

Productivity and Safety Management of Coal Mines

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ABSTRACT

Being in the present technological era Coal Mining could be considered as one among the most significant domains where not only refuge arrangements but the thought of “productivity” as well is becoming an ever-increasing point of focus. Regarding coal mines the “management system” practiced in coal mines is entirely manual thus making it significantly difficult to remain updated about the most essential security-related situations early monitor employees in an appropriate manner and as a outcome take immediate actions during the time of emergency situations. As a start to developing “An App and Web-Based Software for work efficiency & Security Management of Coal Mines” that is an entirely technological innovation solution set aiming to cater to the coal mining management requirements by means of “continuous” and “automatic” notification systems basing entirely on decision-making by “analysis.”

The platform will also encompass a mobile app for use by the miners and employees at the mines a web-based application for use by the respective supervisors. This classification will also contain facilitating a seamless communication process for different levels of operations conducted through the use of functions such as location tracking accident reporting e- checklists equipment management and assignment systems. The miners system will also comprise the application and utilization of internet of things sensors for the purpose of testing gas content composition temperature and all aspects related to safety.

I. INTRODUCTION

Being ratified as part of the tougher tasks coal mining an area that need to be dealt with safety also efficiency with utmost cautions. Being dependent on the human errors in both written and verbal communication forms

the processes involving coal mining were relying on the mistakes in both communication forms. However with smartphones being inducted into the processes of coal mines technology has started upgrading the processes of tracking the activities of coal mines thus shortening the response time to the threats to a great extent.

This proposed project entitled “An App and Web-Based Management of Coal Mines” develops an intelligent system for the efficiency and safety aspects of a coal mine. The computer software ought to provide details about the personnel and environment of mine which enables the supervisors to monitor and prepare for emergencies. Mobile application: this can be utilized by miners and field staff to check-in at their location as well as assignment of tasks submission of incidents sending SOS and status update – all will be carried out in real-time.

Additionally this will help to track the location of a miner with respect to mine safety. The online dashboard can also be provided for the managers that monitoring of the live location of employees the location of equipment the allocation of tasks the reporting of issues affecting productivity as well as the reporting of potential risks posed by gas leakage and equipment failure. Besides that the dashboard is also able to connect with the sensors that are utilized in the application of the concept of IoT in identifying gas/temperature vibrations and potential risks posed by unsafe movements within the mine area. potentially the affirmative impact that may be caused by the reduced cost of the daily business operations carried out at the mine site as a result of improved opportunities for communication and mine safety inspections made available through technology and specialist care of the mine activities at the site.

II. LITERATURE REVIEW

Productivity and safety management in coal mines is grounded in the principle that efficient production and worker safety are mutually dependent rather than conflicting objectives. In modern mining theory, a coal mine is considered a socio-technical system where human workers, machinery, environmental conditions, and management policies interact continuously. Any imbalance within this system—such as equipment failure, unsafe behavior, or poor supervision—can affect both output and safety performance. Therefore, an integrated and systematic approach is required to maintain operational stability.

The theoretical base of safety management in coal mines is strongly influenced by accident causation theories. One of the earliest and most influential models is the Domino Theory proposed by Herbert William Heinrich. According to this theory, accidents occur due to a sequential chain of events, beginning with social environment and leading to unsafe acts, accidents, and finally injury. If one element in this chain is removed, the accident can be prevented. In coal mining, this means eliminating unsafe conditions such as methane accumulation, poor ventilation, unstable roofs, or improper equipment handling to stop accidents before they occur.

Overall, the theory of productivity and safety management in coal mines emphasizes that sustainable production can only be achieved through systematic risk control, technological integration, human-centered design, and effective organizational management. Safety improvements reduce accidents and downtime, which in turn enhance productivity. Thus, modern mining theory supports the concept that safe operations form the foundation of long-term productive efficiency.

III. EXISTING SYSTEM

The project entails the collection of real-time data of the monitor automation. The fact that the data placid using real-time monitoring methods for the automation of the project exerts a large influence on ensuring safety and improvement of productivity during coal mining operations. The application of modern technology such as mobile app web dashboards IoT and analysis assists in monitoring coal mining processes 24/7 as recognizing any potential dangers.

Coal taking out is an industry with higher risks. Here the protection of the coal miners is the priority. Previously the coal mining process uses mostly manual and paper record systems. These systems will result in accidents and production loss. However technology has improved and is the solution. This project uses the above concept for the production and management of coal mine.

1. Manual Monitoring of Workers

- Attendance of the work shift and the job allocation of the employees are noted either in a paper format or using a spreadsheet.
- Management usually cannot monitor the location of employees making it harder to act promptly during emergencies.

2. Late Incident Reporting

- Safety incidents that involve near misses or equipment failure occur after the fact.
- The longer wait makes it less likely for something to happen and may cause an accident to occur.

3. Limited Equipment Monitoring

- There is manual monitoring or intermittent observation of machines.
- There is a absence of implementation of Predictive Maintenance which leads to unexpected downtime.

4. Inefficient Communication

- Warning notifications concerning danger-related emergencies and schedule changes are communicated through verbal or phone calls.
- Communication delays may heighten the severity of accidents also lower the productivity of operations.

IV. PROPOSED SYSTEM

The system is prepared to enhance levels of safety and productivity during coal mining operations by incorporating current digital technology. The proposed system will be different that still use human labor because it provides real-time monitoring and notifications. personnel to log into work receive notifications for tasks send notifications for incidence occurrences via text image or audio and send SOS notifications during emergencies through the mobile

app solution.

given by the proposed system will enable administrators to track location information equipment performance information as well as productivity information along with notifications from the mobile solution/IoT sensors dispersed all over the mine. The backend server is responsible for the linking of the mobile and web platforms through the usage of secured APIs and it also ensures that all the gathered information is stored in the centralized database by doing analysis of the gathered information from the sensors wearable technology and mobile inputs.

Any abnormal data indicating dangerous concentrations of gases vibration of the machines and entry into restricted zones will generate notifications for the management to take immediate actions to avoid any incidents. The database keeps a record of all the safety incidents and productivity of the machines and other related aspects by providing the management with the ability to generate reports.

Generally the new technology will entirely change the coal mining process it will be done in a fully improved communication channels and faster emergency response. The new technology employs mobile technology to create a very productive workplace.

System Architecture

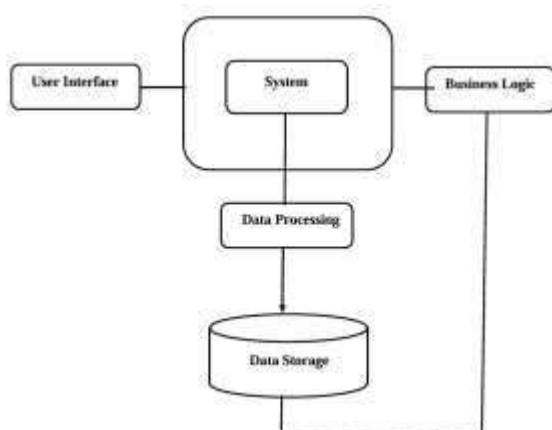


Fig 1. System Architecture

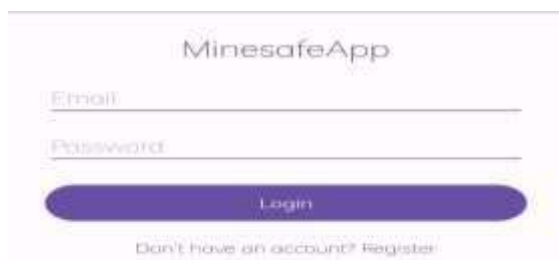
V. METHODOLOGY MODULES DESCRIPTION:

The methodology for Productivity and Safety Management of Coal Mines is designed to integrate real-time monitoring, predictive analytics, risk management, and decision support systems into a unified operational framework. The approach follows a systematic sequence beginning from data acquisition in underground environments to intelligent decision-making and corrective action at the surface control center.

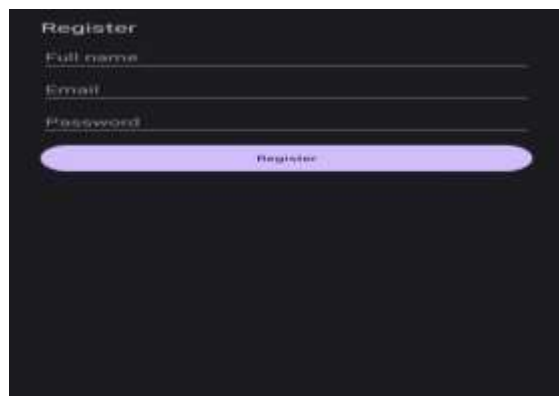
The first stage involves identifying operational and safety requirements such as gas monitoring, equipment condition tracking, worker health monitoring, and production measurement. Based on these requirements, appropriate sensors, wearable devices, and communication technologies are selected and deployed inside the mine. Environmental parameters including methane concentration, temperature, humidity, carbon monoxide levels, and dust concentration are continuously monitored using IoT-enabled sensor nodes. Simultaneously, machinery parameters such as vibration, motor temperature, conveyor speed, and load conditions are captured to evaluate equipment performance.

- 1. User Login:** The miner or supervisor logs into the system through the mobile app or web dashboard using valid credentials.
- 2. Task Assignment and Monitoring:** Supervisors use the dashboard for assigning tasks to miners. The miners receive notifications of tasks through the mobile application.
- 3. Worker Check-In/Check-Out:** Miners check in at the beginning of a shift and check out at the end of a shift. The program records check-in and check-out times.
- 4. Incident Reporting:** Miners submit safety events risks or equipment failures to the mobile app. The system stores and transmits these reports to their respective supervisors.
- 5. Real-Time Alerts:** Miners submit safety events risks or equipment failures to the mobile app. The system stores and transmits these reports to their respective supervisors.

VI. RESULT



The login page for MinesafeApp features a white background with a light blue header. It includes input fields for 'Email' and 'Password', a blue 'Login' button, and a link for 'Don't have an account? Register'.



The register page for MinesafeApp has a dark blue background. It contains input fields for 'Full name', 'Email', and 'Password', a blue 'Register' button, and a link for 'Already have an account? Login'.



The MinesafeApp dashboard has a light blue header and a white body. It includes buttons for 'Check API' and 'Logout', a section titled 'MineSafe - Safety Dashboard' with a list of safety instructions, and a 'Submit Message' button at the bottom.

1. The Login Page is the initial interface of the Productivity and Safety Management System for Coal Mines. This page allows authorized users such as administrators, safety officers, and supervisors to securely access the system.

2. The Register Page is designed to allow new users to create an account in the Productivity and Safety Management System for Coal Mines. It serves as the entry point for authorized personnel to gain access to system functionalities based on their assigned roles.

3. The Safety Dashboard shown in represents the theoretical implementation of a centralized monitoring and communication interface within a coal mine productivity and safety management system. It is based on the principles of Safety Management Systems (SMS), Human–Machine Interaction (HMI), and Real-Time Information Systems.

VII.CONCLUSION

However, for this implemented system, there would be additional developments that would make sure that this proposed system becomes efficient and safe for use at the coal mine site. Firstly, the utilisation of either AI or ML in predicting accidents, also miners' fatigue, would be included in this proposed system. Secondly, there would be more incorporation of IoT sensors in monitoring miners' environment and health. Furthermore, the feature or function that would allow this proposed system to be "voice-controlled" or "multi-languages supported/capable" would also be very helpful in ensuring that this proposed system would be used by miners at the coal mine site.

REFERENCES

1. Singh R. & Kumar A. (2020). Digitalization in Coal Mining: Enhancing Safety and Productivity Using Technology.
2. Sharma P. & Verma S. (2019). IoT- Based Safety Management in Underground Mines. Journal of Safety Research and Engineering 12(3) 45–53.
3. Python Software Foundation. (2023). Python Programming Language – Official Documentation. Retrieved from <https://www.python.org/doc/>
4. Google Developers. (2023). Android Studio Overview. Retrieved from <https://developer.android.com/studio> .
5. PostgreSQL Global Development Group. (2023). PostgreSQL Documentation. Retrieved from <https://www.postgresql.org/docs/>