Title

AI-Based Real-Time Coal Mine Safety Monitoring System

Abstract

Coal mining operations in India face persistent safety challenges due to hazardous gas accumulation, structural instability, and delayed human response. This project proposes an AI-based real-time monitoring system for coal mines that integrates IoT sensors with machine learning models to predict unsafe conditions such as methane leakage, roof collapse risks, and abnormal temperature variations. The system aims to reduce fatal accidents, enhance worker safety, and support proactive decision-making for mine operators.

Problem Statement

Despite advances in mining technology, coal mine accidents remain a major concern due to delayed detection of hazardous conditions. Existing safety mechanisms rely heavily on manual inspections and threshold-based alarms, which are insufficient for complex underground environments.

Objectives

1. To design an AI-driven system for continuous mine safety monitoring
2. To predict hazardous events before they occur using machine learning
3. To provide real-time alerts to mine operators
4. To reduce mine-related accidents and fatalities

Methodology

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Deployment of IoT sensors for gas, temperature, and vibration monitoring

- Data collection and preprocessing
- Training ML models for anomaly detection
- Integration with a centralized monitoring dashboard

Expected Outcomes

- Early warning system for mine hazards
- Improved worker safety
- Reduction in operational downtime
- Scalable solution for multiple mining sites

Relevance to Coal Sector

The proposed solution directly addresses critical safety challenges in coal mining operations and aligns with Coal India Limited’s mission to ensure sustainable and safe mining practices.

Budget Estimate

- Equipment: ₹18,00,000
- Manpower: ₹8,00,000

- Software & Cloud: ₹3,00,000
- Travel & Miscellaneous: ₹1,00,000

Total Budget: ₹30,00,000

Project Duration

24 months

Institution Capability

The proposing institution has prior experience in AI, IoT, and mining-related research projects, with dedicated infrastructure and domain experts.