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A Digital Platform For Coal Transportation

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Abstract

The proposed Digital Platform for Coal Transportation focuses on improving efficiency in coal logistics by integrating multiple transportation modes, including rail, road, and maritime routes, into a unified digital environment. Conventional coal transport systems rely heavily on manual coordination and isolated data handling, which often results in delays, limited transparency, and inefficient resource utilization. To overcome these challenges, the proposed system introduces a centralized web-based platform that supports real-time shipment monitoring, intelligent route planning, automated alerts, and analytics-driven decision-making.The platform defines distinct user roles such as Administrator, Driver, and Transport Manager to ensure secure access control and streamlined operational coordination. By enabling continuous tracking and communication among stakeholders, the system enhances visibility across the transportation chain and minimizes operational bottlenecks. The application is developed using PHP, Java, MySQL, HTML, CSS, and JavaScript, providing a scalable and user-friendly interface for managing coal logistics activities.The implementation of this digital solution improves transparency, reduces manual workload, optimizes transport scheduling, and lowers operational costs. Ultimately, the proposed platform supports the digital transformation of coal transportation by promoting automation, reliability, and efficient supply chain management.

Keywords: *Coal Transportation System, Digital Logistics Platform, Supply Chain Management, Real-Time Tracking, Route Optimization, Web-Based Application, Transportation Management System, Data Analytics, Automation, Logistics Optimization, Fleet Management, PHP, MySQL, JavaScript, Smart Transportation, Industrial IoT, Resource Optimization, Operational Efficiency, Decision Support System, Smart Logistics.*

Introduction

Coal remains one of the primary energy resources supporting power generation and various industrial operations. Efficient transportation of coal from mines to power plants, ports, and industrial facilities is therefore critical for maintaining uninterrupted supply chains. However, conventional coal transportation systems often rely on manual coordination and fragmented data handling, which results in delays, poor visibility, and increased operational costs. Limited communication between stakeholders further complicates logistics management and reduces overall efficiency.The Digital Platform for Coal Transportation is proposed to address these challenges by introducing a centralized web-based system that enhances transparency, reliability, and operational control. The platform integrates technologies such as GPS-based vehicle tracking and centralized database management to monitor transportation activities in real time. It enables continuous tracking of vehicles, drivers, routes, fuel consumption, and transportation expenses. By providing timely updates and accurate operational data, the system supports improved decision-making, reduces delays, and enhances logistics performance.In addition, the platform supports multi-modal transportation by integrating road, rail, and sea transport into a unified environment. This ensures smooth coordination among different transportation modes and minimizes communication gaps. The system also maintains comprehensive records of shipments and operational activities, improving accountability and traceability throughout the supply chain. Overall, the proposed platform aims to deliver a more efficient, transparent, and cost-effective coal transportation framework.

Existing System

Traditional coal transportation systems operate through manual and disconnected processes, where each transport mode such as road, rail, and waterways functions independently. The absence of a centralized platform makes coordination between stakeholders difficult and time-consuming. Communication gaps between suppliers, transport operators, and regulatory authorities often result in delays and operational inefficiencies. In many cases, data related to shipments and logistics is recorded manually, increasing the risk of human errors and inconsistencies.Furthermore, shipment tracking is typically performed only after transportation is completed rather than in real time. This limits visibility into the current status and location of coal consignments, making it difficult to respond proactively to delays or disruptions. The lack of automation in scheduling, route planning, and vehicle allocation further contributes to

inefficiencies and increased operational costs. As a result, decision-making becomes reactive, and overall supply chain performance is affected.The major limitations of the existing system include the absence of real-time tracking, poor coordination among transportation modes, high operational expenses due to manual processes, increased chances of data errors, limited transparency, and frequent delivery delays. These shortcomings highlight the need for a more integrated and automated solution.

Proposed System

To overcome the limitations of traditional methods, the proposed system introduces a unified digital platform that provides real-time visibility across multiple transportation modes. The system integrates GPS tracking, IoT-enabled monitoring, and centralized data management to track coal shipments from source to destination. This approach ensures seamless coordination between road, rail, and maritime transport, thereby reducing delays caused by miscommunication.The platform offers an intuitive user interface displaying real-time information such as vehicle location, route details, fuel consumption, and operational expenses. It also includes analytics features that assist in route optimization, cost reduction, and performance monitoring. By maintaining accurate digital records, the system improves transparency, accountability, and operational efficiency across the transportation network.

Advantages of Proposed System

The proposed system provides several advantages over traditional coal transportation methods. It enables real-time tracking of vehicles and shipments, allowing stakeholders to monitor transportation progress and respond quickly to potential delays. Integration of multiple transportation modes improves coordination and ensures efficient communication among participants. Optimized route planning helps reduce fuel consumption and lowers operational costs.The platform also enhances transparency by maintaining digital records of all transportation activities, which improves accountability and trust among stakeholders. Access to real-time data and analytical reports supports better decision-making for administrators and transport managers. In addition, automation reduces manual data entry, minimizing errors and improving the reliability of information. These benefits collectively contribute to a more efficient and intelligent coal transportation system.

Requirement Analysis

Functional Requirements

The functional requirements define the core operations of the Digital Platform for Coal Transportation. The system is designed with multiple user roles, primarily Administrator and Driver, each having specific responsibilities to ensure efficient coordination and monitoring of coal transportation activities. The Administrator module provides complete control over system management. The administrator can register and log in securely using valid credentials. Once authenticated, the administrator can view and add vehicle details, manage driver information, and monitor vehicle locations in real time. The system also allows the administrator to search records using various criteria, view transportation updates, and add new status updates whenever necessary. These features enable centralized monitoring and improved decision-making. Additionally, the administrator can securely log out to terminate the session.he Driver module supports operational-level updates and communication. Drivers can view their profile information, including personal details and assigned vehicle data. They are also able to update their current location, which helps in real-time tracking of transportation activities. The system allows drivers to add status updates related to delivery progress, delays, or route changes. Furthermore, drivers can view previously submitted updates to maintain continuity in communication. A secure logout option ensures safe session termination. These functionalities collectively support effective coordination between administrators and drivers, improving operational efficiency.

Non-Functional Requirements

Non-functional requirements describe the quality attributes and performance expectations of the system. Usability is a key consideration, and the platform is designed with a simple and intuitive interface to ensure ease of use for all users. The system also supports multiple languages to enhance accessibility across different regions. Accuracy is ensured through precise GPS-based tracking and reliable data management, allowing users to obtain correct and up-to-date information for better decision-making.Availability is another important requirement, as the system is designed to remain accessible with minimal downtime. Continuous operation ensures uninterrupted monitoring of transportation activities. Maintainability is addressed by developing the system in a modular manner, allowing easy updates, error corrections, and feature enhancements. Scalability is incorporated to enable the system to handle increasing numbers of users and larger datasets without affecting performance. Security requirements include user authentication, encrypted data transmission, and role-based access control to protect sensitive transportation information and ensure that only authorized users can access system resources.

Computational Resources

Software Requirements

The proposed system is developed using standard web technologies and software tools. The platform

operates on a Windows-based environment, preferably Windows 10 or higher. Development is carried out using XAMPP as the local server environment. The front-end interface is designed using HTML, CSS, and JavaScript, while PHP and Java are used for backend processing. MySQL is employed as the database management system to store and manage transportation data efficiently.

Hardware Requirements

The hardware requirements for implementing the system are minimal and cost-effective. A system with an Intel i5 processor or equivalent is recommended to ensure smooth operation. The platform requires at least 8 GB of RAM for efficient processing and multitasking. Additionally, a minimum of 500 GB hard disk storage is sufficient for storing application files, database records, and system backups. These requirements ensure reliable performance without the need for high-end infrastructure.

Life Cycle Model

The Waterfall Model is adopted for the development of the proposed system. This model follows a structured and sequential approach, where each development phase is completed before moving to the next. The model provides clear documentation, defined milestones, and systematic progress throughout the project lifecycle. It is suitable for projects with well-defined requirements and limited scope for frequent changes.The first phase is requirements analysis, where all system requirements are gathered from stakeholders and documented clearly. This phase forms the foundation for further development. In the system design phase, the collected requirements are transformed into system architecture and detailed design specifications. This helps developers understand the structure and functionality of the platform. The implementation phase involves coding of individual modules based on the design documents. Each module is developed and tested independently to ensure functionality.During the integration and testing phase, all modules are combined into a complete system. Comprehensive testing is conducted to identify and correct errors, ensuring the system meets the specified requirements. After successful testing, the deployment phase involves installing the system in the user environment and making it available for real-time usage. Finally, the maintenance phase ensures continuous system support after deployment. This includes fixing bugs, improving performance, and adding enhancements as needed. The maintenance process continues throughout the operational life of the system.

Design

The design of the Digital Platform for Coal Transportation follows a structured and modular approach to efficiently integrate multiple modes of transport such as road, rail, and waterways within a unified digital environment. The system is developed using a layered architecture that separates user interaction, application processing, and data management. This separation improves maintainability, scalability, and security. The design enables real-time vehicle tracking using GPS technology, efficient data handling, and seamless communication between administrators and drivers. By providing centralized monitoring and structured workflows, the system enhances transparency, coordination, and operational efficiency throughout the coal transportation process.

Architecture

The overall architecture of the proposed system is based on a three-tier model consisting of the presentation layer, application layer, and database layer. The presentation layer provides the user interface through web pages, allowing administrators and drivers to interact with the system. Users can perform tasks such as login, vehicle management, tracking, and status updates through this interface. The application layer processes user requests and implements business logic, including vehicle registration, driver management, location updates, and data processing. This layer ensures that all operations are executed efficiently and according to system rules. The database layer stores structured information related to vehicles, drivers, locations, and updates. By separating these layers, the architecture ensures smooth data flow, improved performance, and secure access to information.

The application architecture is further categorized into software architecture and technical architecture. These architectural views define how the system components interact and how technologies are integrated to achieve reliable performance.

Software Architecture

The software architecture adopts a three-tier structure to enhance system scalability and performance. The presentation layer handles user interaction, while the application layer processes operational logic. The database layer manages storage of all system data. The system enables administrators and drivers to perform key operations such as managing vehicles, tracking locations, and updating transportation information in real time. Backend processing is implemented using server-side technologies, and database connectivity ensures secure storage and retrieval of data. This architecture supports smooth communication between system components and ensures reliable operation.

Technical Architecture

The technical architecture is implemented using a web-based client-server model. The front-end interface is developed using standard web technologies to provide an interactive and user-friendly experience. The backend is implemented

using server-side programming for handling business logic and database operations. A web server is used to deploy the application and manage client requests. The database system stores essential data such as driver details, vehicle information, and transportation updates. This architecture ensures efficient communication between the client and server, secure data management, and stable system performance.

Use Case Diagram

The use case diagram represents the interactions between system users and the platform. The primary actors include the administrator and driver. The administrator performs operations such as login, managing vehicles, managing drivers, viewing locations, searching records, and updating transportation details. The driver interacts with the system by viewing profile information, updating vehicle location, and adding transportation status updates. This diagram illustrates how different users access system functionalities and how responsibilities are distributed.

Class Diagram

The class diagram describes the structural design of the system by representing classes, attributes, and relationships. The main classes include Admin, Driver, Vehicle, and Update. Each class contains attributes relevant to its functionality, such as identification details, contact information, and operational data. Relationships between classes define how data flows within the system. This design ensures organized data handling and modular implementation.

Sequence Diagram

The sequence diagram illustrates the order of interactions between system components during specific operations. It shows how users initiate requests, how the application processes them, and how the database stores or retrieves information. The diagram highlights communication between user interface components, application logic, and database modules, ensuring a clear understanding of system workflow.

Collaboration Diagram

The collaboration diagram represents interactions among system objects and their relationships while performing tasks. It focuses on message passing between components such as the user interface, application controller, and database. This diagram helps visualize how system elements cooperate to complete operations like login, tracking, and updates.

Activity Diagram

The activity diagram describes the flow of activities within the system. It shows the sequence of steps involved in operations such as user authentication, vehicle tracking, and update submission. Decision points and parallel activities are represented to illustrate process flow. This diagram provides a clear view of operational workflows and system behavior.

Database Design

The database design defines how system data is structured and stored. The database is organized into multiple tables to maintain efficient data management and reduce redundancy. Each table represents a specific entity within the system.

The Admin table stores administrator credentials and login information required for system access. The Driver table contains driver details such as identification number, contact information, and assigned vehicle data. The Vehicle table maintains records related to vehicle identification, type, and operational status. The Updates table stores transportation status updates, including location changes and delivery progress. This structured database design ensures data integrity, fast retrieval, and reliable system performance.

Implementation

The Digital Platform for Multi-Modal Visibility of Coal Transportation is implemented as a web-based application designed to monitor and manage coal logistics efficiently across multiple transportation modes. The system provides real-time visibility of vehicle movements, driver information, and transportation status. It supports multiple user roles, including Administrator, Driver, and Manager, to ensure proper coordination and secure access to system functionalities. The implementation focuses on centralized data management, real-time tracking, and streamlined communication among stakeholders involved in coal transportation. By integrating tracking and reporting features, the system improves operational efficiency and enhances transparency throughout the transportation process.

Technologies Used

The system is developed using standard web technologies that support reliability, scalability, and ease of maintenance. The frontend is implemented using HTML, CSS, and JavaScript. HTML is used to structure web pages such as login forms, dashboards, and tracking interfaces. CSS enhances the visual appearance of the application and ensures responsive design across devices. JavaScript provides interactivity, enabling dynamic updates and improved user experience without reloading pages.The backend is developed using Java, which handles core application logic such as user authentication, vehicle and driver management, and real-time tracking operations. Servlets and JSP technologies are used to process requests and generate dynamic content. MySQL is used as the database management system to store and manage all application data. The database includes tables for user details, vehicle information, driver records, tracking updates, and transportation logs. This combination of technologies ensures efficient

communication between frontend and backend components while maintaining secure and structured data handling.

Algorithm and Process Flow

The implementation includes several core modules that manage authentication, transportation tracking, and administrative operations. The login module verifies user credentials by retrieving input data and validating it against stored records in the database. If authentication is successful, a session is created, and the user is redirected to the dashboard; otherwise, an error message is displayed. The logout functionality invalidates the active session and redirects the user to the login page, ensuring secure system access.

The registration module allows new users to create accounts by entering required details, which are then stored in the database. Administrative functions include adding vehicles and drivers, where input data such as vehicle identification, type, and capacity, as well as driver information, are stored for further use. The system also supports assigning vehicles to drivers by updating the relevant records in the database, ensuring proper allocation.Real-time tracking is implemented by capturing vehicle location and status updates, which are periodically inserted into the tracking database. These updates are retrieved and displayed to users for monitoring transportation progress. The system also includes cost calculation functionality, where fuel consumption and travel distance are processed to estimate operational costs. The calculated values are stored for reporting and analysis.Additional management features include viewing tracking details, generating transportation reports, and deleting vehicle records when necessary. Each module communicates with the database using secure query execution methods to maintain data integrity and prevent unauthorized access. Overall, the implementation ensures efficient workflow management, real-time monitoring, and reliable system performance.

Testing

Testing plays a critical role in ensuring the reliability and correctness of the Digital Platform for Coal Transportation. This phase focuses on validating that all system modules, including Administrator and Driver functionalities, operate as intended. The primary objective of testing is to verify real-time tracking accuracy, secure user authentication, and proper management of vehicle and driver information. The system was evaluated under realistic operational scenarios such as vehicle tracking, route updates, and data processing. These evaluations ensured that the platform meets requirements related to performance, usability, and system stability while supporting efficient coal transportation management.

Dimensions of Testing

Multiple dimensions of testing were considered to validate different aspects of the system. Functionality testing was conducted to verify essential operations such as user login, vehicle and driver management, real-time tracking, and data updates. Performance testing measured system response time when loading tracking data, retrieving vehicle details, and handling concurrent users. Usability testing focused on evaluating the user interface for ease of navigation, clarity in presenting vehicle location information, and overall user-friendliness of dashboards. Reliability testing examined the system's behavior under edge conditions, including invalid inputs, missing data, incorrect login credentials, and session timeouts. Security testing ensured protection against unauthorized access attempts and verified role-based access control. Additional checks were performed to reduce vulnerabilities such as SQL injection and improper session handling.

Types of Testing

Both manual and real-time testing approaches were used during system validation. Manual testing was performed on all modules, including login, vehicle management, driver management, tracking, and reporting. Form validation, navigation flow, session handling, and correct data display were verified during this process. Real-time testing was carried out in a live server environment to evaluate system performance under operational conditions. Sample vehicle and driver data were used to validate real-time tracking, update functionality, and role-based access control. This testing ensured that the system performed reliably in practical deployment scenarios.

Test Cases

Test cases were prepared to validate the functionality of individual modules and overall system behavior. These test cases covered user authentication, vehicle and driver management, real-time tracking, data updates, and reporting features. Each test case included input conditions, expected outcomes, and observed results. The results confirmed that the system functions correctly and meets the specified requirements. The prepared test cases also helped identify minor issues, which were resolved to improve system stability and performance.

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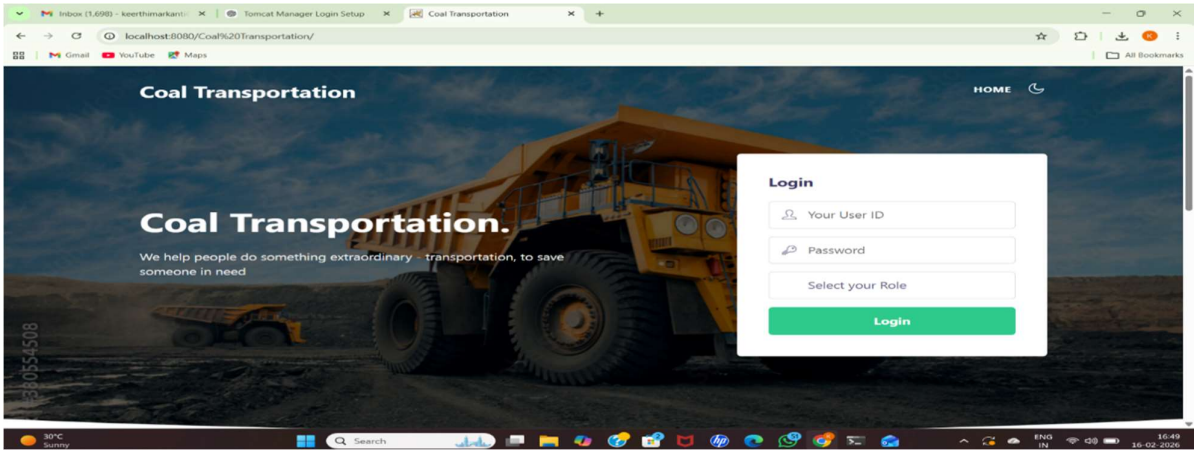
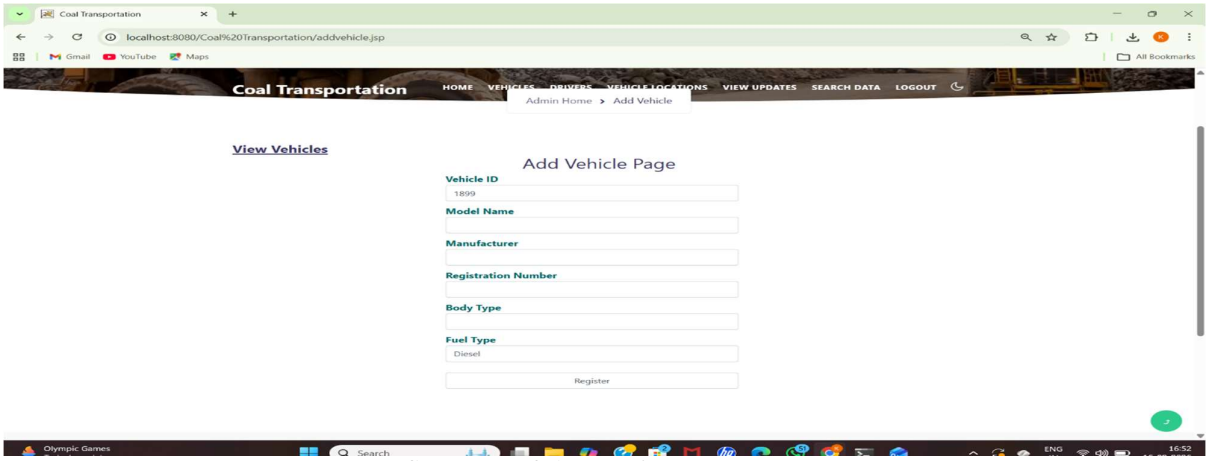
Screenshots

Admin Login: Interface for admin to log in using user ID and password.

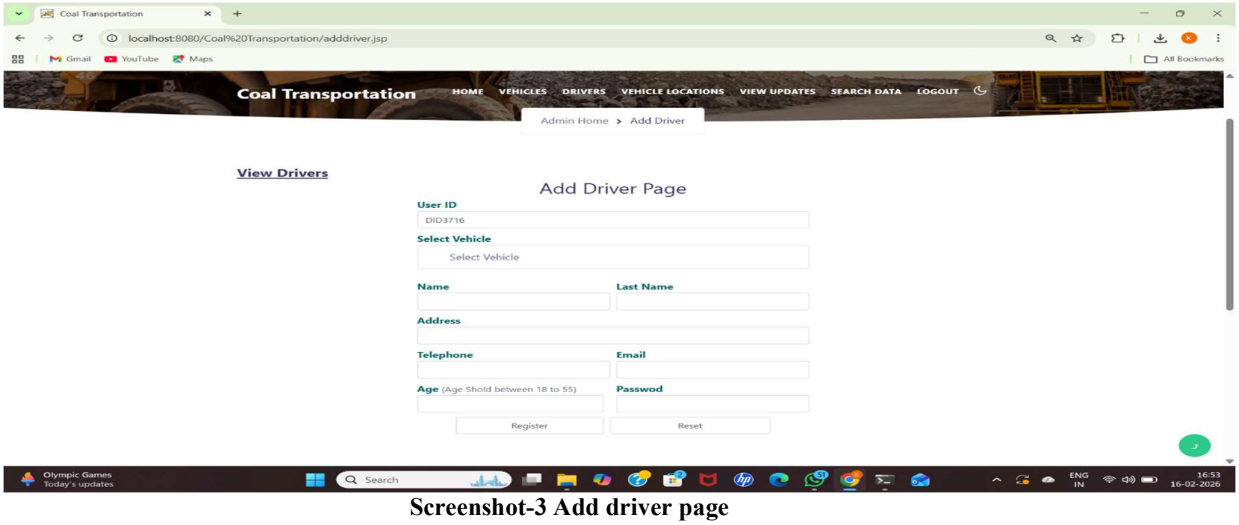


Screenshot-1 Admin Login

Add vehicle Page: Form for new vehicles to register by entering vehicle details.



Screenshot-2 Add vehicle page



Screenshot-3 Add driver page

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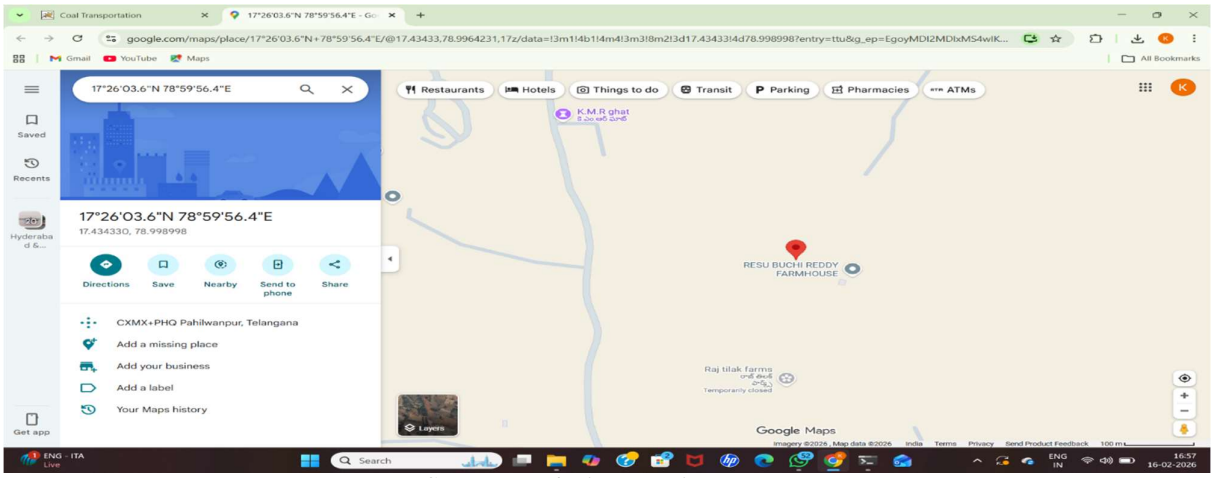
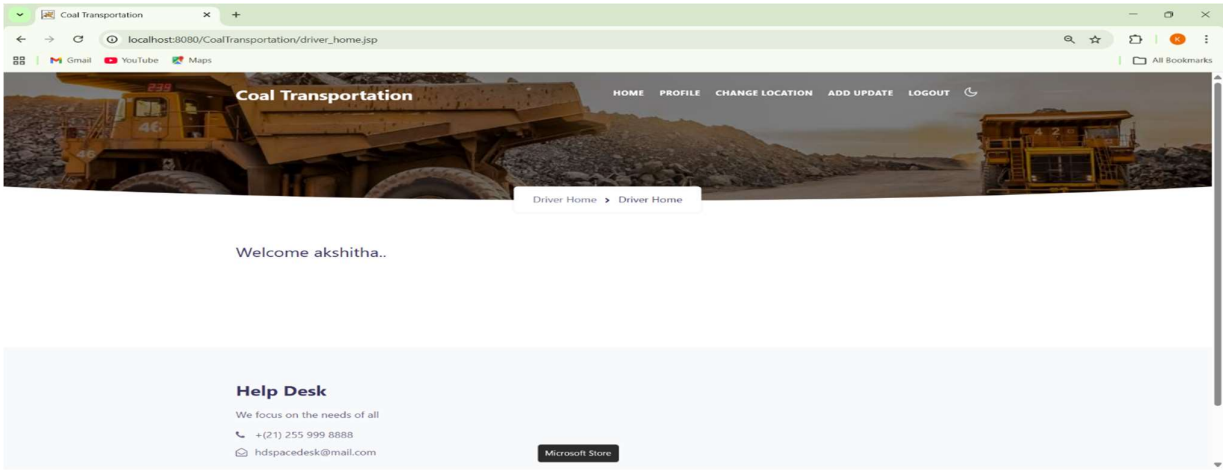
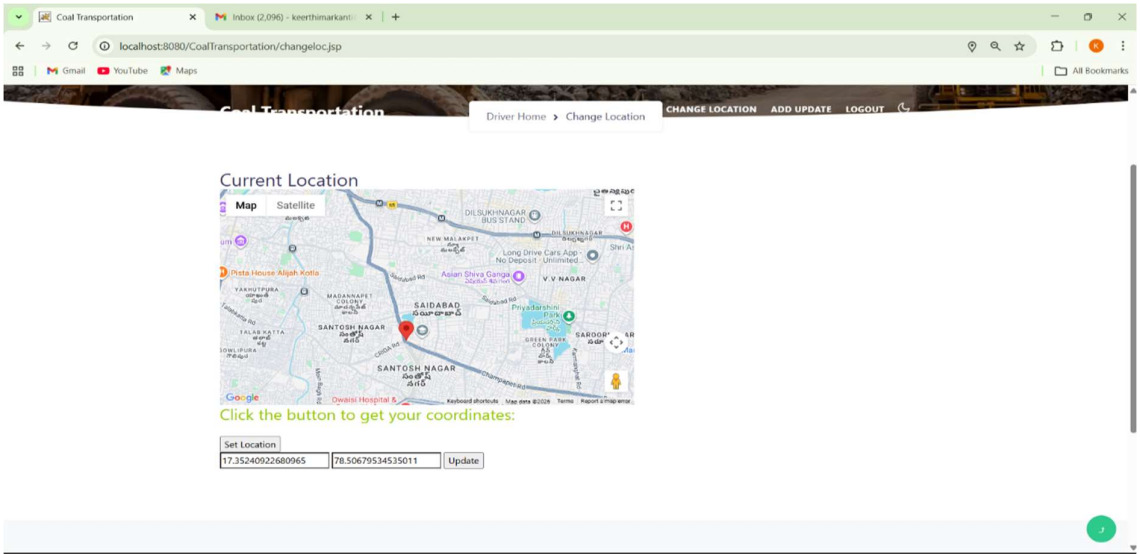
View Location: Shows the live tracking of vehicle.



Screenshot-4 View location



Screenshot-5 Driver Home



Screenshot-6 Change location Page

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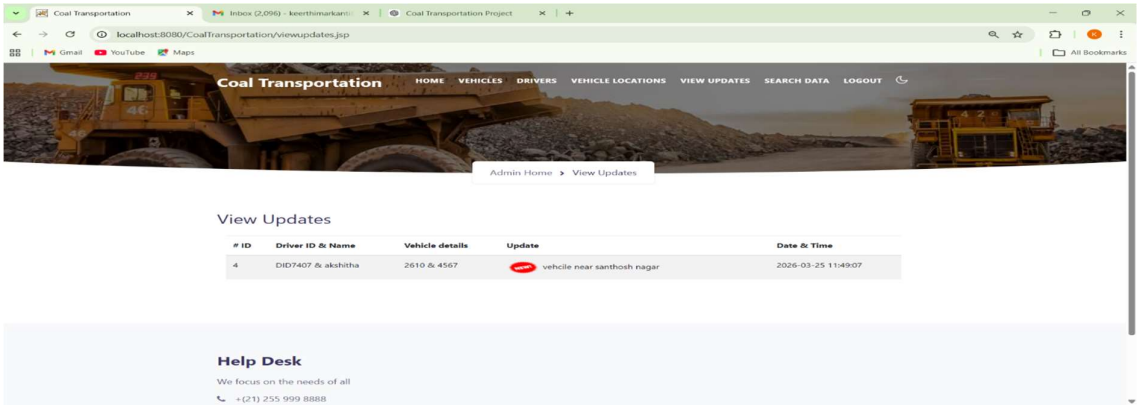

Screenshot-7 View updates

Conclusion

The Digital Platform for Multimodal Visibility of Coal Transportation provides an efficient and structured solution for managing coal logistics across different transportation modes, including rail, road, and sea. The proposed system improves operational efficiency by enabling real-time tracking, centralized data management, and seamless coordination among stakeholders. The scalable architecture and secure access mechanisms ensure reliable system performance while maintaining data integrity. By integrating tracking, monitoring, and reporting functionalities, the platform minimizes delays and enhances supply chain visibility. The implementation demonstrates how digital technologies can modernize coal transportation processes and support informed decision-making. Overall, the proposed system contributes to improved logistics management by providing a reliable, transparent, and efficient framework for coal transportation.

Future Scope

The system can be further enhanced by incorporating advanced technologies to improve automation and intelligence in coal transportation management. A dedicated mobile application can be developed to provide real-time tracking, notifications, and operational updates for users in remote locations. Integration of Internet of Things (IoT) sensors can enable automatic location updates and environmental monitoring during transportation. The platform can also be extended with advanced analytics and machine learning algorithms to predict delays, optimize routes, and improve resource utilization. In addition, cloud-based deployment can enhance scalability and accessibility, allowing the system to support larger transportation networks. Future enhancements may also include integration with government logistics portals and enterprise resource planning systems to provide comprehensive supply chain management.

References

1. S. Kumar and R. Sharma, “Digital Platform for Real-Time Coal Transportation Tracking Using GPS and Web Technologies,” *International Journal of Scientific Research in Computer Science*, vol. 14, no. 1, pp. 40–48, 2025.
2. D. Patel and S. Mehta, “Real-Time Vehicle Tracking and Route Optimization Using GPS Technology,” *IEEE Access*, vol. 13, pp. 102345–102354, 2025.
3. P. Nair and S. Rao, “Data Analytics for Cost and Resource Optimization in Transportation Systems,” *International Journal of Engineering Research & Technology (IJERT)*, vol. 14, no. 3, pp. 55–60, 2025.
4. M. Reddy and P. Singh, “Development of Java-MySQL Based Logistics Management System for Coal Transportation,” *International Journal of Computer Applications*, vol. 181, no. 4, pp. 20–27, 2024.
5. R. Verma and K. Gupta, “Enhancing Supply Chain Visibility in Multimodal Transportation Systems,” *International Journal of Advanced Computer Science and Applications (IJACSA)*, vol. 15, no. 2, pp. 112–118, 2024.
6. K. Ramesh and V. Kumar, “Design and Implementation of Role-Based Admin Dashboard for Logistics Applications,” *International Journal of Innovative Technology and Exploring Engineering (IJITEE)*, vol. 13, no. 2, pp. 70–76, 2024.
7. A. Mishra and S. Kulkarni, “IoT-Based Smart Monitoring System for Transportation and Logistics,” *International Journal of Internet of Things and Applications*, vol. 9, no. 1, pp. 15–23, 2023.
8. N. Gupta and P. Agarwal, “Web-Based Fleet Management System Using GPS and Cloud Technologies,” *Journal of Transportation Engineering and Technology*, vol. 12, no. 4, pp. 88–96, 2023.
9. T. Joseph and R. Mathew, “Multimodal Transportation Management Using Integrated Information Systems,” *International Journal of Logistics Systems and Management*, vol. 11, no. 2, pp. 134–142, 2022.

ISSN 2347–3657
Volume 14, Issue 1, 2026

10. V. Karthik and S. Babu, “Secure Role-Based Access Control in Web-Based Logistics Applications,” *International Journal of Advanced Research in Computer Science*, vol. 13, no. 5, pp. 201–208, 2022.