Smart Jacket for the Safety of Coal Miners

Syed Ashhad Ibrar[1], Bisma Javed[2], Sehrish Younas[2], and Faizan Badar[2]

[1]*Student Member IEEE, Department of Biomedical Engineering, University of Engineering and Technology Lahore (Narowal Campus)*
[2] *Department of Biomedical Engineering, University of Engineering and Technology Lahore (Narowal Campus)*

1 Introduction

Coal mining is considered one of the most dangerous professions in the world due to the numerous hazards associated with the industry. The underground working environment in coal mines presents numerous physical and health risks to miners, including exposure to toxic fumes, fire, and explosions, as well as the risk of other accidents. The health and safety of miners, who play a critical role in driving the industry, should be given the highest priority. IIoT (Industrial Internet of Things) is transforming the way of monitoring and management of industrial processes. It involves the integration of internet-connected devices with existing industrial systems to create a smart and connected ecosystem. The IIoT enables real-time monitoring and analysis of data from industrial processes, providing insights into performance and efficiency. This information can be used to optimize processes and improve safety. [1] In this project, we have designed a smart jacket for the safety and monitoring of coal miners using IIoT technology. The system detects different parameters for monitoring the safety and protection of coal miners. All this data of parameters is sent to the control room where safety precautions are monitored.

2 Methods and Results:

The complete system is implemented on a single jacket and ESP-32 is used for signal processing and sends the sensor data using WiFi technology. MQ-4, MQ-7, and MQ-135 sensors have been used to monitor the concentration of Methane, CO, and O_2 in the coal mine. DHT11 sensors monitor the temperature and humidity in the air. While the MPU6050 is used in fall detection in any emergency situation. The pulse sensor is used to monitor the heartbeat of coal mine workers continuously. If gases and temperature level rises from their normal concentration, the worker falls down or his heartbeat slows down then normal. The buzzer turns on and warns the worker and control room about emergency situations.
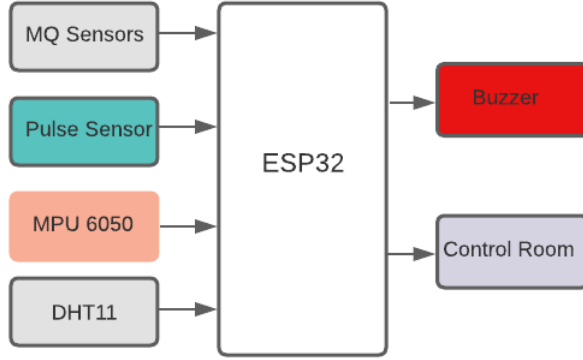
Figure 1: The block diagram of implemented system

3 Conclusion

This research is aimed towards improving the safety of coal miners. The smart jacket for coal miners using IIoT technology is a significant step towards enhancing the safety and protection of workers in the coal mining industry. The integration of various sensors and technology provides real-time monitoring of various parameters, including gas concentrations, temperature, humidity, heartbeat, and fall detection. The system alerts workers and the control room in case of emergency situations, enabling immediate action to be taken. This project not only enhances the safety and well-being of workers but also contributes to sustainability in the industry by ensuring the health and safety of those who play a critical role in driving the industry. By incorporating advanced technology in the industry, the coal mining industry can work towards creating a safer and more sustainable work environment for its workers.

References

[1] S. Munirathinam, "Chapter six - industry 4.0: Industrial internet of things (iiot)," in *The Digital Twin Paradigm for Smarter Systems and Environments: The Industry Use Cases* (P. Raj and P. Evangeline, eds.), vol. 117 of *Advances in Computers*, pp. 129–164, Elsevier, 2020.