Smart India Hackathon 2025

AI-Based Rockfall Prediction and Alert System

Problem ID: 25071 | Theme: Disaster Management

Category: Software

Team: Cluster 2.0 (Rakshak)

Proposed Solution / Idea

- Predictive ML models detect precursors of rockfalls
- Real-time risk mapping (Red = High, Yellow = Medium, Green = Safe)
- Automated alerts: SMS, Email, Mobile app, Buzzers
- Smart handbands guide workers to nearest safe zones
- Scalable & adaptive with existing mine infrastructure

Technical Approach

Data Sources:

• DEM (Digital Elevation Models) – slope geometry

• Drone imagery – detect cracks, provide real-time maps

• IoT sensors – strain, vibration, weather

• Weather APIs & historical failure events

Technologies:

• Python, TensorFlow, PyTorch (AI/ML models)

• OpenCV + GIS for DEM & image processing

• Cloud-based data pipeline & storage

• Web/Mobile Dashboard (React, Node.js, Flask/Django)

Feasibility & Viability

Feasibility:

- Technical: Uses AI, IoT, GPS, Cloud
- Economical: Open-source reduces costs
- Operational: Easy site integration

Viability:

- Revenue: Licensing & partnerships
- Scalability: Mines, tunnels, highways
- Social Impact: Enhances worker safety

Challenges:

- Data scarcity for rockfall cases
- Offline functionality in remote mines

Impact & Benefits

Worker Safety: Up to 50% fewer injuries

Operational Uptime: 25–30% more productivity

Cost Savings: 40% lower monitoring/equipment losses

Social: Safer miners, commuters, villages

Economic: Saves ■10–15 lakh per incident

Environmental: Lower emissions, eco-friendly sensors

Technological: Outperforms traditional methods

References & Demo

- DEM & GIS datasets (open sources)
- Weather APIs (IMD, OpenWeather)
- Research papers on rockfall prediction
- Industry reports on mining safety

Demo Link: https://zippy-twilight-24f1a1.netlify.app