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Implementation of an Automatic Goods Delivery Scheduling System using a Heuristic Algorithm for *Sinar Terang* Building Material Store in BSD

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ABSTRACT

This study aims to develop an automated delivery scheduling system for *Sinar Terang* Building Material Store BSD using a heuristic algorithm to optimize delivery routes and schedules. The previous manual system caused scheduling conflicts, inefficient routes, delivery delays, and poor vehicle utilization. To solve these problems, a heuristic approach based on the Nearest Neighbor method was implemented to generate near-optimal delivery routes with faster computation time. The research stages included requirements analysis, system design, algorithm implementation, and system testing. Black box testing showed that all system functions operated properly, including data input, route calculation, and automatic schedule generation. The results indicate improved delivery efficiency, shorter scheduling time, more optimal routes, and better fleet utilization compared to the manual method. Therefore, the proposed system effectively enhances delivery punctuality and service quality at *Sinar Terang* Building Material Store BSD and can be further developed through GPS integration and advanced optimization methods.

I. Introduction

In the early days, computers were used primarily as calculation tools. However, as time progressed, computer technology developed rapidly. Computers are now used not only for information processing, but also as communication tools. Throughout its development, computer technology has evolved into internet technology, which has become an essential part of the global network. Today, the use of the internet has spread across all levels of society, including to support various business operations. Indonesia continues to advance in adapting to technological progress, especially in network technology. Therefore, understanding the concepts and implementation of networking is crucial, particularly in the context of developing and managing websites that support business activities.

Sinar Terang Building Material Store BSD is a retail shop that provides a wide variety of construction materials and equipment. Strategically located in the BSD area, this store serves the needs of contractors, construction workers, and the general public who require materials for construction projects, whether small or large scale. By offering products such as cement, paint, pipes, ceramics, tools, and home renovation supplies, *Sinar Terang* Building Material Store BSD has become a complete solution for construction needs. In addition, the store is known for its friendly and professional service, ensuring that every customer receives product recommendations that match their needs. With its easily accessible location and comprehensive product selection, the store has become a preferred choice for the surrounding community in fulfilling their construction material needs.

Sinar Terang Building Material Store BSD faces several challenges in managing product deliveries. Delivery delays often occur due to an inefficient scheduling system, resulting in shipments not being completed according to the planned schedule. Furthermore, poorly structured delivery documents lead to confusion in administrative processes, while inaccurate stock data creates

additional issues in ensuring the availability of products needed by customers. Therefore, a system is required to automate the delivery scheduling process more efficiently and to address administrative and stock accuracy problems.

To address these challenges, the author plans to develop a web-based system capable of managing product inventory, automatically scheduling deliveries, and generating structured delivery documents. This system will help ensure that inventory data remains accurate so that customer needs can be fulfilled on time. Additionally, the automated delivery scheduling feature will minimize shipment delays, while the automatically generated delivery documents will improve administrative efficiency and reduce the risk of data errors. With the implementation of this system, store operations are expected to run more smoothly, increase customer satisfaction, and support overall business growth.

II. Method

A. Method Collection Data

In collecting the data, the author used several methods, including the following:

1. Literature Study

Gathering information from various sources such as books, papers, journals, and internet references needed for this research.

2. Interview

Interviews were conducted at the research site to obtain information related to the current issues in order to provide appropriate solutions for the problems encountered.

3. Observation

In this study, observations were carried out to examine the operational system of Sinar Terang BSD Building Store, including stock management, delivery scheduling, and delivery administration. Identified issues, such as delivery delays and inaccurate stock data, were analyzed to design a web-based system solution aimed at improving operational efficiency and accuracy.

B. System Development Method

In this study, the method used is the RAD (Rapid Application Development) method. RAD is an object-oriented software development approach that focuses on rapid, iterative, and incremental application development. This method emphasizes producing a working system in a shorter time through repeated refinement throughout the development process.

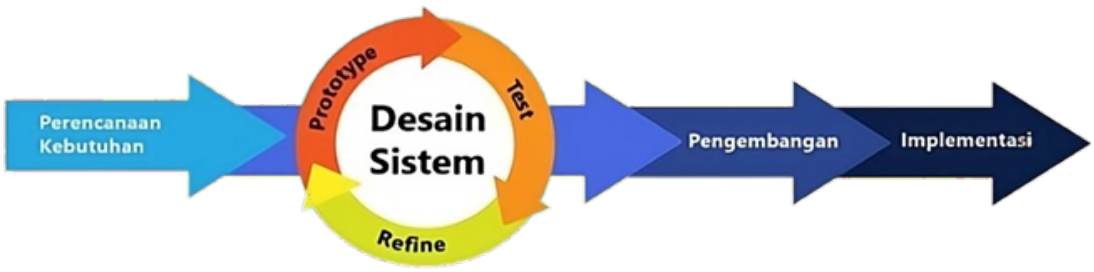

Fig 1. Rapid Application Development

1. Requirement Planning
   The initial stage of system development involves identifying problems and collecting data from users or stakeholders to determine the system objectives and the expected information requirements. Collaboration between both parties is essential to ensure that all needs are accurately identified.
2. System Design

3. At this stage, the system design is created and refined iteratively until it meets the previously identified user requirements. The final outcome includes software specifications, such as data structures and the overall system organization.
4. Development Process and Feedback Collection
   The system design is implemented in the form of an application, starting from the beta version to the final release. Developers continuously integrate system components while receiving and considering user feedback. If discrepancies arise, the process returns to the design phase.
5. Implementation and Product Completion
   The approved system design is implemented and followed by testing to ensure there are no errors. The system is then deployed after receiving final approval from the user.

III. The Proposed Method/Algorithm

A. Heuristic Method

The initial stage of developing this system begins with identifying the problem. This step is crucial because it determines the knowledge needed for the automation that will later be utilized by the driver. At this stage, the formulation of the nearest routes is carried out, supported by information obtained from sources such as journals, books, and related media.

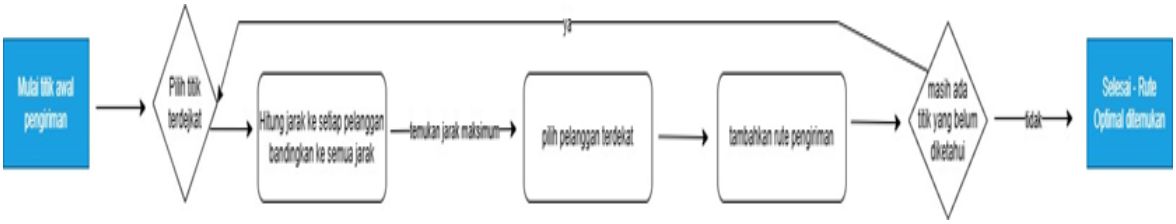

Fig 2. Heuristic

Below is an overview of the Nearest Neighbor approach — the process of determining the automatic delivery route:

1. Start from the initial point (warehouse/store).
2. Calculate the distance to all customers using the Haversine formula based on latitude–longitude coordinates.
3. Select the customer with the shortest distance.
4. Add that customer to the delivery route.
5. Repeat the process from the last visited customer to the next nearest point.
6. Finish when all customers have been visited — resulting in an optimal delivery route with minimum distance.

B. Usecase Diagram

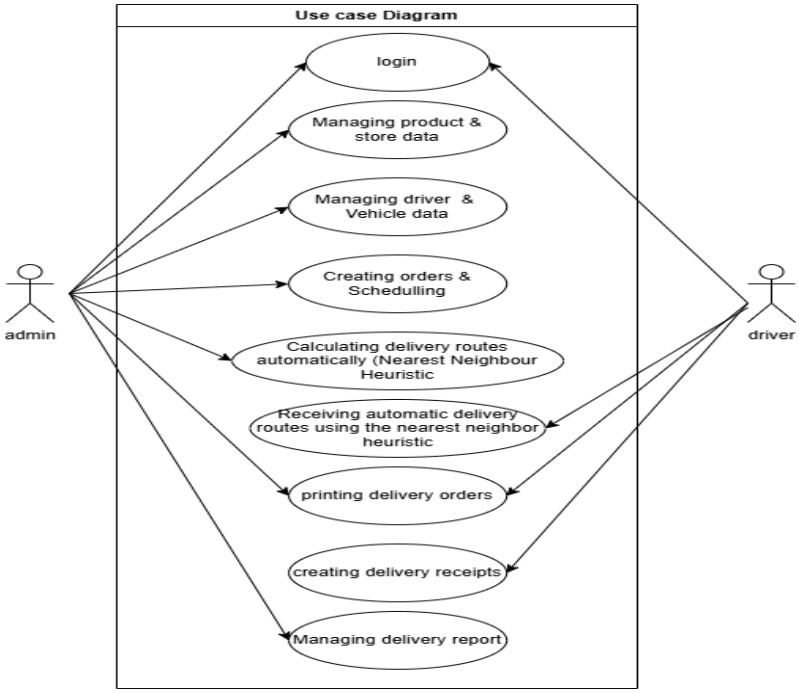

Fig 3. Use Case diagram

A use case diagram is one of the various types of UML (Unified Modeling Language) diagrams that illustrates the relationship between a system and its actors.

C. Entity Relationship Diagram

An Entity Relationship Diagram is a diagram used to model or design a database, illustrating the relationships between entities (data objects) along with their attributes. The ERD (Entity Relationship Diagram) design is presented as follows:

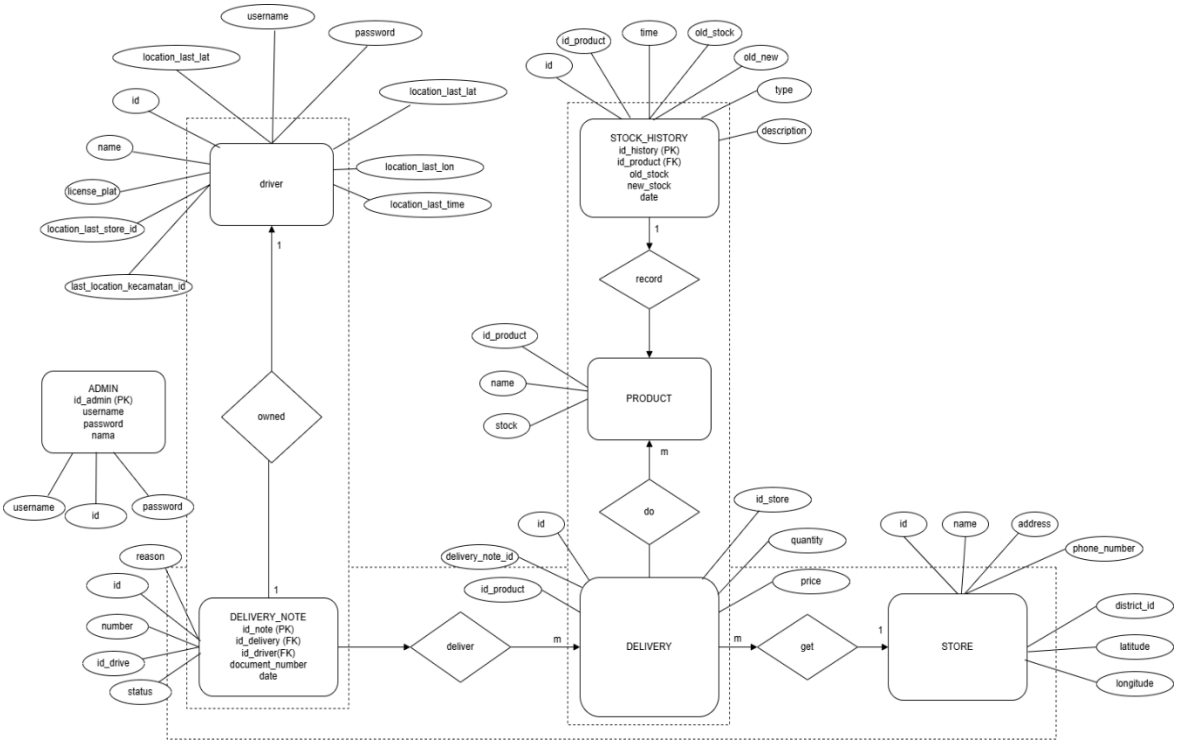

Fig 4. Entity Relationship Diagram

IV. Results and Discussion

A. Login Page Interface

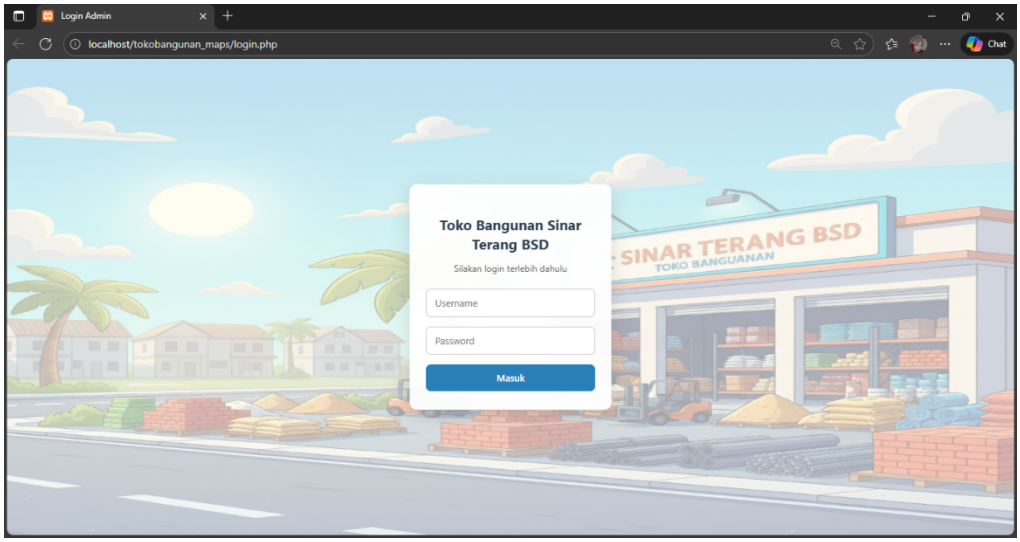

Fig 5. Login Page

The image shows the Login page of the Delivery Management System for Toko Bangunan Sinar Terang BSD. On this page, users are required to perform authentication before being able to access the system. The login page provides two input fields, namely Username and Password, as well as a Login button to proceed with the authentication process.This system supports login access for both administrators and drivers, where each user has a username and password according to their access rights. This page functions as a security gateway to ensure that only registered users can access and use the system's features.

B. Dasboard Admin Page

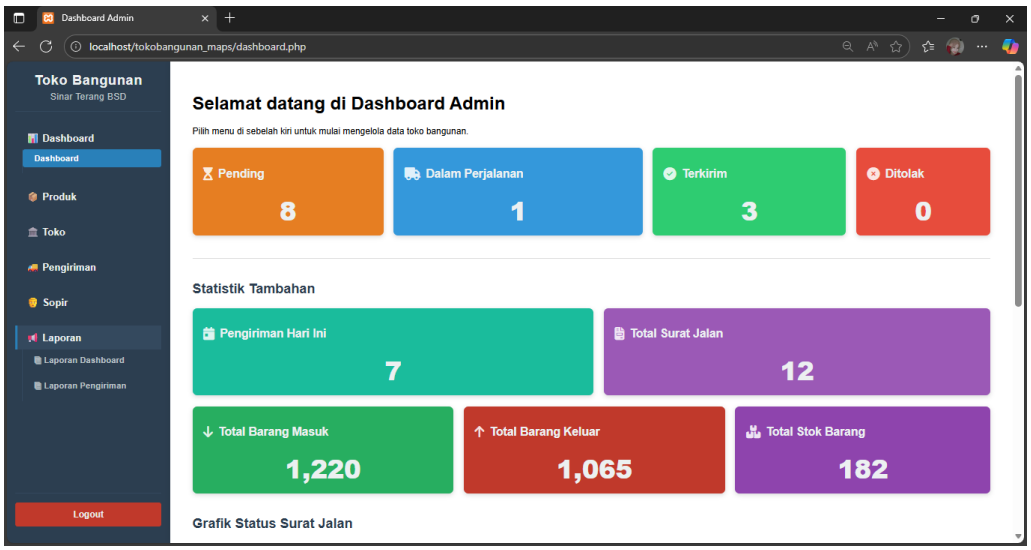

Fig 6. Dashboard Admin Page

The Admin Dashboard page displays a summary of key information in the Delivery Management System of *Toko Bangunan Sinar Terang* BSD. This page can only be accessed by administrators and is used to monitor delivery statuses in real time, such as Pending, In Transit, Delivered, and Rejected. The dashboard also presents operational statistics, including today's deliveries, total delivery orders, incoming goods, outgoing goods, and total stock. In addition, there is a delivery order status chart

and a navigation menu on the left side that allows access to data management and reporting features. This page serves as the main information center for monitoring delivery operations.

C. Heuristic Page

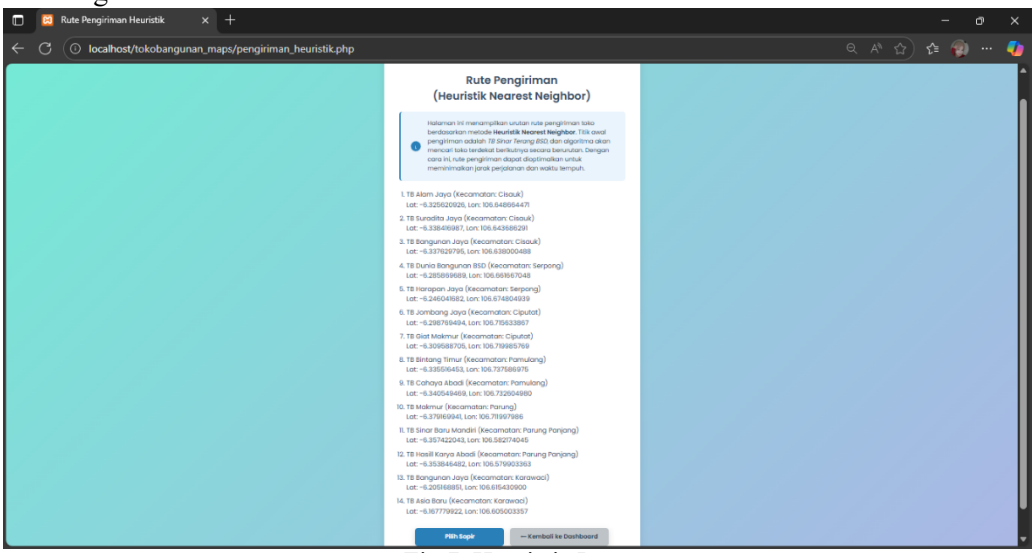

Fig 7. Heuristic Page

This image shows the Heuristic Delivery Route page, which is used to display the sequence of delivery routes that have been automatically calculated using the Nearest Neighbour heuristic method. On this page, the admin can see which stores need to be visited based on the shortest distance, making the delivery process more efficient. The calculation results help speed up the scheduling process and minimize travel time in goods delivery.

V. Conclusion

Based on the results of the research entitled "Implementation of an Automatic Delivery Scheduling System Using a Heuristic Algorithm for *Sinar Terang* BSD Building Store", several conclusions can be drawn as follows:

1. The developed system is capable of automating the delivery scheduling process, thereby reducing the potential for shipment delays. The implementation of the heuristic algorithm enables the system to determine delivery schedules more quickly and in a more structured manner compared to manual processes. The effectiveness of the system is further supported by user testing results, which show an index score of 88%, indicating that the majority of respondents strongly agree with the system's performance and usability. This helps the admin distribute goods based on priority and select more efficient delivery routes.
2. The system ensures the accuracy of stock data, allowing customer needs to be fulfilled in a timely manner. Through the integration of product data, stock information, and records of incoming and outgoing goods, the system is able to display real-time stock updates. Consequently, input errors, stock discrepancies, and the risk of shortages can be minimized.
3. The implemented delivery administration system helps organize administrative processes more systematically, including the automated generation of delivery notes, which increases operational efficiency. Features such as delivery note generation, dashboard reporting, and history recording produce a more orderly, faster, and more accurate administrative workflow. This supports improved operational performance in managing the delivery process.

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