250–300 milliseconds. These fluctuations illustrate the possible effects of Wi-Fi signal conditions, communication distance and environmental interference on the transmission of live video from the rover to the laptop monitoring station.



F. Event Detection and Recording Response Time

Fig. 8. Event Detection and Recording Response Time.



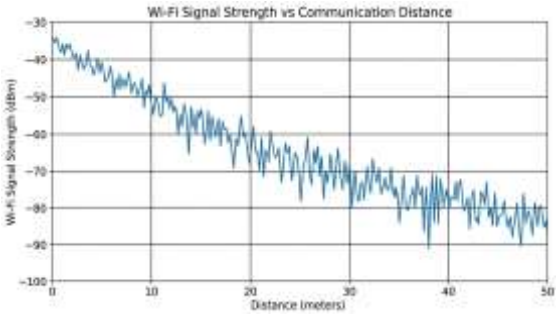
This bar graph compares the expected response time of four event-related operations in the SUSPENSE rover.

- **Obstacle Detection – 250 ms:** Expected time taken to process obstacle detection and initiate the corresponding response.
- **Gas Threshold Alert – 350 ms:** Expected time required to identify a gas threshold violation and trigger an alert.
- **Abnormal Temperature Alert – 300 ms:** Expected time required to identify abnormal temperature conditions and generate an alert.
- **Laptop Recording Request – 200 ms:** Expected time required to process a recording request received from the laptop.

The comparison helps illustrate the expected responsiveness of the event detection and recording functions.

G. Wi-Fi Signal Strength vs Distance

Fig. 9. Wi-Fi Signal Strength vs. Communication Distance



This graph illustrates the expected relationship between communication distance and Wi-Fi signal strength. The signal starts at approximately -35 dBm near the rover and gradually decreases towards -85 dBm at a distance of 50 metres. Minor fluctuations represent possible variations caused by obstacles, environmental conditions and wireless interference. It helps explain the importance of maintaining a reliable Wi-Fi connection for transmitting sensor readings, alerts and live video.

XIV. LIMITATIONS AND FUTURE SCOPE

A. Limitations

The proposed system has certain limitations:

1. Wi-Fi communication may be interrupted by distance, tunnel structures or physical obstacles.
2. The four-wheeled chassis is suitable mainly for accessible terrain and cannot guarantee movement through deep rubble or narrow collapsed spaces.
3. Environmental sensor accuracy depends on calibration and operating conditions.
4. Battery operating time depends on motor load, processing requirements and battery capacity.
5. Ultrasonic and ToF sensors have limitations in detecting certain surfaces and obstacles.
6. Reliable return-to-station operation requires suitable navigation and location information.

B. Future Scope

Possible improvements after the initial prototype include:

- Improved autonomous navigation.
- Better terrain mobility.
- Extended wireless communication coverage.
- More accurate battery-state estimation.
- Additional application-specific environmental sensors.
- Improved event recording and data storage.
- Enhanced return-to-station reliability.
- Further testing in controlled disaster-like and underground environments.

XV. CONCLUSION

This paper presents SUSPENSE, a proposed low-cost, four-wheeled autonomous exploration rover designed for preliminary inspection and environmental monitoring in accessible but potentially hazardous environments. The proposed architecture integrates Raspberry Pi-based processing, distance-sensor-based obstacle detection, environmental monitoring using BME280 and a separate gas sensor, live video transmission, event-based recording, wireless



communication and battery management. The system is intended to provide useful visual and environmental information to a laptop-based monitoring station while operating autonomously without continuous manual driving. Its potential applications include disaster-affected areas, underground mines, tunnels, caves, industrial locations, remote environmental monitoring and terrestrial research related to planetary exploration. The project remains at the design stage

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