Heavy Equipment Rental Apps Using Ionic Framework

Neec Chander Tobias

PT. Gajah Unggul Internasional, Palembang, Indonesia

ARTICLE INFO

ABSTRACT

The study delves into the development of an Android-based heavy equipment rental application for PT. Gajah Unggul Internasional. The article underscores the significance of information systems in the heavy equipment rental business, introducing the specific context of PT. Gajah Unggul Internasional, a company providing various construction and industrial equipment. Recognizing the need for an efficient system to expedite processes such as borrowing, repaying, and restocking heavy equipment, the author proposes an Android application utilizing the Ionic Framework, a powerful open-source SDK. The methodology section outlines a meticulous five-stage research design, encompassing data collection, inception, elaboration, construction, and transition. The results and discussion section provides a detailed analysis of the application, including use case diagrams, activity diagrams, sequence diagrams, class diagrams, and the system interface. Black box testing validates the functionality and effectiveness of the proposed system, demonstrating successful outcomes in various aspects such as login, registration, equipment data viewing, and rental history tracking. In conclusion, the study showcases the successful integration of the Ionic Framework to enhance the efficiency and effectiveness of heavy equipment rental processes for PT. Gajah Unggul Internasional. The developed application offers a user-friendly interface catering to diverse stakeholders, emphasizing its practicality and functionality. Overall, the article contributes valuable insights into leveraging technology to streamline and optimize business operations in the heavy equipment rental industry.

1. Introduction

An information system is a combination of people, hardware, software, communication networks, data resources, policies, and procedures for storing, retrieving, changing, and disseminating information within an organization. PT. Gajah Unggul Internasional, located in Palembang City - South Sumatra, is a company engaged in the heavy equipment rental business, providing various types of construction and heavy industrial equipment to customers who need it. This heavy equipment includes excavators, bulldozers, cranes, tow trucks, loaders, graders, and other equipment used in construction projects, mining, and other industries. Heavy equipment rental is a

* *Corresponding author:* Neec Chander Tobias

business activity where companies or individuals rent out construction equipment or heavy machinery to other parties for temporary use. This heavy equipment includes various types of machines and equipment used in construction, mining, industrial, and other work projects that require large strength or capacity. In heavy equipment rental, the renter usually pays the rental fee based on a certain period, such as per hour, per day, per week, or month, depending on the contractual agreement. The renter is responsible for using the heavy equipment safely and complying with the usage guidelines set by the rental provider. Lease is regulated in articles 1548 to 1600 of the Civil Code.

To speed up the process of borrowing, repaying, extending loan terms, restocking heavy equipment, or recording in report books, a system is needed that can shorten the time for each process [1],[2]. Based on these needs, the author proposes an Android-based heavy equipment rental application using the Ionic Framework. Ionic is an Open Source SDK Framework that can be used for developing hybrid mobile applications. Ionic provides tools and services for developing hybrid mobile applications using web technologies such as CSS, HTML 5, and SASS. Ionic is a free, powerful framework, has a very complete library, and is an open-source product. This framework is one of the Javascript Frameworks currently available and is fully supported by Google Inc., Android's parent company.

2. Method

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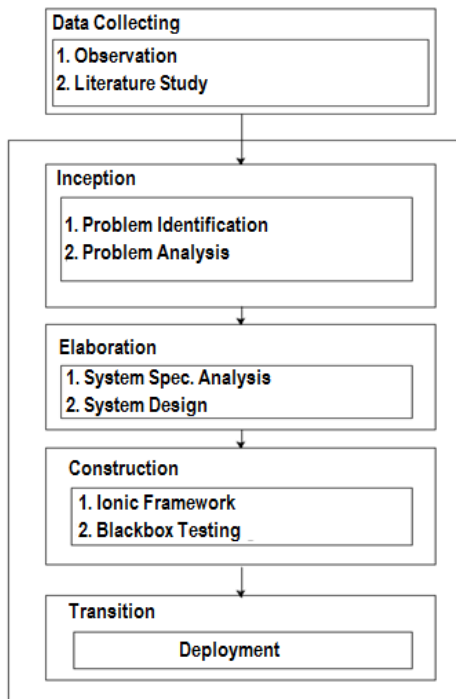

Figure 1 – Research Design

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

1. Data Collection [3]: This stage is an activity that aims to collect data and analyze research needs based on existing problems. At this stage, the author collects data obtained directly from the research location, such as heavy equipment rental procedures, heavy equipment data and heavy equipment rental prices which are then analyzed to define the needs that must be met during the research.
2. Inception Stages: At this stage, the researcher focuses on identifying and analyzing the problem to be solved using the application being developed involving initial concept formulation and user identification [4].
3. Elaboration Stage At this stage, we detail the functional and non-functional requirements of the application being developed, evaluate the system architecture to be used, and design a solution that suits the problem to be solved.
4. Construction stages: At this stage, the application begins to be built using the Ionic framework according to the plan that has been made [5]-[7]. This process includes programming, testing, and integration of system components. The main focus is implementing the design that has been designed and testing each function using a black box approach [8],[9].
5. Transition Stages: At this stage, the heavy equipment rental application at PT. Gajah Unggul Internasional is ready to be introduced to users. This stage involves final testing, training, and application deployment.

3. Result and Discussion

3.1. Use diagram

A use case diagram is a functional part of the system that describes the interaction between actors and the system to be built. The application use case diagram can be seen in Figure 2.
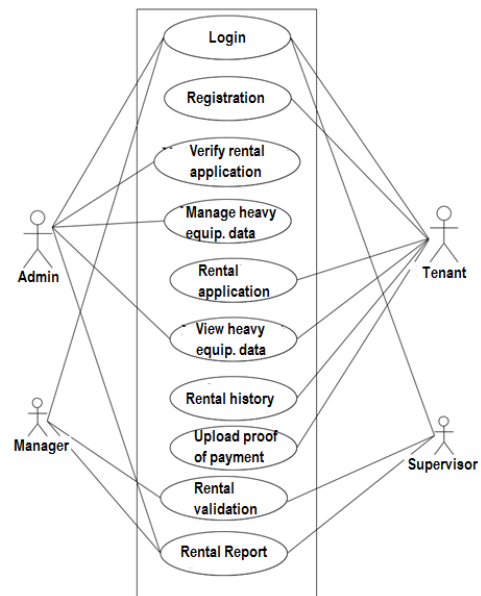

Figure 2 – Use Case Diagram

In the diagram shown in Figure 2, four actors interact with the system, namely admin, manager, tenant, and supervisor.

3.2. Activity diagram

An activity diagram is a description of function paths in an information system [10]. In full, the activity diagram defines where the system process starts, where it stops, what activities occur during the system process, and what sequence these activities occur in.

3.3. Sequence diagram

Based on the use case that has been created, a sequence diagram is obtained which describes the behavior of objects in the use case by describing the lifetime of the object and the messages sent and received between objects.

3.4. Class diagram

Class diagrams describe the types of objects in the system and the various static relationships that exist between them [11]. Class diagrams show the properties and operations of a class and the boundaries contained in the object relationships. The class diagram of the proposed system is shown in Figure 3.
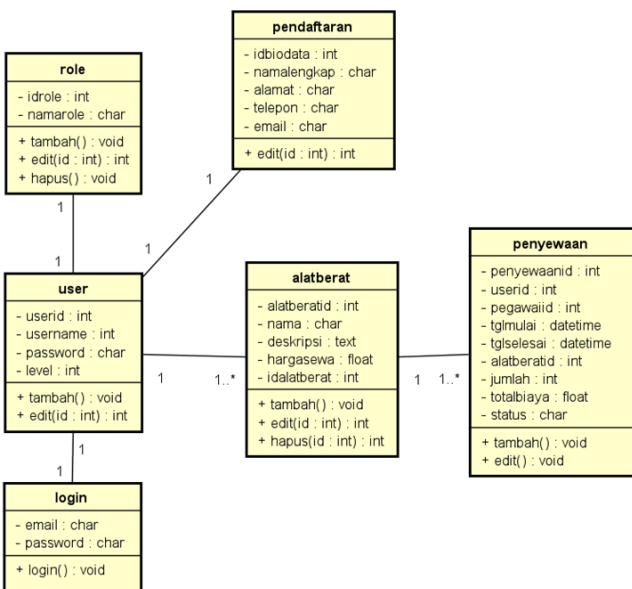

Figure 3 – Class Diagram

The class diagram in Figure 3 shows and defines the database structure, which involves tables, columns, indexes, constraints, and other elements. In this design, the database that will be used is named 'gajahunggul', which contains several tables.

3.5. System Interface

The interface used for renters to apply for heavy equipment rental by filling in all the input on the form can be seen in Figure 4.
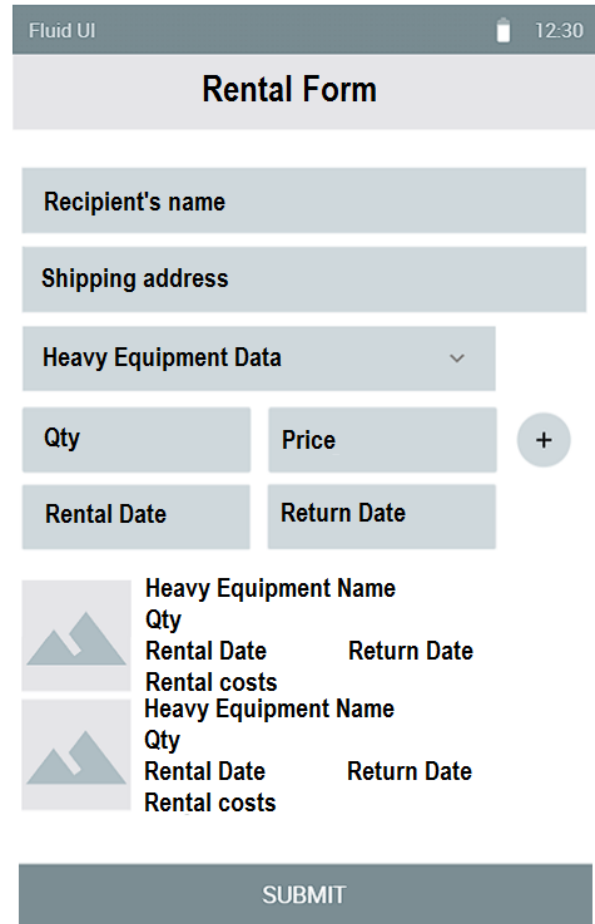

Figure 4 – Login Page

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

The study presents a comprehensive exploration of developing an Android-based heavy equipment rental application using the Ionic Framework for PT. Gajah Unggul Internasional. The introduction highlights the significance of information systems in the context of heavy equipment rental and the specific needs of PT. Gajah Unggul Internasional. The proposed solution leverages the Ionic Framework, an Open Source SDK Framework, to streamline processes such as borrowing, repaying, extending loan terms, restocking heavy equipment, and recording in report books. The methodology section outlines a well-structured research design with five stages, including data collection, inception, elaboration, construction, and transition. The results and discussion section provides an in-depth analysis of the developed application, covering essential components like use case diagrams, activity diagrams, sequence diagrams, class diagrams, and the system interface. The testing results demonstrate the effectiveness of the application, as all functions and interfaces pass the black box testing stage successfully.

The proposed heavy equipment rental application offers a user-friendly interface, catering to various stakeholders such as administrators, managers, tenants, and supervisors. The successful implementation of features like user registration, viewing heavy equipment data, rental history tracking, and approval/rejection processes signifies the practicality and functionality of the system. Overall, the article showcases the successful integration of technology, specifically the Ionic Framework, to enhance the efficiency and effectiveness of heavy equipment rental processes for PT. Gajah Unggul Internasional.

References

[1] W. Zhu, T. Zhang, Z. Ying, Z. Liao, X. Luan, and L. Meng, "Real-time high-speed train rescheduling based on a Human-Computer Interaction framework," *High-speed Railw.*, vol. 1, no. 2, pp. 130–140, 2023, doi: 10.1016/j.hspr.2023.06.001.

[2] I. Baumann *et al.*, "First experiences with a surgery supporting computer system in regard to education, efficiency and complications," *Surg. Open Sci.*, vol. 16, no. November, pp. 228–234, 2023, doi: 10.1016/j.sopen.2023.11.005.

[3] C. Ramonell, R. Chacón, and H. Posada, "Knowledge graph-based data integration system for digital twins of built assets," *Autom. Constr.*, vol. 156, no. May, 2023, doi: 10.1016/j.autcon.2023.105109.

[4] T. Zhu, X. Yang, S. Haugen, and Y. Liu, "A multi-dimensional approach for analyzing risk-related decision problems to enhance decision making and prevent accidents," *J. Loss Prev. Process Ind.*, vol. 87, no. November 2023, p. 105235, 2024, doi: 10.1016/j.jlp.2023.105235.

[5] A. González-Pérez, M. Matey-Sanz, C. Granell, L. Díaz-Sanahuja, J. Bretón-López, and S. Casteleyn, "AwarNS: A framework for developing context-aware reactive mobile applications for health and mental health," *J. Biomed. Inform.*, vol. 141, no. October 2022, p. 104359, 2023, doi: 10.1016/j.jbi.2023.104359.

[6] L. Corral, I. Fronza, and T. Mikkonen, "User Interface Matters: Analysing the Complexity of Mobile Applications from a Visual Perspective," *Procedia Comput. Sci.*, vol. 191, pp. 9–16, 2021, doi: 10.1016/j.procs.2021.07.039.

[7] A. I. Khan, A. Al-Badi, and M. Al-Kindi, "Progressive web application assessment using AHP," *Procedia Comput. Sci.*, vol. 155, pp. 289–294, 2019, doi: 10.1016/j.procs.2019.08.041.

[8] L. S. Jr, F. Ruiz, and L. Fagiano, "A Set Membership approach to black-box optimization for time-varying problems," *IFAC-*

PapersOnLine, vol. 56, no. 2, pp. 3966–3971, 2023, doi: 10.1016/j.ifacol.2023.10.1343.

[9] A. Alsaedi, A. Alhuzali, and O. Bamasag, "Effective and scalable black-box fuzzing approach for modern web applications," *J. King Saud Univ. - Comput. Inf. Sci.*, vol. 34, no. 10, pp. 10068–10078, 2022, doi: 10.1016/j.jksuci.2022.10.006.

[10] Z. Daw and R. Cleaveland, "Comparing model checkers for timed UML activity diagrams," *Sci. Comput. Program.*, vol. 111, no. P2, pp. 277–299, 2015, doi: 10.1016/j.scico.2015.05.008.

[11] F. Chen, L. Zhang, X. Lian, and N. Niu, "Automatically recognizing the semantic elements from UML class diagram images," *J. Syst. Softw.*, vol. 193, p. 111431, 2022, doi: 10.1016/j.jss.2022.111431.

[12] D. Felicio, J. Simao, and N. Datia, "Rapitest: Continuous black-box testing of restful web apis," *Procedia Comput. Sci.*, vol. 219, no. 2022, pp. 537–545, 2023, doi: 10.1016/j.procs.2023.01.322.

[13] H. Bostani and V. Moonsamy, "EvadeDroid: A Practical Evasion Attack on Machine Learning for Black-box Android Malware Detection," *Comput. Secur.*, p. 103676, 2021, doi: 10.1016/j.cose.2023.103676.

[14] F. Pagano, A. Romdhana, D. Caputo, L. Verderame, and A. Merlo, "SEBASTiAn: A static and extensible black-box application security testing tool for iOS and Android applications," *SoftwareX*, vol. 23, p. 101448, 2023, doi: 10.1016/j.softx.2023.101448.

[15] C. Cronley *et al.*, "Designing and evaluating a smartphone app to increase underserved communities' data representation in transportation policy and planning," *Transp. Res. Interdiscip. Perspect.*, vol. 18, no. January, p. 100763, 2023, doi: 10.1016/j.trip.2023.100763.