

Grant Number: AFCTG20-103

Title: Comprehensive Atmospheric Monitoring in Underground Coal Mines: Long Term Critical Trend Analysis and Tablet-Based Communication

Organization: University of Kentucky

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Partnerships: Blackhawk Mining LLC and Buchanan Minerals

Focus Area: Health and Safety Interventions: Monitoring Systems and Integrated Control Technologies

SYNOPSIS

Problem Statement: Big data is generated at both surface and underground mining operations. Real-time operational and equipment maintenance data as well as data related to mining conditions such as ground control, ventilation, are amassed at tremendous rates. This data, however, unless properly analyzed, cannot provide the information needed for informed decisions regarding safety and health in the workplace. Therefore, methodologies are required not only to analyze this data in order to develop potential risk indicators or matrices (commonly used in preventive equipment maintenance), but also to communicate the results to mine personnel, stakeholders and decision makers in real or near real-time in a user-friendly way.

Research Approach: This project will collect atmospheric data from underground mines and analyze them using long term trend analysis. The goal of the analysis is to determine factors that indicate developing critical conditions. When these conditions are found in the development stage, they can be mitigated safely, timely and effectively.

In partnership underground coal mines the research group will develop a unique database which includes both underground sensor data as well as data external to mining operations, such as regional or local barometric pressure, temperature and humidity. Currently, methods and tools for big data analysis and presentation are readily available although such tools have not been implemented for analyzing atmospheric mine data related to underground coal mining operations.

The research approach will focus on (a) the development of automated data reduction techniques aimed at long term analysis of atmospheric time series data and their relationships to meteorological and possibly other related time series data (such as production rate) and (b) the development of a web interface optimized for *real-time or near real-time* atmospheric data visualization for mine personnel.

Impact of the Research: Mine operators and stakeholders will be able to visualize atmospheric data measurement in near real-time on mobile devices, including tablet computers, cell phones or comparable portable technology. In addition, an alerting and notification subsystem will be developed based on forecasting of underground atmospheric conditions as a function of meteorological measurements and other related data such as production levels, etc.