Project Title: Integrated Surface Mining Safety System.

Organization: West Virginia University Foundation.

Partnerships: Red Hills Mine, Mississippi Lignite Mining Company (North American Coal)

Investigator(s): Vladislav Kecojevic (PI)
Vinod Kulathumani (Co-PI)
Bojan Cukic (Co-PI)
Ashish Nimbarte (Co-PI)

Focus Area: Safety

SYNOPSIS

Problem Statement and Justification: Although the total number of mining fatalities have trended downward during the past two decades, the proportion of these fatalities involving mining equipment (powered haulage, machinery and hoisting) has consistently been significant. According to the MSHA records, a total of 643 fatalities, or 68.8%, is attributed to the mining equipment from 1995 to 2011. Further analysis of MSHA data indicates that 85.1% of truck-related fatalities, 80% of conveyor related fatalities, 84.6% of loader-related fatalities, and 87.1% of dozer-related fatalities occurred in surface mining. In order to reduce these fatalities, the mining industry has applied numerous technological and engineering advances, behavioral principles, and training programs. Yet, challenges still remain as evidenced by the persistent recunence of fatalities and the significant proportion of equipment-related fatalities as compared to all fatalities that occur in US coal, metal and non-metal mining. Additional problem represents a lack of research capacity in surface mining safety in US mining schools.

Impact of the Research: The outcome of the project has a potential to address the root causes of equipment- related fatal and non-fatal injuries in the surface mining operations. The proposed system is expected to provide both real time processing and hazard identification, and also support post processing of the data for the analysis of patterns that may be significant for hazard mitigation. As opposed to lea ving individual sensing sub-systems disconnected, a ll components will be integrated into a common information management. Such an integrated system will enable the data from multiple sensing su b-systems to be fused and hence facilitate more exhaustive hazard monitoring, tisk analysis and Jong-tenn data analytics for risk management.

Objective(s) and Research Approach: The main objective of this research is to develop and deploy an integrated safety system to help reduce equipment-related fatal and non-fatal injuries. We will (i) design a large-scale sensor network system; (ii) establish infrastructure communication platform and information management system for real-time situational awareness; (iii) provide a non-distractive User Interface for equipment operators/drivers and an integrated, informative console for mine operation management; and (iv) educate and train a new generation of professionals who will be working on surface mining safety research. The proposed system will include features such as existing proximity warning system and non-invasive eye detection and tracking system for drivers fatigue; vehicular motion profile; illumination on the site; critical intersections in the mine; reduced visibility due to factors such as dust and fog; speed of the vehicle; and warning signals if maintenance of the equipment is not conducted after certain miles and/or hours. The proposed integrated system will be tested and deployed at an operating surface coal mine in southern US.