

Design Android-Based Car Rental Management Application Using Prototype Method

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Abstract—Inayah's car rental is one of the business sectors in the field of transportation services at Pekanbaru, Riau. Inayah car rental carries out management activities for car rental management that can be rented from daily to monthly. Management of rental transactions is currently done manually by recording customer data and storing customer guarantees in the archives that have been provided. Problems arise when the data is lost or damaged while the car is on the customer's side. In addition, other issues arise when a customer cancels suddenly on that day, or the customer's uncertainty about car rental will impact other customers who are serious about renting a car at that time. From these problems, we need a system that can automatically manage, store, and manage car rental transactions using Android. The development method in this study uses the prototype development method. The Prototype is a development method that involves users in system development. Based on the research results, we get a very good interpretation of the standard quality of the ISO 25010 system test, functional, performance, reliability, maintainability, security, usability, and efficiency.

Keywords— ISO 25010, Prototype, Rent.

I. INTRODUCTION

Inayah Rental Car is one of the businesses engaged in transportation services operating since March 13, 2010. Inayah Rental Car has two employees; one is in charge of administration and is tasked with checking the car's condition that customers will use. Car units owned by Inayah Rental Car consist of 15 units that can be borrowed daily, weekly, or monthly. Management problems at Inayah Rental Car arise when the customer visits a car rental place and takes care of loan administration, such as filling in the required data and leaving a guarantee before the car is handed over. The customer data will be recorded in archives and stored in a library for collateral during the car loan process. Archives containing the guarantee may be damaged or lost. Besides that, other problems arise when a customer cancels suddenly, or the customer's uncertainty about car rental will impact the next customer who wants to order a car.

The customer will also need help getting information about what cars can be ordered and when the car loan schedule

can be made. The customer must go directly to the car rental place or contact the car rental party to get information about what cars can be ordered [1]. This will take time because the rental party will re-check the car the customer will order to collect and ensure the loan schedule is at the right time [2].

Android-based car rental applications make it very easy for customers to order cars because they can be accessed easily, and some features can display the information needed by customers in terms of the appearance of the vehicle they want to order, choosing a loan schedule, and making payments very easily [3]. Using social media to make car rental transactions will be easier than using an application. By using the Android application, customers do not need to contact the car rental party and ask for information about the availability of the car they need. Customers can immediately respond to the car rental [4]. Based on these problems, an Android-based car rental application system is needed. This system can minimize issues with Inayah Car Rental, increasing the company's quality of service, efficiency, and time and reducing any significant losses experienced by car rental parties [5]. The system will provide features that make it easier for the service party to record and store data completely in the database. In addition, customers also have easy access to information about car loans and determine the loan schedule and the type of vehicle they want. The car rental application is developed using the Android system. Android is a current operating system that can be used to design applications [6]. Android is a device that is affordable, small, and easy to carry anywhere so that users can more easily complete activities on Android, including making car rentals via Android [7]. Software development is carried out using the Prototype method. The prototype method has advantages over other methods. The Prototype method allows users to be involved in the application development process. So that the development team can collect user feedback and understand user needs properly [8]. In addition, identification of software development risks can be identified earlier and can reduce development costs and time. Collecting feedback from users starting system development early on can minimize the risk of more expensive and longer actions, producing more efficient results [9].

II. METHODOLOGY

A. Prototype Method

This system was designed and built using the Prototype method. The Prototype method is used to describe and validate the product's main features to be made. The Prototype method has the initial goal of feedback from users, thus enabling quick fixes before development is complete [10].

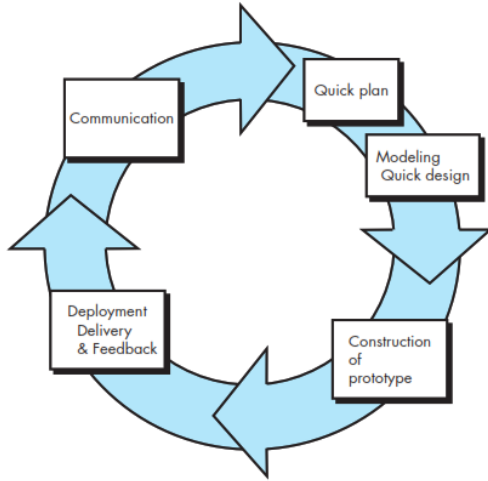


Fig.1. Prototype Model

The first line of the prototype model is Communication. Communication is the stage where the developer and the client hold discussions to get the desired results from the client. After that, the developer does a Quick Plan or plans quickly for making the system. These requirements consist of functional requirements, non-functional requirements, and data fields needed in system development. Next, enter the Modeling Quick Design stage. Modeling Quick Design is a stage that focuses on representing parts of the system that will be shown to the user later. After that, the developer enters the Construction of Prototype stage, which is carried out to create a framework or system design in the form of a wireframe that the developer will make. Finally, the developer carries out the next step, namely Delivery, and Feedback, where the developer submits the Prototype that has been made to the client to get revisions to whatever parts the developer needs to revise. This process repeats itself if the client wants to change back to the system being developed.

B. Testing

After the system has been successfully designed and built, the system needs to carry out periodic testing before the procedure is published online. To ensure that the system runs properly and perfectly, the system performs testing in the form of the international system standard quality, namely ISO 25010 [11]. This standard is carried out to measure, evaluate, and describe software quality attributes. The ISO 25010 quality standard has eight criteria: functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability [12]. ISO 25010 will help developers identify and meet user requirements according to international quality [13].

III. RESULT AND DISCUSSION

A. Communication

Based on the results of interviews with developers and potential users of the car rental system, it was found that the current management and service system still uses the old method of contacting the car rental party and asking for information about car availability. If a car is available, the customer can come to the rental office and request data on the car loan terms. These data are recorded manually and stored in a folder. The data is stored in a folder which can be at risk of damage or loss because it is not stored properly. So, if there is a violation or failure of the car by the customer, it won't be easy to find the data that has been stored.

B. Quick Plan

Rapid system planning has two important aspects: user and application requirements. These needs are needed during the processing of the application system are met. User requirements are collected and compiled by conducting interviews and observations with the car rental admin, where two categories of users are involved, namely admins and customers, in Table 1.

TABLE I. USER REQUIREMENTS

Id	User Requirements
01	Customers can register a personal account on the application.
02	Customers can make car loans through the application.
03	Rental parties can process data by deleting, adding, editing, and updating car data.
04	The rental party can accept or reject the order.

Application requirements planning makes it easier for developers to create systems and determine what data fields will enter the system.

TABLE II. APPLICATION REQUIREMENTS

Id	Application Requirements
01	The application requires customer data. Customers who do not have an account can register on the application.
02	The application requires an internet network so that the admin can claim orders.

C. Modelling Quick Design

Modeling design has four aspects, namely, flowcharts, use case diagrams, and class diagrams, that developers use to model a system's structure and data flow. Fig.2 describes the application process, from logging in to choosing the type of car you want to borrow and the date and time. This process lasts until the customer pays the rental by sending proof of payment. Fig.3 describes the application that can be accessed by two potential users, namely admin and customer. The admin can manage data such as car data, user data, loan data, and facility data. In addition, customers can validate incorrect data and confirm car loans to the rental party. Fig.4 shows the activity diagram of the customer. Customers can carry out activities from logging in to the application's start page stages.

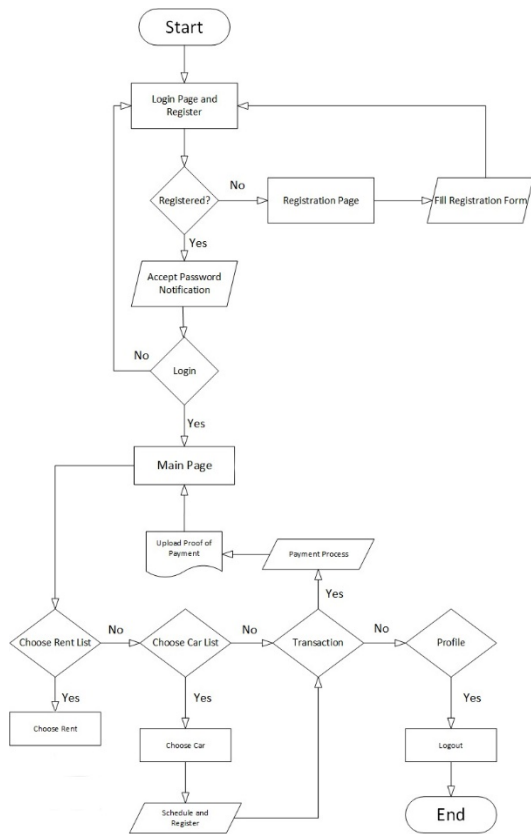


Fig.2. Application Flowcharts

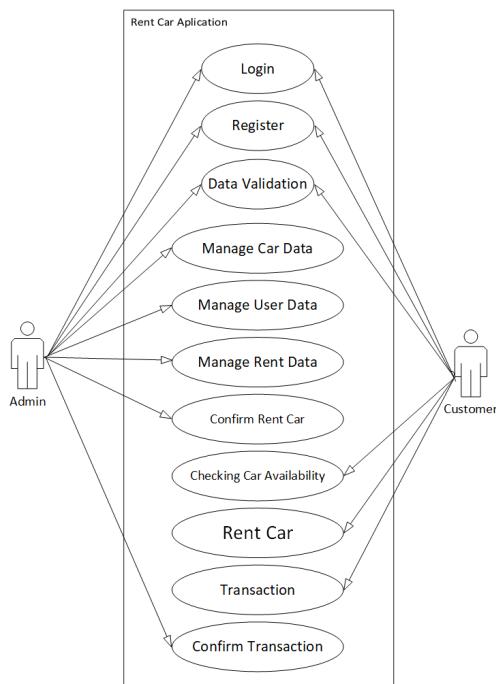


Fig.3. Use Case Diagram

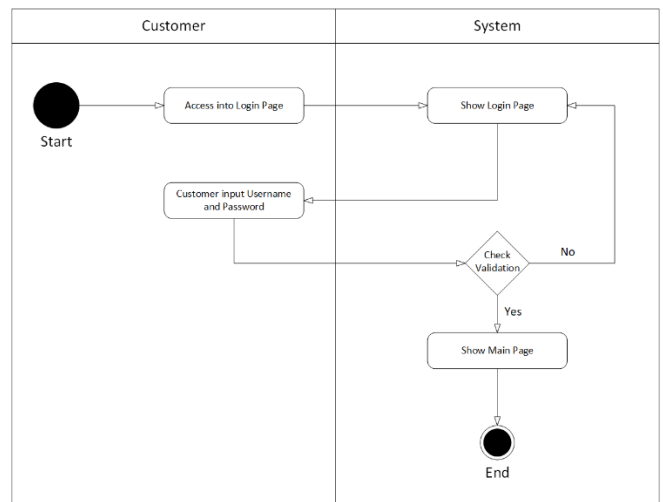


Fig.4. Customer Activity Diagram

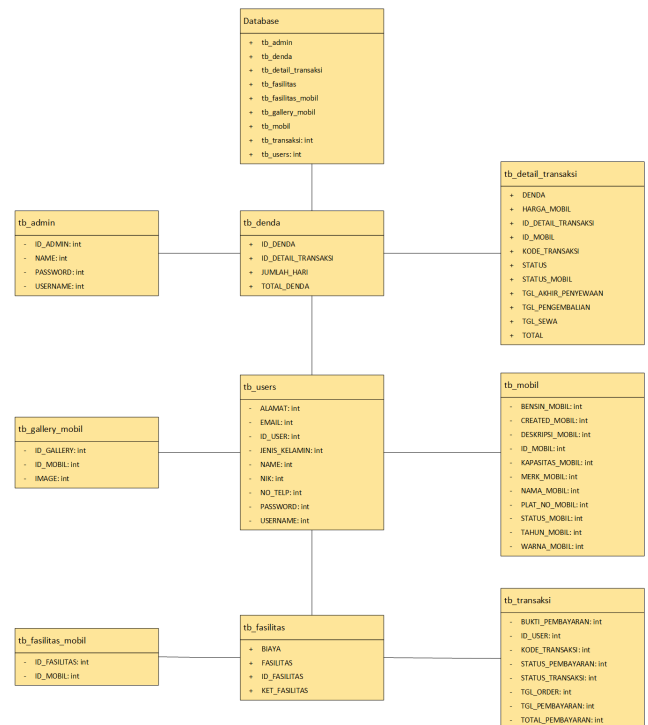


Fig.5. Class Diagram

Fig.5 shows a class diagram that clearly describes the class structure, method attributes, and the interrelationships of each existing object. Class diagrams are made to increase understanding of the description of the system that has been made.

D. Construction of Prototype

Prototyping is designing the application interface. If the interface design has been made, it is easier for the developer to convert the format into an application that has been coded.

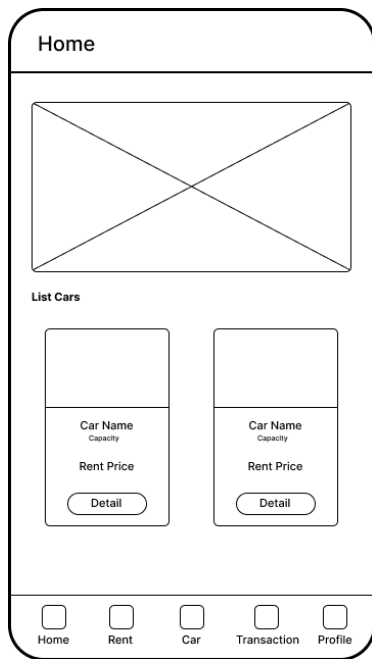


Fig.6. Car Loan Wireframe

Fig. 6 is the interface design of the car ordering page on the Inayah Rental Car application. The order page functions so that customers can determine the car rental schedule.

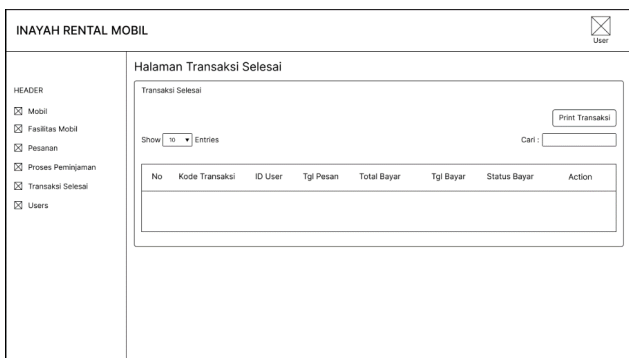


Fig.7. Admin Transaction Page

Fig.7 is the design of the transaction interface on the web admin. This transaction page aims to validate proof of payment that the customer has made to the car rental party.

E. Development Delivery and Feedback

The development of application coding is a process by developers to carry out program logic on each layout or page, which will later be compared to use cases that have previously been made [14]. The next step is configuring the consuming application programming interface using a library, namely Retrofit, for the programming language used in making logic using the Java language.

In this study, developers use the Integrated Development Environment (IDE), namely Android Studio, which will facilitate the application coding process. In the application coding process, there are several steps that developers must take, namely setting up the project, setting dependencies, and compiling packages in Android Studio.

After the coding has been done, the results of the interface design have been successfully implemented. The following is the result of the implementation that has been designed.

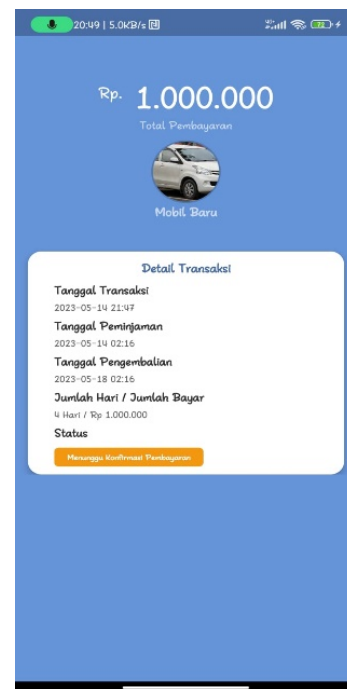


Fig.8. Transaction Detail Page

Fig. 8 is a transaction detail page for customers who have made payments. If the rental party has confirmed payment, the customer has booked on that date.

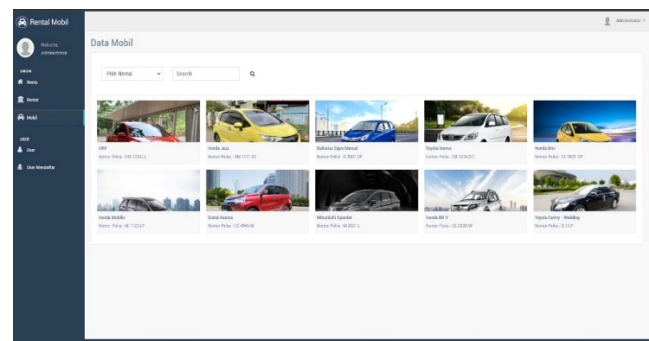


Fig.9. Admin Web Car Data Page

Fig. 9 is a car data page that is on the web admin. Admin web pages such as adding car data, editing user data, and carrying out car loan transaction activities can be fully managed. Inayah's car rental application has several web pages consisting of a car page menu, car facilities page, order page, loan process page, transaction page, and user page. Meanwhile, the page on Android consists of the main page menu, rental page, car page, transaction page, and profile page. The results of this implementation are given to the main prospective users, namely the admin of Inayah's car rental, to be tested and provided feedback regarding the application. Feedback will be received and tested again on the application that has been developed; as for the feedback given by the owner of the Inayah's car rental or the admin, namely

in the form of color selection and layout, which according to him, was not good. Furthermore, the developer changes the application until the user wishes to declare the trial.

F. Testing

Testing on the system follows the ISO 25010 standard, which has several parameters, namely Functional Suitability, Reliability, Performance Efficiency, Usability, Security, Compatibility, Maintainability, and Portability.

TABLE III. RESULTS OF FUNCTIONAL SUITABILITY TEST

Rent Car Application				
No	Scenario	Test Data	Expected Result	Testing Result
1	Login	Valid Data	Login Success	Login Success
		Invalid Data	Login Failed	Login Failed
2	Register	Valid Data	Register Success	Register Success
		Invalid Data	Register Failed	Register Failed
3	Input, Delete and Edit Customer Data	Valid Data	Input, Delete, Edit Customer Data Success	Input, Delete, Edit Customer Data Success
		Invalid Data	Input, Delete, Edit Customer Data Failed	Information, Delete, Edit Customer Data Failed
4	Input, Delete and Edit Car Data	Valid Data	Input, Delete and Edit Car Data Success	Input, Delete and Edit Car Data Success
		Invalid Data	Input, Delete and Edit Car Data Failed	Input, Delete and Edit Car Data Failed
5	Input, Delete and Edit Rent Data	Valid Data	Input, Delete and Edit Rent Data Success	Input, Delete and Edit Rent Data Success
		Invalid Data	Input, Delete and Edit Rent Data Failed	Input, Delete and Edit Rent Data Failed
6	Add Loan Schedule	Valid Data	Loan Schedule Success	Loan Schedule Success
		Invalid Data	Loan Schedule Failed	Loan Schedule Failed
7	Make a Payment Transaction	Valid Data	Payment Transaction Success	Payment Transaction Success
		Invalid Data	Payment Transaction Failed	Payment Transaction Failed
8	Extend The Loan	Valid Data	Extend The Loan Success	Extend The Loan Success
		Invalid Data	Extend The Loan Failed	Extend The Loan Failed

In the first test, testing was carried out on the system using the black box method on the functionality aspect. Functional testing is also carried out using a checklist system on the expert system by checking the test scenarios that have been designed [15]. The scenario test has 16 main functions.

Successful calculation results will show a result of 1 and fail to deliver a result of 0.

$$X = I/P = 16/16 = 1$$

where: X: Result, I: The number that was successfully implemented, P: Designed function

The calculations above show that the results are one or all functions designed successfully and successfully implemented. The next test is portability testing, namely testing the system transferred to different devices.

TABLE IV. PORTABILITY TEST RESULTS

No	Devices	Type	Result
1	Samsung	Galaxy J6	Success
2	Xiaomi	Redmi Note 12	Success
3	Oppo	A57	Success
4	Vivo	Y36	Success

Based on the test results of Table IV. It was found that portability testing could run well 100% on all Androids that were tested. The next test is efficiency testing. Efficiency testing is carried out using mobiles, calculating the average time needed for the system to function in the application. In addition, the test also calculates the average time required by the application to perform functions such as adding to the database.

TABLE V. PERFORMANCE EFFICIENCY TEST RESULTS

No	Task Category	Response Time
1	Launch Time	2.6 s
2	Main Page	2.5 s
3	Car Page	2.7 s
4	Rent Page	2.5 s
5	Schedule Page	2.7 s
6	Profile Page	2.5 s
7	Submit Identity Card	2.9 s
8	Submit Proof of Payment	3.0 s
9	Submit Rent	2.8 s
10	Submit Profile Edit	2.7 s
Amount		26.9 s
Average		2.69 s

Based on Table V, the efficiency test shows a response time of 2.69 s. The car rental system is declared to run 100% well in the efficiency test because the response time does not exceed 5 seconds. The next test is usability testing. Usability testing is carried out by distributing a UEQ (User Experience Questionnaire) questionnaire with 26 questions [16]. Respondents comprised 25 other people: two car rental admins and 23 potential customers.

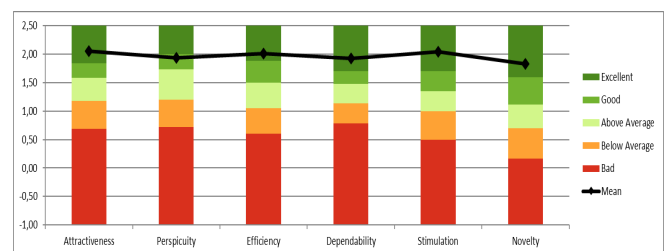


Fig.10. Benchmark Scale Calculation

TABLE VI. UEQ MEAN AND VARIANCE

UEQ Scales (Mean and Variance)		
Attractiveness	2,052	0,23
Perspicuity	1,940	0,36
Efficiency	2,009	0,37
Dependability	1,931	0,31
Stimulation	2,046	0,25
Novelty	1,830	0,32

In Figure 10 and Table VI, it is known that the scale of usability testing using UEQ shows an "excellent" interpretation in the aspects of attractiveness, efficiency, dependability, stimulation, and novelty. Meanwhile, the Perspicuity aspect offers the performance of "good". Consequent tests, namely reliability, maintainability, and security, were conducted using SonarQube tools.

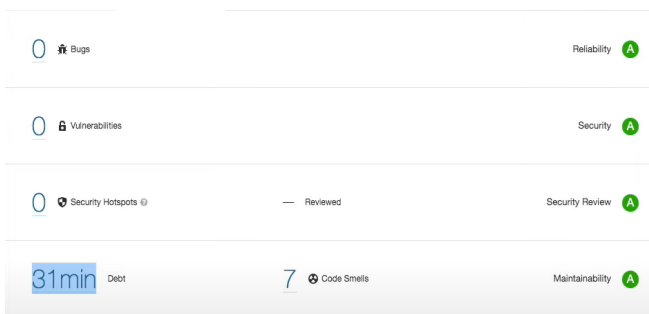


Fig.11. Reliability, Maintainability, and Security Testing

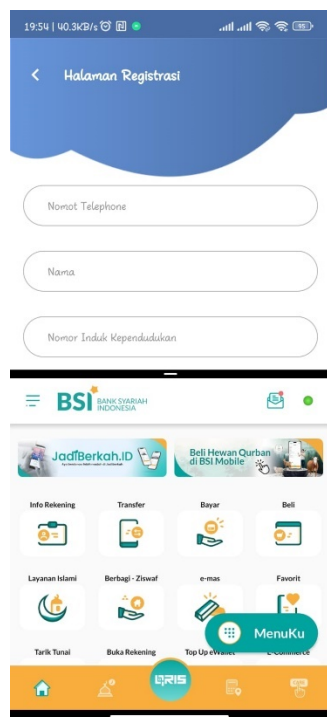


Fig.12. Compatibility Testing

Fig. 11 shows a very good interpretation of reliability, security, and maintainability testing with a value of A. This value indicates that the system has no significant errors or

bugs. Finally, the compatibility test. Compatibility testing is done by running two systems on Android. The first system is a rental application, and the second is another application. The two applications share 2 Android screens. This is to prove that the car rental application is orderly in layout and neat. Based on Fig.12 shows that the car rental application is orderly in layout and not cluttered, even though the screen is divided into two parts. This indicates that the car rental application runs well in the compatibility test.

IV. CONCLUSION

The car rental management application at Inayah Car Rental in Pekanbaru, Riau, has been designed and built accordingly. The design is done by following the wishes of the client. Development is carried out starting from the needs identification stage to testing using the ISO 25010 software quality standard. Based on the ISO test results, functionality shows result 1 (all designs are successfully implemented), portability shows that all Android can run the system, performance with an average speed of 2.6s, usability with a moderate interpretation shows excellent, and maintainability, portability, and security shows an A scale, which means there are no errors or bugs in the system.

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