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Smart Mobile Application for Heavy Equipment Rental

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ABSTRACT

This study explores the development of an Android-based heavy equipment rental application tailored for PT. Gajah Unggul Internasional. It highlights the pivotal role of information systems in the heavy equipment rental sector, focusing on the specific needs of PT. Gajah Unggul Internasional, a provider of various construction and industrial equipment. To address the demand for a streamlined system to manage borrowing, returning, and restocking equipment, the study proposes an Android application built with the Ionic Framework, a robust open-source SDK. The methodology employs a comprehensive five-stage research design: data collection, inception, elaboration, construction, and transition. The results and discussion section offers an in-depth evaluation of the application, presenting critical components such as use case diagrams, activity diagrams, sequence diagrams, class diagrams, and the system interface. Functionality and efficiency are validated through black box testing, confirming the system's reliability in processes such as login, registration, equipment data access, and rental history tracking. In conclusion, the study demonstrates the successful application of the Ionic Framework to enhance heavy equipment rental operations at PT. Gajah Unggul Internasional. The user-friendly application caters to various stakeholders, emphasizing practicality and efficiency. The article provides valuable insights into leveraging technology to optimize business processes within the heavy equipment rental industry.

1. Introduction

In today's fast-paced world, industries like construction, mining, and logistics are heavily reliant on heavy equipment to complete projects efficiently. However, owning and maintaining such machinery can be costly, especially for businesses that only require them for short-term projects. This is where heavy equipment rental emerges as a practical solution, enabling businesses to access the tools they need without the financial burden of ownership. To streamline the rental process, a smart mobile application can serve as a game-changer, simplifying the

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way individuals and companies find, book, and manage heavy equipment rentals. The proposed smart mobile application for heavy equipment rental combines cutting-edge technology with user-centric design to create a seamless experience for both renters and providers [1], [2]. It integrates features such as real-time equipment availability, pricing comparisons, and secure payment options, ensuring convenience and transparency. By connecting users to a wide network of equipment providers, the application not only saves time but also optimizes resource utilization, making it a valuable tool in today's digital economy. With such innovation, businesses can focus on what truly matters: getting the job done efficiently and effectively.

According to the 2019 Indonesian Big Dictionary, *rent* refers to the use of something by paying a fee. It is defined as the payment made for using or borrowing an item, allowing its temporary use in exchange for money. Similarly, other scholar describes rent as an agreement or contract in which one party agrees to hand over an object to another party for a specific period, during which the latter party pays a fee for its use. Heavy equipment rental is a business activity where a company or individual leases construction equipment or heavy machinery to another party for temporary use. This equipment encompasses various types of machines and tools commonly employed in construction projects, mining, industrial operations, and other activities requiring significant strength or capacity. In such arrangements, the lessee typically pays a rental fee based on a specific timeframe, such as hourly, daily, weekly, or monthly, as stipulated in the contract. The lessee is responsible for operating the equipment safely and adhering to the usage guidelines provided by the rental provider. Some common types of heavy equipment available for rent include:

1. Excavator: Used for digging soil or other materials with a bucket attachment.
2. Bulldozer: Equipped with a wide blade at the front to level soil or materials.
3. Loader: Utilized for loading materials into trucks or storage areas with a front-mounted bucket.
4. Grader: Used for leveling road or land surfaces with an adjustable blade.
5. Tractor: Designed for tasks such as plowing, weeding, and transporting goods.
6. Dump Truck: Ideal for transporting large quantities of materials.
7. Crane: Used to lift heavy loads using cables and pulleys.
8. Concrete Mixer: Rotates a drum to mix concrete efficiently.

The concept of renting is regulated by Articles 1548 to 1600 of the Civil Code. Article 1548 defines rent as an agreement in which one party commits to providing the enjoyment of an item to another party for a specific period, in exchange for an agreed-upon price.

2. Method

Figure 1 shows the research method that the author used to achieve the objectives set at the beginning.

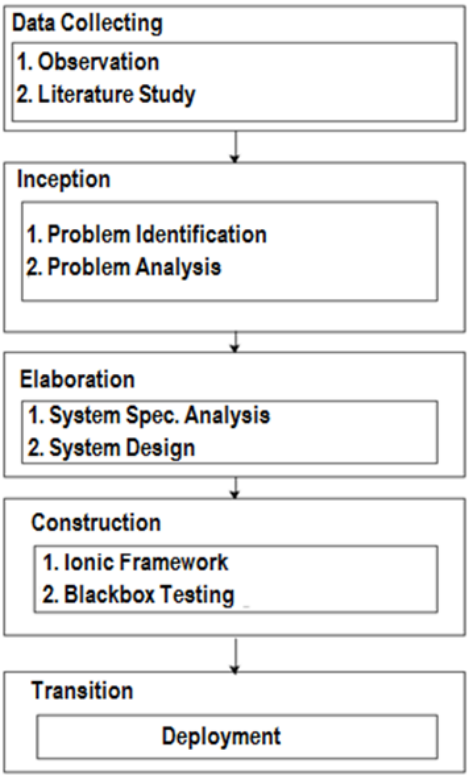

Figure 1 – Research Design

Figure 1 show the steps used during research and application development which consists of the following 5 stages:

a. Data Collection [3]: This stage involves gathering and analyzing data to identify research needs based on existing issues. The author collects information directly from the research site, including details on heavy equipment rental procedures, equipment specifications, and rental pricing. This data is then analyzed to determine the requirements essential for the research.
b. Inception Stages: During this stage, the researcher concentrates on defining and analyzing the problem to be addressed through the development of the application. This process includes formulating initial concepts and identifying the target users [4].
c. Elaboration Stage In this phase, we outline the application's functional and non-functional requirements, assess the appropriate system architecture, and design a solution tailored to address the identified problem.
d. Construction stages: In this phase, the application development process begins using the Ionic framework, following the established plan [5]-[7]. This process involves programming, testing, and integrating system components. The primary objective is to implement the planned design and test each function using the black box testing method [8],[9].
e. Transition Stages: In this phase, the heavy equipment rental application at PT. Gajah Unggul Internasional is prepared for user introduction. This includes conducting

final tests, providing user training, and deploying the application. We create UML-based system designs [10], [11].

3. Result and Discussion

Some interfaces of the proposed system are shown in Figure 2 – Figure 5. Figure 2 shows the interface used by the admin to verify heavy equipment rental applications.

Figure 2 – Verify rental application

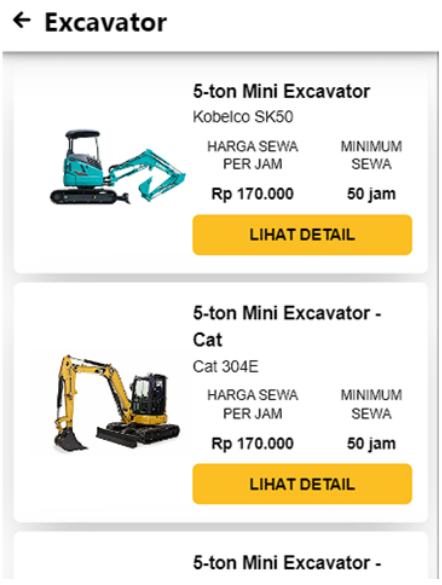

Figure 3 – Excavator Catalog Interface

Figure 5– Rental history detail

Next, the author carries out black box testing (Table 1), as an initial stage of evaluation of the system that has been created [12]-[15].

Table 1 – Result of Black Box Testing

Testing	Requirements	Test	Results
Login	Enter the appropriate nip and password	Success login as user	Valid
Registration	Select the registration menu, fill in all the required data	Save the registrant data to the database	Valid
Viewing Heavy Equipment Data	Login as a user, select the heavy equipment catalog at home	Displaying heavy equipment data that can be rented	Valid
View Heavy Equipment Details	Login as user, select the heavy equipment catalog at home and select the heavy equipment	Display photos, descriptions and heavy equipment specifications	Valid
Perform Rental	Login as a user, select the heavy equipment catalog at home and select heavy equipment and select rental and fill in the heavy equipment rental form	Save rental data to database	Valid
Rental History	Log in as a user, select the history menu	Show rental history that has been done	Valid
View Rental History Details	Login as user, select the history menu and select the rental history you want to view	Display rental history details	Valid
Approve/Reject	Login as admin or manager, select the history menu and select the heavy equipment rental request you want to approve/reject	Update heavy equipment rental	Valid

The test results show that all functions and interfaces of the proposed system can run well.

4. Conclusion

This study provides a detailed examination of the development of an Android-based heavy equipment rental application for PT. Gajah Unggul Internasional, utilizing the Ionic Framework. The introduction emphasizes the importance of information systems in the heavy equipment rental industry and addresses the specific requirements of PT. Gajah Unggul Internasional. The proposed solution uses the Ionic Framework, an open-source SDK, to optimize processes such as borrowing, returning, extending rental periods, restocking equipment, and maintaining records.

The methodology outlines a structured approach comprising five stages: data collection, inception, elaboration, construction, and transition. The results and discussion section thoroughly analyzes the application, presenting key elements such as use case diagrams, activity diagrams, sequence diagrams, class diagrams, and the system interface. Testing outcomes confirm the application's reliability, as all functions and interfaces pass black box testing. The heavy equipment rental application features an intuitive interface designed for various stakeholders, including administrators, managers, tenants, and supervisors. Key functionalities, such as user registration, equipment data access, rental history tracking, and approval or rejection of requests, highlight the system's practicality and utility. Overall, the study demonstrates the successful application of technology, particularly the Ionic Framework, to improve the efficiency and effectiveness of heavy equipment rental operations at PT. Gajah Unggul Internasional.

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