IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Coal Mine Monitoring System With Landslide Hazard Detection

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Abstract: Real time monitoring of landslides is one of the challenging research areas nowadays within the field of geophysical research. The event of an actual field deployment of devices network primarily based landslide detection system. This system uses sensor nodes and communication for efficient delivery of real time data to the system for monitoring and provides warning and risk assessments to the inhabitants of the area. This network will be used for understanding the capability and usability of sensor network for critical and emergency application. In the context this project delves into the development of a sensor based system that utilizes multiple sensors for landslide detection as well. We will explore how these sensors enhance the monitoring surrounding environmental awareness in a coal mine, enabling it to relay data in dynamic and complex scenarios.

Keywords: Temperature Sensor, Pressure Sensor, Gas Sensor, Buzzer

Introduction

A mine is considered to be a plant that produces useful mineral with a given percentage of ore and given quantity, whereas the cost of mining is expected to be minimum price. Geological conditions of any mine are determined by nature. They are unpredictable. The various environmental parameters of mine system, such as methane, carbon monoxide, temperature, oxygen and so on, are currently using the traditional cable transmission. Thus truly mine methane; carbon monoxide gas accumulation area mechanized mining face, such as the dead gob cable security parameters cannot be monitored, so they cannot predict the alarm. Mining project activity is subject to high risks because of its size, the emission of toxic gases from the coal seam in turn leads to air pollution in the mine area. These conditions can be monitored using robotic device.

The filed robotics constantly evolving, with robots becoming increasingly sophisticated and capable of operating in complex environments. One key factor driving this advancement is the integration of multi-parameter observing sensors. These sensors allow robots to perceive their surroundings in a richer and more nuanced way compared to traditional single-parameter sensors.

A robot equipped with multi-parameter sensors could gather data on temperature, pressure, and even the presence of specific gases. This rich data allows the robot to identify potential hazards with greater accuracy, ultimately completing its task more safely and effectively.

Literature Review:

No	Research paper , Author	Research work done	Proposed work
1.	Recent Advancements in IoT Implementation for Environmental, Safety, and Production Monitoring in Underground Mines ; 2023 Huili Zhang , Binghao Li , Senior Member, IEEE, Mahmoud Karimi, Serkan Saydam, and Mahbub Hassan , Senior Member, IEEE	Discussion of various working situations and recent trends in industry	Actual implementation of some of these techniques for demonstrative / fabricated model
2.	COAL MINE WORKER SAFETY MONITORING AND ALERTING SYSTEM USING IOT TECHNOLOGY ; 2024 U. Chandra mouli1, M. Namratha2, N. Rahim Kumar3, U. Teja4, P. Venkata Kalyan5, Dr. Virender Singh6	Wear on device with two sensor for workers	Remotely operated robotic device with array of sensors including critical and video sensors
3.	COAL MINE SAFETY MONITORING AND ALERTING SYSTEM POWERED BY THE INTERNET OF THINGS ; 2023 Dr. N. Sambasiva Rao1, Mr. Gangisetty Devanand2, Vamsi Addagarla3, Gayathri Paila4, Nagateja Methukumelli5, Lakshmi Siva Sri Ram Lakkoju6	Five sensor based system , wireless working, standalone system	More than seven, eight sensor sytem , wireless system, mobile unit with onboard power supply along with video streaming.
4.	Low-Cost Sensor-Based and LoRaWAN Opportunities for Landslide Monitoring Systems on IoT Platform: A Review ; **2022** SWAPNIL BAGWARI1, ANITA GEHLOT2, RAJESH SINGH2, NEERAJ PRIYADARSHI 3, (Senior Member, IEEE), AND BASEEM	Discussion of various sensors and their characteristics and wireless data transmission	Actual implementation of some of these sensors and data transmision using wireless method.

	KHAN 4, (Senior Member, IEEE)		
5.	IoT-Driven Microseismic Sensing System and Monitoring Platform for Landslide Detection ;**2024** P. K. INDUKALA , U. G. GOSH, AND MANEESHA VINODINI RAMESH , (Senior Member, IEEE)	A comprehensive study and implementation of a type of sensor	Implementation of multiple types of sensors and a novel concept sensing method
6.	IoT based Landslide Detection and Monitoring System ;2022 Mrunal Jawalkar1, Nikita Malviya2, Prerna Hage3, Shraddha Chakule4, Pranav Pattewar	Two sensors are used with wireless data transmission	More sensors with some novel method are used with wireless data transmission

Problem Formulation:

In the previous papers and the devices made the sensors used are less number and so they detect the less number of parameters. In the coal mine monitoring system the parameters depends on natural conditions and as well as the second part is the landslide hazard detection is also important to find out the land is proper for the coal mine generation for extraction of coal as well as it concerns to the safety of the workers. So the overall key is it is comprehensive study which includes land collapsing and internal as well as external parameters.

Problem Statement:

The problem lies in the lack of effective, real-time monitoring systems for predicting and mitigating landslides in coal mining areas. Existing approaches are often limited by geographical reach, accuracy, or the ability to provide timely alerts for preventive measures.

Therefore, the research aims to design an intelligent monitoring system for coal mining regions that can:
- Detect early signs of landslides (e.g., ground movement, changes in terrain, rainfall, etc.)
- Provide real-time data to mining operators and authorities
- Offer predictive analytics for risk assessment and timely intervention.

Methodology:

This section outlines the key steps involved in developing a robotic system that utilizes multi-parameter observing sensors.

1. Define Project Goals and Requirements:

- **Identify the Application:** Clearly define the purpose of the robot and the environment it will operate in. (e.g., environmental monitoring, land slide detection, coal mine inspection and rescue as well)
- **Specify Environmental Parameters:** Determine the critical environmental factors the robot needs to be aware of for successful operation. (e.g., Temperature, pressure, obstacles, presence of chemicals)

2. Sensor Selection and Integration:

- **Research Sensors:** Explore various sensor technologies capable of measuring the chosen environmental parameters. Consider factors like range, accuracy, size, power consumption, and cost.
- **Choose Appropriate Sensors:** Select the most suitable sensor for each parameter, considering the application requirements and robot platform limitations.
- **Sensor Integration:** Physically integrate the chosen sensors onto the robot platform, ensuring proper placement and secure connections.
- **Calibration and Testing:** Calibrate each sensor for accurate readings and thoroughly test the integrated sensor suite for functionality and communication with the robot controller.

3. Data Acquisition and Processing:

- **Data Acquisition System:** Develop a system to collect raw data from all sensors at a specified sampling rate. This may involve an embedded controller or dedicated data acquisition hardware.

- **Feature Extraction:** Extract relevant features from the preprocessed data that best represent the environmental parameters for decision-making. (e.g., Average temperature, range to obstacle, presence of specific chemicals)

4. Testing and Evaluation:

Real-World Testing: Conduct real-world testing in a controlled environment that mimics the target application. This allows for evaluation of the robot's performance with actual sensor data.

- **Iterative Improvement:** Based on testing results, refine sensor selection, data processing methods, or decision-making to optimize performance.

5. Documentation and Reporting:

- **Document the Design Process:** Detail the sensor selection, integration techniques, data processing algorithms, and decision-making strategies.
- **Present Results:** Report the performance of the robot in simulations / real-world testing, highlighting the effectiveness of the multi-parameter sensor approach.

Conclusion:

After testing in simulated / real time environment the proposed work shall prove its usefulness not only in coal mine region but in many associated / allied fields and shall contribute to provide more safe and secure environment for workers in the vicinity and allied authorities.

References:

1.
Huili Zhang , Binghao Li , Senior Member, IEEE, Mahmoud Karimi, Serkan Saydam, and Mahbub Hassan , Senior Member, IEEE

Recent Advancements in IoT Implementation for Environmental, Safety, and Production Monitoring in Underground Mines ; 2023
IEEE INTERNET OF THINGS JOURNAL, VOL. 10, NO. 16, 15 AUGUST 2023

2.
U. Chandra mouli1, M. Namratha2, N. Rahim Kumar3, U. Teja4, P. Venkata Kalyan5, Dr. Virender Singh6
COAL MINE WORKER SAFETY MONITORING AND ALERTING SYSTEM USING IOT TECHNOLOGY ; 2024
INTERNATIONAL JOURNAL OF PROGRESSIVE RESEARCH IN ENGINEERING MANAGEMENT AND SCIENCE (IJPREMS)

Vol. 04, Issue 05, May 2024, pp: 1111-1114

3.
Dr. N. Sambasiva Rao1, Mr. Gangisetty Devanand2, Vamsi Addagarla3, Gayathri Paila4, Nagateja Methukumelli5, Lakshmi Siva Sri Ram Lakkoju6

COAL MINE SAFETY MONITORING AND ALERTING SYSTEM POWERED BY THE INTERNET OF THINGS ; 2023
INTERNATIONAL JOURNAL OF PROGRESSIVE RESEARCH IN ENGINEERING MANAGEMENT AND SCIENCE (IJPREMS)

Vol. 03, Issue 08, August 2023, pp : 364-371

4.
SWAPNIL BAGWARI1, ANITA GEHLOT2, RAJESH SINGH2, NEERAJ PRIYADARSHI 3, (Senior Member, IEEE), AND BASEEM KHAN 4, (Senior Member, IEEE)
Low-Cost Sensor-Based and LoRaWAN Opportunities for Landslide Monitoring Systems on IoT Platform: A Review ; **2022**
Received November 20, 2021, accepted December 6, 2021, date of publication December 23, 2021,
date of current version January 20, 2022.
Digital Object Identifier 10.1109/ACCESS.2021.3137841

5.

P. K. INDUKALA , U. G. GOSH, AND MANEESHA VINODINI RAMESH , (Senior Member, IEEE)

IoT-Driven Microseismic Sensing System and Monitoring Platform for Landslide Detection ;**2024**

Received 28 June 2024, accepted 5 July 2024, date of publication 12 July 2024, date of current version 23 July 2024.

Digital Object Identifier 10.1109/ACCESS.2024.3427386

6.

Mrunal Jawalkar1, Nikita Malviya2, Prerna Hage3, Shraddha Chakule4, Pranav Pattewar

IoT based Landslide Detection and Monitoring System ;2022

International Journal for Research in Applied Science & Engineering Technology (IJRASET)

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538

Volume 10 Issue V May 2022- Available at www.ijraset.com