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STIKI Informatika Jurnal

Development of a Web-Based ERP System Using Next.js and Laravel: A Prototyping SDLC Approach

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Keyword	Abstract
	The development of information technology encourages companies to digitize business processes to improve the efficiency and accuracy of data management. CV AS Nusa Trans (CV ANT), a land transportation service company, still uses manual spreadsheet-based recording scattered across multiple links, causing problems such as data duplication, information delays, and difficulties in preparing reports. This research aims to develop a web-based Enterprise Resource Planning (ERP) system as an integrated digital solution to support company operations. The development was carried out using the System Development Life Cycle (SDLC) Prototyping model approach, which allows user involvement from the early stages through an iterative process. Next.js is used as a front-end framework to produce a responsive and fast interface display, while Laravel is used as a back-end to ensure a secure and organized business logic structure. The system design process includes observation, requirements analysis, system modeling and iterative prototype implementation. The developed ERP system integrates invoice management, fleet management, customer data, and an operational calendar into a single centralized platform. To evaluate system usability, the System Usability Scale (SUS) method was applied involving two main user roles: Admin and Owner. The evaluation results indicate an average SUS score of 93.75, which falls into the Excellent Usability category, demonstrating that the system is easy to learn, efficient to use, and well accepted by users. This research contributes scientifically by demonstrating the effectiveness of combining the SDLC Prototyping approach with modern Web Application technologies (Next.js and Laravel) in the development of an ERP system, particularly within the land transportation service sector.

1. Introduction

The development of information technology has had a significant impact on the modern business world, including for small and medium-sized enterprises[1], [2], [3], [4]. Digitalization of information systems has become a crucial necessity because, without proper system integration, companies often face various operational issues such as reporting delays, fragmented data, and difficulties in supporting strategic decision-making processes[5], [6], [7]. Enterprise Resource Planning (ERP) systems offer an integrated solution by consolidating multiple business functions into a centralized system, thereby reducing information redundancy and improving operational accuracy and efficiency[8], [9].

CV AS Nusa Trans (CV ANT), a land transportation service provider, still relies on separate spreadsheet-based manual records to manage income and expense transactions, fleet data, and invoice processing. This condition has led to several critical operational problems, including data duplication and inconsistency, difficulties in monitoring payment and fleet status, a high risk of errors during invoice creation, and the absence of an integrated reporting mechanism. Consequently, administrative processes become inefficient, fleet availability checks must be conducted manually, and financial reports are often inaccurate due to the large number of disconnected data files. These challenges are particularly critical in the land transportation service industry, which requires high levels of speed, punctuality, and coordination among fleets, customers, and internal administration.

Previous studies on ERP system development have predominantly focused on micro, small, and medium-sized enterprises (MSMEs) in relatively simple operational contexts, such as human resource management, retail businesses, coffee shops, and small-scale production industries[10], [11], [12], [13], [14]. While these studies demonstrate the feasibility of ERP adoption, many of them emphasize system functionality without thoroughly addressing the complexity of operational workflows found in service-based industries, such as transportation and logistics. Additionally, several ERP studies tend to limit their evaluation phase to functional testing, with minimal emphasis on systematic usability assessment from the end-user perspective.

From a methodological standpoint, many prior ERP development studies predominantly adopt Agile or Scrum-based approaches[15], [16], [17]. Although these methodologies are effective for rapid development, they often place limited emphasis on early-stage user feedback and iterative prototype refinement that directly involves stakeholders throughout the system design process. As a result, the potential of the System Development Life Cycle (SDLC) Prototyping model particularly its strength in accommodating evolving user requirements through repeated evaluation cycles remains underexplored in ERP research. Furthermore, several prototyping-based ERP studies do not explicitly report usability evaluation results, creating a gap in understanding how well the developed systems are accepted and used by actual users.

From a technological perspective, the combination of Next.js as a front-end framework and Laravel as a back-end framework is still rarely applied in ERP system development, despite evidence that both technologies offer high performance, strong security, and flexible API-based integration[18], [19], [20], [21]. Existing studies that utilize modern web frameworks often focus primarily on implementation aspects, without systematically linking technology choices to development methodologies and usability outcomes. In the context of CV ANT, this technology combination is particularly relevant because it supports fast data access, modular system architecture, and secure transaction handling required in dynamic transportation service operations.

Considering the identified operational problems and the limitations of previous ERP studies particularly in terms of methodological focus, industry context, and usability evaluation this research proposes the development of a web-based ERP system using the SDLC Prototyping approach combined with Next.js and Laravel frameworks. The objectives of this study are as follows:
1. To design and develop a web-based ERP system tailored to the operational needs of CV ANT.
2. To apply the SDLC Prototyping model alongside Next.js and Laravel to produce a responsive, structured, and user-centered system.
3. To develop and evaluate an ERP system prototype that improves data management efficiency, system integration, and usability in a land transportation service environment.

This research provides both practical and academic contributions. Practically, the study delivers a web-based ERP system that addresses real operational problems at CV ANT, including data fragmentation, invoice processing errors, limited fleet visibility, and the lack of integrated financial reporting.

Academically, this study contributes to ERP development literature in three main ways. First, it extends existing ERP research by applying a prototyping-based SDLC approach within a land transportation service context, which has received limited attention in prior studies. Second, it demonstrates how the integration of

modern web technologies (Next.js and Laravel) can support modular system design and operational integration in applied ERP development. Third, this research explicitly incorporates usability evaluation using the System Usability Scale (SUS), providing empirical evidence of user acceptance that is often absent in prototyping-based ERP studies.

As a context-bound and exploratory study, this research does not aim for broad generalization. Instead, it offers methodological and empirical insights that may inform future ERP development research and practical implementation in similar organizational and industry settings.

2. Research Method

2.1 Research Nature and Approach

This study adopts an applied system development research approach with characteristics aligned with Design Science Research (DSR). The primary objective of this research is not only to analyze a phenomenon, but to design, develop, and evaluate an information system artifact namely, a web-based ERP system intended to solve real operational problems faced by a specific organization, CV AS Nusa Trans (CV ANT).

The research is context-bound and exploratory in nature, as the system is developed and evaluated within a single organizational setting. Therefore, the findings focus on understanding how an ERP system designed using the SDLC Prototyping model, combined with modern web technologies, performs in a real-world land transportation service environment, rather than aiming for broad generalization across industries.

2.2 SDLC Prototyping Method

The System Development Life Cycle (SDLC) Prototyping model was selected because it emphasizes iterative development and continuous user involvement, which is particularly suitable for organizations with evolving requirements and limited prior experience with integrated systems. Unlike linear development models, prototyping allows early visualization of system functionality and rapid feedback from users, reducing the risk of mismatched requirements.

The prototyping process in this study consists of the following stages:

2.2.1 Observation

Direct observation was conducted at CV ANT to identify existing workflows, data recording practices, and operational bottlenecks. This stage aimed to understand the root causes of data redundancy, reporting delays, and manual coordination issues.

2.2.2 System Requirements Analysis

Functional and non-functional requirements were identified based on the observation results. Functional requirements focused on core ERP processes such as invoice management, fleet management, and reporting, while non-functional requirements emphasized usability, data integration, system responsiveness, and security.

2.2.3 Iterative Prototype Development

A functional prototype was developed and refined through multiple iterations. User feedback was continuously incorporated to ensure that system behavior aligned with actual operational needs.

2.3 Core System Design Artifacts

To avoid excessive visual redundancy and to maintain analytical depth, this study focuses only on essential design artifacts that directly support the research objectives.
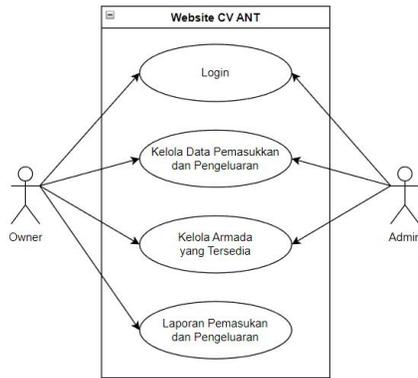
Figure 1. Use Case Diagram CV ANT

The Use Case Diagram is used to clarify role boundaries and access control, which directly addresses the problem of unclear responsibility separation found in CV ANT's manual operational system. In the existing spreadsheet-based workflow, both administrative and decision-making tasks are often handled without clear role distinction, increasing the risk of data misuse and reporting errors.

By explicitly separating the roles of Admin and Owner, this diagram ensures that operational tasks (data entry, modification, and deletion) are restricted to the Admin, while strategic functions such as financial reporting are reserved exclusively for the Owner. This role separation supports better internal control, reduces unauthorized access to sensitive reports, and aligns system functionality with organizational responsibilities. As a result, the Use Case Diagram provides a structural foundation for secure and accountable ERP system implementation.
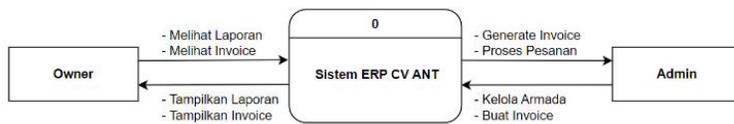

Figure 2 Data Flow Diagram Level 0

DFD Level 0 is used to provide a high-level overview of data flow integration within the ERP system, addressing the issue of fragmented data processing in CV ANT's previous manual system. Previously, financial, fleet, and transaction data were processed in separate files, making it difficult to obtain a unified operational view.

This diagram demonstrates how all core processes are centralized within a single system, allowing both Admin and Owner to interact with shared data sources. By illustrating system-wide data integration, DFD Level 0 supports the research goal of developing an ERP system that eliminates data silos and improves organizational transparency. Further decomposition of system processes was conducted internally to support implementation, but is not presented to maintain focus on core design artifacts.
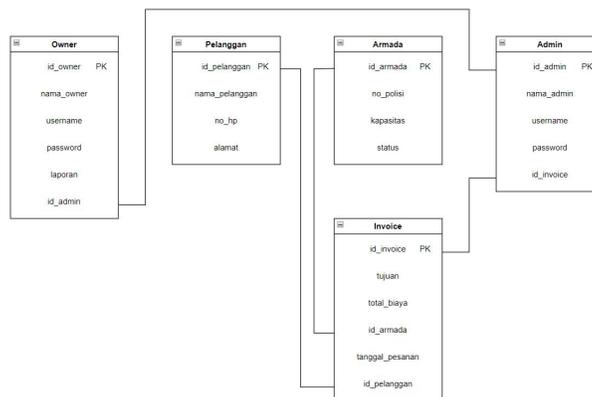
Figure 3. Entity Relationship Dabase

The Entity Relationship Diagram (ERD) is designed to address the problem of data duplication and inconsistency inherent in spreadsheet-based systems. Without a structured database design, the same customer, fleet, or transaction data may be recorded multiple times across different files. By defining normalized relationships between entities such as Customer, Fleet, Invoice, Admin, and Owner, the ERD ensures single-source data storage and eliminates redundant records. This database structure supports accurate transaction tracking, consistent reporting, and long-term data integrity. As a result, the ERD forms the backbone of the ERP system's data management strategy and directly supports the research objective of improving data accuracy and integration.

2.4   System Development
The prototype was developed using:
- **Next.js** as a React-based front-end framework for speed and display efficiency.
- **Laravel** as a back-end framework to manage business logic, databases, and system security.
- **API** integration was implemented to ensure consistent data communication between the front-end and back-end.
- **Docker Containerization** was used to package the Next.js and Laravel applications and all their dependencies in isolated containers, eliminating version dependency issues between devices.

2.5   Evaluation and Revision
The evaluation and revision phase was conducted to ensure that the system prototype met CV ANT's operational needs. During this phase, the initial prototype was demonstrated to two primary system users: the administrator and the owner. Both users were asked to directly interact with the system's key features, including invoice management, fleet availability, financial reporting, and the dashboard interface. Their interactions were observed to assess usability, efficiency, and workflow suitability.

The feedback obtained from users was then compiled and analyzed to identify areas requiring improvement. Several adjustments were made, such as refining the interface layout to improve navigation clarity, simplifying the invoice input process, enhancing the validation mechanism, and adjusting the fleet status logic to better reflect actual operational conditions. Additional improvements were made to the financial report display to ensure that the owner could easily access and interpret monthly and annual summaries.

This iterative evaluation process is consistent with the SDLC Prototyping approach, which emphasizes ongoing collaboration between users and developers. Each revision cycle contributed to improving system functionality, fixing usability issues, and ensuring the final system prototype was more accurate, user-friendly, and aligned with actual workflow needs. Therefore, the evaluation and revision stage plays a crucial role in producing a system that effectively supports CV ANT's operational processes.

3. Result and Discussions

This section presents the results obtained from the development and evaluation of the ERP system, followed by an interpretation of their significance in relation to the research objectives. Rather than focusing on detailed system features, the discussion emphasizes the knowledge gained from system implementation and usability evaluation within a land transportation SME context.

3.1 System Implementation Results

The main result of this study is a functional web-based ERP system that integrates previously fragmented operational processes at CV AS Nusa Trans (CV ANT) into a single centralized platform. The system consolidates transaction management (income and expense invoices), fleet management, scheduling, and reporting, which were previously handled using separate spreadsheet files.
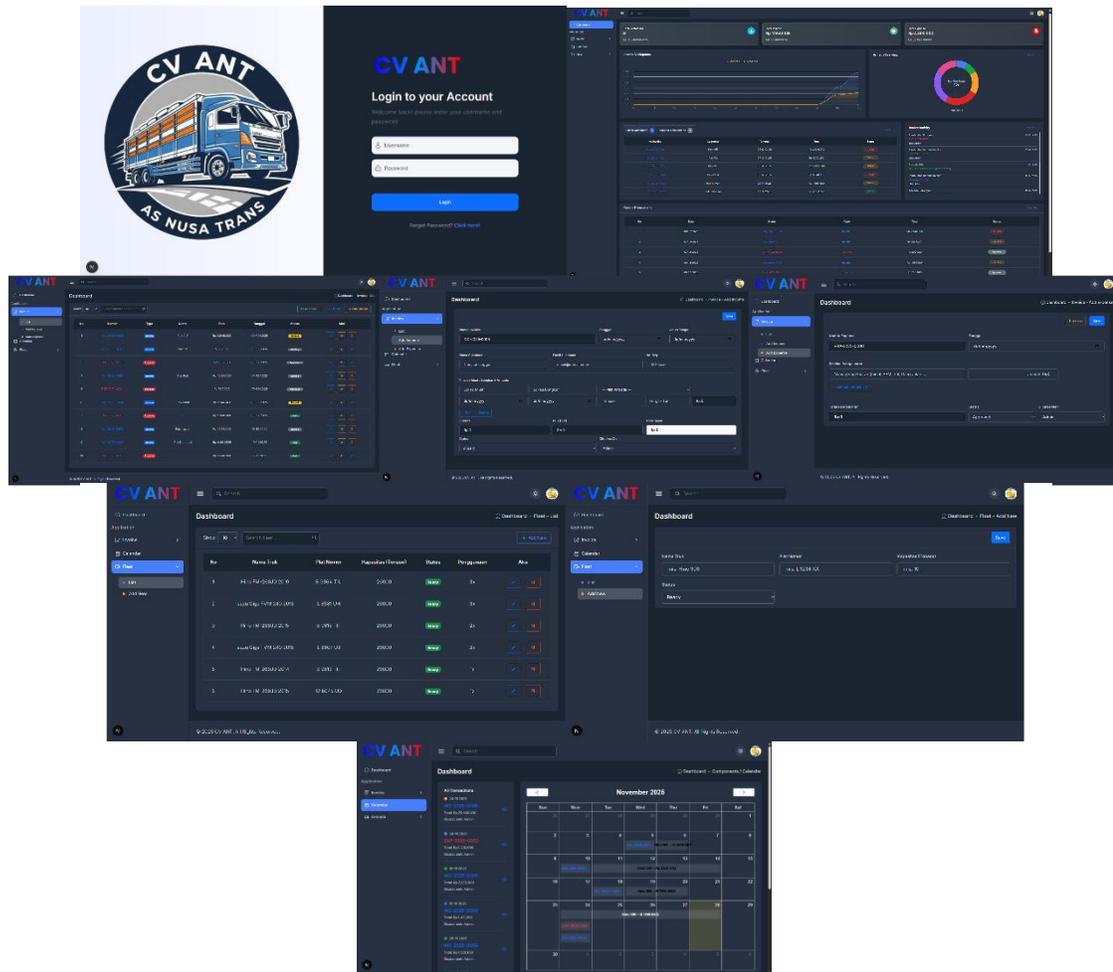

Figure 4. Main System Interfaces

Some of the system interfaces are designed to support role-based access and operational efficiency. As illustrated in Figure 3.1 (Main System Interfaces), the ERP system consists of five core interface components:
1. Login.
2. Dashboard.
3. Invoice Module.
4. Fleet Module.
5. Calendar.

The login interface enforces secure, role-based authentication to protect sensitive financial and operational data. The dashboard provides a summarized view of key operational information, enabling users particularly the Owner to monitor business performance efficiently. The invoice module integrates income and expense recording, fleet assignment, and invoice status management, forming the operational backbone of the ERP system. The fleet module supports centralized fleet data management, ensuring that fleet availability and status information remain consistent and up to date across the system.

The calendar interface plays a critical role in supporting operational scheduling and coordination by visualizing transaction-related activities over time. This interface consolidates invoice transactions, fleet usage schedules, and operational events into a single calendar view, allowing users to monitor delivery timelines, identify scheduling overlaps, and track fleet deployment more effectively. By transforming transaction data into a time-based representation, the calendar interface addresses the previously identified problem of fragmented operational planning and enhances situational awareness for both administrative and managerial roles.

From a results perspective, the successful implementation of these integrated interfaces demonstrates that the SDLC Prototyping approach can effectively translate complex operational requirements into a usable and coherent ERP system within a land transportation service environment.

3.2 System Usability Scale (SUS)

System usability was evaluated using the System Usability Scale (SUS), which consists of 10 standardized statements rated on a one until five Likert scale. The questionnaire was administered to two primary system users Admin and Owner who represent the actual stakeholders responsible for daily operations and managerial decision-making at CV ANT.

Table 1. System Usability Scale Result

Number	Question	Owner	Admin
1	I think I will use this system frequently.	5	5
2	I find the system complicated.	1	2
3	I find the system easy to use.	5	5
4	I need technical assistance to understand how to use the system.	2	2
5	The features in the system feel well integrated.	5	5
6	I feel there are still many inconsistencies in the system.	1	1
7	I believe most people will be able to learn to use the system quickly.	5	5
8	I find the system confusing to use.	1	1
9	I feel confident using the system.	5	5
10	I need to learn more before I can use the system.	2	2

Calculate Owner

$$SUS\ Score = 38 \times 2.5 \tag{1}$$

Owner SUS score = 95

Calculate Admin

$$SUS\ Score = 37 \times 2.5 \tag{2}$$

Admin SUS score = 92.5

Average System SUS

$$\frac{95+92.5}{2} = 93.75 \tag{3}$$

With an average score of 93.75, the system falls into the following categories:
- Excellent Usability (Grade A).
- Above Average.
- Indicates that the system is easy to understand, easy to use, and comfortable for both user roles.

The high SUS score provides empirical evidence supporting the effectiveness of the prototyping-based SDLC approach applied in this study. Continuous user involvement during iterative prototype development allowed usability issues to be identified and addressed early, reducing cognitive load and minimizing system complexity. This finding aligns with prior studies that emphasize the importance of user-centered design in improving system acceptance, particularly in ERP implementations.

Compared to many ERP studies that report moderate usability outcomes or rely solely on functional testing, the usability results of this study indicate that integrating formal usability evaluation into applied system development can significantly enhance system quality. The results also suggest that ERP systems developed for service-based industries such as land transportation can achieve high usability when operational workflows are explicitly embedded into system design.

User feedback played a formative role in shaping the final system design. During prototype evaluation sessions, users suggested improvements related to navigation clarity, invoice input simplification, and fleet status validation. These inputs led to design refinements, such as streamlined transaction forms, clearer status indicators, and improved dashboard layout. This iterative refinement process demonstrates how formative evaluation complements usability measurement by directly influencing design decisions before final evaluation.

4. Conclusions and Future Works

This study demonstrates that a prototype-based ERP development approach can effectively support operational integration and usability enhancement in land transportation small and medium-sized enterprises. Rather than focusing solely on system implementation, this study highlights how iterative user engagement throughout the SDLC prototyping process contributes to the development of an ERP system that aligns with real-world operational workflows and user expectations.

From a research perspective, these findings provide empirical evidence that combining the SDLC prototyping model with modern web technologies, specifically Next.js and Laravel, can produce an ERP system with high usability and strong user acceptance. Usability evaluation using the System Usability Scale (SUS) yielded excellent scores, indicating that continuous formative feedback and user-centered design play a critical role in improving ERP system quality. These results support previous theoretical arguments emphasizing the importance of usability-focused development in applied information systems research.

Academically, this study contributes to the ERP development literature in three main ways. First, this study extends existing research by applying a prototyping-oriented Software Development Life Cycle (SDLC) approach to the context of land transportation services, which remains underrepresented in previous ERP studies. Second, this study provides methodological insights into how usability evaluations can serve as research evidence, rather than simply a validation step in system development. Third, this study demonstrates the relevance of modern web-based architectures in supporting modular and integrated ERP solutions for service-oriented SMEs (Small and Medium Enterprises).

This study is inherently context-bound and exploratory in nature, with findings derived from a single organizational setting and a limited number of system users. While this limits generalizability, it enhances the depth of the analysis and provides practical methodological insights for similar ERP development efforts.

Future research could expand this work by involving multiple organizations, larger user groups, or additional evaluation metrics such as system performance, scalability, or long-term usage behavior.

In conclusion, this study underlines that the main contribution of ERP development research lies not only in building functional systems, but also in generating knowledge about effective development approaches, usability integration, and user-centered design practices that can form the basis for future research and practical implementation in similar organizational contexts.

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