

BUS TRANSPORTATION MANAGEMENT SYSTEM LOGISTIC I: DEVELOPING EFFICIENT INVENTORY AND WAREHOUSE MANAGEMENT, AUDIT MANAGEMENT, AND INFRASTRUCTURE MAINTENANCE USING REVERSE LOGISTICS

ABSTRACT

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Provincial bus transportation companies often rely on outdated legacy systems that are inadequate for managing inventory, conducting warehouse audits, and addressing location-specific material demands. These limitations lead to stock inconsistencies, delayed resource allocation, and operational inefficiencies that hinder overall productivity. This study introduces the Bus Transportation Management System (BTMS) Logistic I, a web-based logistics platform developed to address these challenges. The system includes robust modules for inventory management, audit tracking, infrastructure maintenance, and AI-powered demand forecasting and analytics. Developed using Agile methodologies and continuous deployment pipelines, and built on a microservices architecture, BTMS Logistic I ensures modularity, scalability, and enhanced operational efficiency, catering specifically to the complex logistics requirements of provincial bus transport operations. The system was developed using the Agile Scrum methodology, which emphasizes iterative planning, continuous stakeholder feedback, and frequent incremental releases to ensure that the solution aligns with user needs and project objectives. The development process began with an in-depth analysis of the logistical challenges faced by provincial bus transport companies, particularly those related to inventory management and audit procedures. A multidisciplinary team composed of software developers, logistics experts, and operational stakeholders collaborated to define and design the system's core functionalities. Key modules—such as Inventory Management, Inventory Audit, and Infrastructure Maintenance for material requisitions—were developed as independent microservices, interconnected through standardized RESTful APIs. This modular architecture enhances the system's scalability, flexibility, and integration capabilities within complex logistical environments. The Inventory Management module provides real-time, granular visibility and precise control over stock levels across multiple facilities, significantly improving inventory accuracy and operational responsiveness. The Audit Management module implements strict stock verification protocols to ensure adherence to regulatory standards and internal control policies. Acting as a centralized interface, the Infrastructure Maintenance module streamlines material requisition workflows, enabling depots and terminals to efficiently submit, track, and manage requests. Additionally, the system integrates reverse logistics functionality, optimizing the management of returned and recyclable materials, and reinforcing the organization's commitment to environmental sustainability. Collectively, these interconnected modules enhance inventory precision, accelerate material distribution, and minimize manual processes, resulting in substantial gains in overall logistics efficiency. By addressing the limitations of traditional workflows, BTMS Logistic I significantly improves data accuracy, streamlines resource allocation, and promotes sustainable operational practices. Its modular architecture enables independent maintenance and effortless scalability of each system component, ensuring adaptability to the dynamic needs of the organization. The findings demonstrate that a well-designed logistics platform can substantially enhance operational efficiency, increase transparency, and improve responsiveness, empowering transportation enterprises to effectively manage and overcome complex logistical challenges.

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