

TITLE: COAL TRACKING- DATA DRIVEN EFFICIENCY IN COAL TRANSPORTATION

ABSTRACT:

1. OBJECTIVE:

- Efficient coal transportation.
- Real-time vehicle tracking.
- Load weight monitoring.
- Weather condition awareness.
- Quality Assurance: Assessment of coal quality.

2. BENEFICIARY:

- Coal-hauling companies and logistics managers.
- Vehicle operators and drivers receive real-time information on routes, weather conditions, and coal quality, ensuring safer and more efficient driving.
- Customers relying on timely coal delivery as they can monitor the quality of transported coal
- Safety and quality assurance personnel.
- Environmental compliance authorities.
- Efforts to reduce transportation costs and improve efficiency.
- Data-driven decision-making for route optimization.

3. VALUE OF USAGE:

- Safety: Weather alerts and environmental suitability monitoring.
- Cost Reduction: Route optimization for fuel and time savings.
- User-Friendly: Easy-to-use mobile interface for accessibility.
- Informed Decisions: Continuous updates for better decision-making.

PROBLEM STATEMENT:

The coal transportation industry faces significant challenges in optimizing efficiency, safety, and quality within its operations. Current issues include inefficient transportation processes that result in increased costs and time inefficiencies, as well as a lack of real-time visibility into vehicle locations, hindering the ability to monitor and optimize delivery routes. Load management problems, such as overloading and underloading of coal trucks, pose safety risks and impede operational effectiveness. Furthermore, disruptions caused by unfavorable weather conditions at the source or destination locations often lead to delays and increased operational costs. Ensuring the environmental suitability of the transportation process and monitoring coal quality are ongoing concerns. In addition, the absence of route optimization contributes to

unnecessary fuel consumption and longer transportation times. To address these challenges, the proposed solution aims to provide an integrated system that optimizes coal transportation, enhances safety, continuously monitors environmental conditions, and offers real-time data updates to facilitate informed decision-making, thereby improving the coal transportation process.

PROPOSED SOLUTION:

A comprehensive system designed to revolutionize the coal transportation industry. It integrates cutting-edge technologies and sensors to streamline the entire process, ensuring efficiency, safety, and quality at every step. Each coal-hauling vehicle is equipped with a GPS module that assigns a unique Vehicle ID, enabling real-time tracking of vehicle locations and offering logistics managers and operators unprecedented visibility into the transportation network. Load weight is continuously monitored using load cells within the vehicles, minimizing safety risks associated with overloading or underloading. Weather conditions at the source and destination are tracked to anticipate unfavorable conditions and proactively manage transportation schedules.

Environmental conditions are diligently monitored, including temperature and humidity, using the DHT11 sensor, which also employs a Machine Learning model to assess coal quality. Route optimization takes into account real-time traffic and road conditions, reducing fuel consumption and transportation time. A user-friendly mobile application provides operators with a comprehensive interface to access continuous updates on remaining coal weight, distributed coal, weather forecasts, optimized routes, and coal quality from a central server. This solution aims to transform coal transportation by enhancing efficiency, safety, and environmental suitability while providing the tools and information needed for better decision-making throughout the process.

BACKGROUND:

The background for this solution is characterized by a series of interconnected challenges. Conventional coal transportation processes have often been marred by suboptimal routing, inaccurate load management, and consequently, higher operational costs, extended delivery timelines, and a notable environmental footprint. Safety concerns loom large, with vehicle overloading or underloading being particularly precarious, endangering the safety of drivers and other road users. Weather-related disruptions, a common occurrence in transportation, lead to delays, cost overruns, and disruptions in the supply chain. Ensuring coal quality is a paramount issue, especially in terms of temperature and humidity control, as the value and usability of coal are intricately tied to its quality during transport. Moreover, environmental impact considerations are critical to ensure transportation is conducted in environmentally suitable conditions,

serving the twin goals of preserving coal quality and adhering to environmental regulations.

The backdrop for this proposed solution is further characterized by a broader industry trend that embraces advanced technologies such as GPS, IoT sensors, Machine Learning, and mobile applications to optimize various aspects of the logistics and transportation sector. By capitalizing on these technologies, the proposed solution aims to address the multifaceted challenges within the coal transportation sector and usher in a new era of enhanced efficiency, safety, and environmental responsibility. It seeks to align the industry with modern standards and best practices, catering to the evolving needs of the energy and manufacturing sectors. Ultimately, the solution represents a transformative step towards a more streamlined, responsible, and technologically advanced coal transportation industry.

DESCRIPTION OF THE PROJECT:

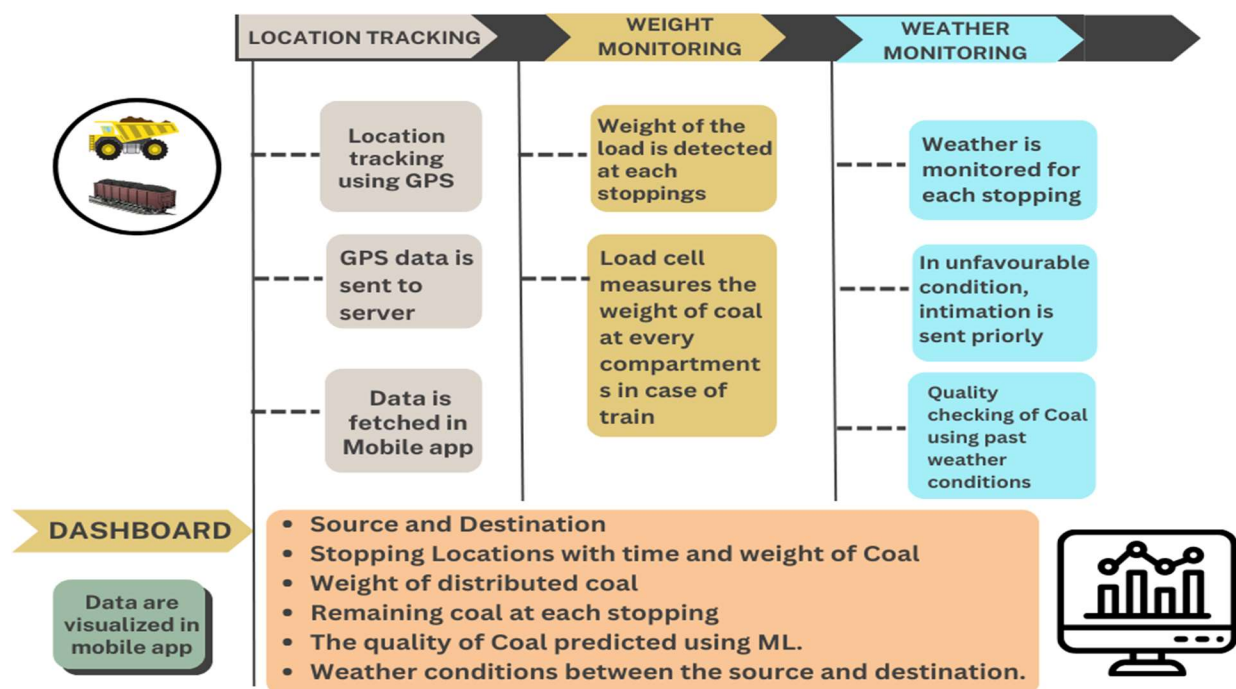
The project focuses on the development and implementation of a sophisticated system designed to revolutionize coal transportation. It incorporates cutting-edge technologies and sensor-based solutions to address inefficiencies and challenges within the coal logistics industry. The core components and functionalities of this project are as follows:

- **Vehicle Tracking and Identification:** Each coal-hauling vehicle is equipped with a GPS module, assigning a unique Vehicle ID to enable real-time tracking of vehicle locations.
- **Location Monitoring:** The system continuously tracks the real-time location of each vehicle using GPS technology, providing logistics managers and operators with unparalleled visibility into the coal transportation network.
- **Load Weight Monitoring:** Load cells within the vehicles monitor the weight of the coal, ensuring accurate and safe load management and mitigating safety risks associated with overloading or underloading.
- **Weather and Environmental Monitoring:** The system monitors weather conditions at both the source and destination locations to anticipate unfavorable conditions, proactively manage transportation schedules, and ensure environmental suitability for coal transportation.
- **Coal Quality Assessment:** A DHT11 sensor is employed to continuously monitor temperature and humidity, while a Machine Learning model assesses coal quality, guaranteeing the integrity of the product throughout transportation.
- **Route Optimization:** Real-time data on traffic conditions and road quality are integrated to suggest optimized routes, reducing fuel consumption and transportation time.

- **Mobile Application Interface:** A user-friendly mobile application provides operators with access to real-time data, including information on remaining coal weight, distributed coal, weather forecasts, optimized routes, and coal quality.

This project aims to bring about a transformative change in the coal transportation industry by enhancing efficiency, safety, and environmental responsibility throughout the coal transportation process. It empowers users with the information and tools needed for better decision-making, ultimately optimizing the entire coal-hauling operation.

WORKFLOW:



KEY FEATURES:

❖ Accessibility:

The project prioritizes accessibility through a user-friendly mobile application interface, ensuring that operators and logistics managers can easily access and interpret the data. This accessibility extends to real-time updates on various parameters, enhancing decision-making.

❖ Feasibility:

The project's feasibility is supported by the integration of readily available technologies like GPS modules, IoT sensors, and machine learning models, making it a practical and cost-effective solution for the coal transportation industry.

❖ Interoperability:

The project is designed to be interoperable with various sensors, GPS systems, and mobile platforms, enabling seamless data sharing and integration with existing logistics and transportation infrastructure.

❖ **Expandability:**

The project's architecture is expandable, allowing for the addition of new sensors, features, and functionalities to adapt to evolving industry needs and technological advancements.

❖ **Emergency Features:**

The solution offers emergency features, such as real-time weather monitoring and location tracking, which can be invaluable in responding to unforeseen emergencies, ensuring safety and mitigating risks.

❖ **Comfort:**

The project prioritizes user comfort by providing an intuitive and user-friendly interface. The availability of real-time data and optimized routes enhances operator comfort by reducing the stress associated with transportation decision-making.

FINANCIAL DESCRIPTION:

LIST OF COMPONENTS USED IN OUR PROJECT:

- GPS Modules: To track the real-time location of coal-hauling vehicles.
- Load Cells: Installed in each vehicle to monitor the weight of the coal continuously.
- DHT11 Sensor: Used for temperature and humidity monitoring.
- IoT Sensors: Including environmental sensors, pressure sensors, and weather sensors.
- Microcontrollers or Processors: To manage data processing and device control.
- Display and User Interface: To present data to users.

Other Technologies Used:

- Machine Learning Model: For assessing coal quality based on sensor data (SVM,XGBoost algorithms)
- Database System: For data storage and management(MongoDB)
- AI Algorithms: For route optimization and predictive analysis (SVM , Random forest algorithms)

S.NO	COMPONENTS	PRICE
1	PRESSURE SENSOR	Rs.280
2	TEMPERATURE SENSOR	Rs.390
3	NODE MCU	Rs.275
4	GPS MODULE	Rs.250
5	DHT11 SENSOR	Rs.63
6	LOAD CELLS	Rs.157
7	LCD DISPLAY	Rs.185
	Tota Price:	Rs.1,600

The sensors and components used in this project is cost-efficient and Affordable.