

Comparing the other papers:

S.No	Paper title and journal/conf details	Inference/Achieved	Gaps identified
1	<p>Title: Digital Transformation in Coal Mining: IoT-Based Air Quality Monitoring System</p> <p>Conference: 023 International Conference on Advanced Mechatronics, Intelligent Manufacture and Industrial Automation (ICAMIMIA)</p>	<p>The technology improves safety and decision-making by offering precise, upto-date data on air quality.</p> <p>It enhances worker safety in mining and promotes environmental sustainability. Through instantaneous data analysis, mining operations are optimized.</p>	<p>Placement of sensors near mining operations is recommended to obtain more accurate data.</p> <p>We require more precise threshold criteria and automated response mechanisms.</p> <p>Scalability and interoperability with other environmental monitoring systems are two areas where the system still needs work.</p>
2	<p>Title: IoT Based Coal Mines Safety Monitoring and Alerting System</p> <p>Conference: 2024 10th International Conference on Communication and Signal Processing (ICCSP)</p>	<p>By keeping an eye on vital indicators, the technology improves mine safety.</p> <p>When limitations are exceeded, it sounds a warning and activates a buzzer to prompt urgent action. IoT-based remote monitoring enhances risk management and intervention.</p>	<p>Compared with wireless options, wired setup is more expensive and timeconsuming.</p> <p>There is no discussion of scalability for larger businesses.</p> <p>There is no discussion of sensor accuracy and reliability problems in challenging situations.</p>
3	<p>Title: A Monitoring and Warning System for Hazards in Coal Mines using CNN and Sensor Fusion</p> <p>Conference: 2024 5th International Conference on Advancements in Computational Sciences (ICACS)</p>	<p>By integrating structural and gas hazard evaluations, the system increases safety.</p> <p>It uses cutting edge technology to provide notifications in real time.</p> <p>It seeks to raise safety standards and lower incident rates.</p>	<p>Expanding data gathering across several mines is necessary.</p> <p>requires mesh network configuration and ZigBee connection with ESP32. The device's power efficiency has to be improved.</p>

4	Title: Real Time Safety Monitoring System in Coal Mines Using IoT	The IoT-based system effectively monitors coal mine conditions	1. Lacks air quality and
	Conference: 2024 International Conference on Intelligent Systems for Cybersecurity (ISCS)	with sensors for gas, temperature, and humidity. The integration of wireless technology and a comprehensive alert system enhances safety and response times.	seismic sensors. 2. Machine learning for data analysis is missing. 3. Wired systems still pose risks in emergencies. 4o mini
5	Title: On Underground Coal Mine Environment Monitoring with LoRa Range Extension Conference: 2023 5th International Conference on Energy, Power and Environment: Towards Flexible Green Energy Technologies (ICEPE)	By using spreading factor optimization and message relaying, the system improves network coverage, displays efficient realtime monitoring of underground coal mine conditions, and achieves power efficiency appropriate for severe situations.	Subsequent research should investigate directional antennas and sophisticated methods for extending range. Signal attenuation and interference are still problems, and the system has to be better adjusted to complicated subterranean settings.

Literature Survey:

Recent advancements in IoT (Internet of Things) technologies have revolutionized the way we monitor and manage air quality in coal mining settings. This review delves into a variety of innovative solutions and methodologies developed to tackle the unique challenges associated with air quality and miner safety in subterranean environments. By examining cutting-edge research and technological implementations, we highlight the evolution of IoT applications aimed at enhancing both environmental monitoring and operational safety within coal mines.

In 2019, Yongping Wu and Guo Feng investigated the application of Bluetooth technology for the surveillance of coal mine shafts. They underscored Bluetooth's advantages as a widely accepted standard for short-distance communication, which provides a cost-effective and energy-efficient method for remote air interface and control systems. Their study delves into the Bluetooth protocol stack's evolution and its integration with mature CAN bus technology, tackling the issues related to cabling in the challenging conditions of mining environments. They advocate for Bluetooth as a viable alternative to conventional communication systems due to its practicality and effectiveness.

In 2020, Y.S Dohare and T. Maity introduced an energy-efficient wireless sensor network utilizing Zigbee technology aimed at enhancing monitoring and mitigating risks in coal mines. The network is composed of various nodes that transmit data wirelessly, enabling real-time communication between ground stations and miners. While this system is recognized for its straightforward installation and affordability, it primarily focuses on environmental monitoring and does not include provisions for evaluating the health status of the miners.

In 2021, research on the SMS Update Notification (SUN) system utilizing Raspberry Pi presented an innovative method for delivering notifications in various work environments. By combining a GSM module with the Raspberry Pi, this system enables authorized users to dispatch SMS alerts that are then shown on a web interface. This solution provides an effective communication tool for remote and difficult environments, though it may need further modifications to be fully applicable for real-time air quality monitoring in mining settings.

In 2024, a cutting-edge helmet system for coal miners was created to continuously track critical parameters such as humidity, temperature, and levels of gases like methane and sulfur dioxide. This advanced system enhances safety protocols by providing real-time monitoring, thereby improving the overall safety standards in underground mining environments.