Android-Based Sports Infrastructure E-Booking Application at Provincial Youth and Sports Office Using Waterfall Method

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ABSTRACT

The rental of sports facilities at the Youth and Sports Office (DISPORASU), under the Governor of North Sumatra, was still conducted manually, requiring tenants to come directly to the office in Medan City. This manual rental process led to a buildup of tenants at the same time, highlighting the need for a more efficient system to support the rental process. This research aimed to develop an Android-based Sports Infrastructure E-Booking application using the Waterfall system development method. The application was designed using Unified Modeling Language (UML), with diagrams such as Use Case Diagrams, Activity Diagrams, and Class Diagrams. The programming language used was Dart with the Flutter Framework, and Firebase was utilized as the database. The results of this application development were expected to improve the efficiency of the sports facility rental business process at DISPORASU and serve as a reference for employees in carrying out rental-related tasks.

Keywords: Android; E-Booking; Dart; Firebase

1. INTRODUCTION

The increasingly rapid development of technology, especially in the Internet sector, has made many users use the Internet for business activities such as ordering, sales, marketing, and other business activities. (Batubara & Nasution, 2023). Rental or booking activities are also increasingly advanced and diverse. (Kristiyanti & Sumarno, 2020). For example, hotel reservations, airplane ticket reservations, travel reservations, and so on. This booking application is very popular with users because it makes it very easy to book a place or product. The internet is a fast and easy means of disseminating information and finding the information needed by visiting sites, websites or applications. Therefore, online media is considered effective for publishing and marketing information for organizations, institutions, government agencies or of a general nature (Lafau, 2023).

Like technology, rental technology that is currently developing, such as sports infrastructure rental, also wants to make changes to the booking process, such as sports infrastructure belonging to the North Sumatra Provincial Youth and Sports Service (DISPORASU). DISPORASU itself is a service belonging to the North Sumatra Provincial Government which oversees youth, sports and athlete services under the auspices of the Governor of North Sumatra (Rihal & Pratiwi, 2022). Within DISPORASU there are several fields, one of which is the Facilities and Partnerships Field, which covers sports infrastructure. DISPORASU experienced a significant increase in visitors after the Corona Virus-19 Pandemic subsided. There are several sports facilities belonging to DISPORASU which can be rented to the public, such as the Multi-Purpose Hall, Futsal GOR, Swimming Pool, Mini Stadium, Circuit, Bolwing Hall, Shooting Range, PBVSI GOR, Athletics Track, PPLP GOR, Football Field and Basketball GOR which can be used by the general public (Febrian et al., 2023). Currently, there are still many people who do not know about this sports infrastructure, the rental process is still done manually by coming in person or sending a letter of application.

Researchers see that there is no special system that markets DISPORASU's sports infrastructure accurately, so researchers will create a system that is expected to be able to market it to the public. When it comes to collecting rental data, errors often occur which we are familiar with as Human Error. Renters who live outside the city of Medan also experience difficulties in renting which are constrained by distance because one infrastructure and another are quite far apart if they have to go to them to get information on each other's facilities and fees. In terms of applications, it is also often the focus of problems among the community or Regency/City Dispora, because you have to send the application letter by coming directly to the rental location, namely DISPORASU which is in Medan City. This makes it difficult for tenants who often do sports activities because of this. Apart from that, managers also experience

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difficulties in marketing the sports infrastructure they oversee due to limited access which is considered ineffective if they market it only through brochures, which in terms of marketing requires a long time.

2. LITERATURE REVIEW

Mobile Development

Mobile programming is the process of creating software applications that are specifically designed to run on mobile devices such as smartphones and tablets. These applications can be native, web, or hybrid applications. (Nasaruddin et al., 2023). Native app programming involves creating an app that is developed specifically for a single mobile platform (iOS or Android) using the programming language and development tools recommended by that platform. iOS apps are typically built using the Swift or Objective-C programming languages using Xcode development tools. Android apps are typically built using Java or Kotlin programming languages using Android Studio development tools. Hybrid apps combine elements from native apps and web apps. They are developed using web technologies (HTML, CSS, and JavaScript) but are wrapped in native applications using frameworks such as Apache Cordova or Ionic. (Wijayanti et al., 2022). Frameworks such as React Native and Flutter are also used to develop hybrid applications with near-native performance.

Booking

Booking is the process of ordering or reservations made by a person or group of people to secure a certain service, goods, or place at a predetermined time. (Arif et al., 2023). This term is commonly used in various industries such as tourism, hospitality, transportation, entertainment, and other services. Booking provides a guarantee that users will get the service or access to the goods they have ordered, and avoids uncertainty about availability at a later date. (Soeharto et al., 2022). When someone makes a booking, they are usually asked to provide relevant details, such as name, date, time, number of people, as well as payment method if necessary. This process ensures that desired services are available on demand and avoids conflicts with other users. Booking systems are often implemented online, allowing users to see availability and make reservations in real-time. The advantage of booking is that it provides certainty for both parties. Customers have peace of mind that they have secured their needs. Service providers can better manage their capacity or resources. (C. C. Kurniawan et al., 2022).

3. METHOD
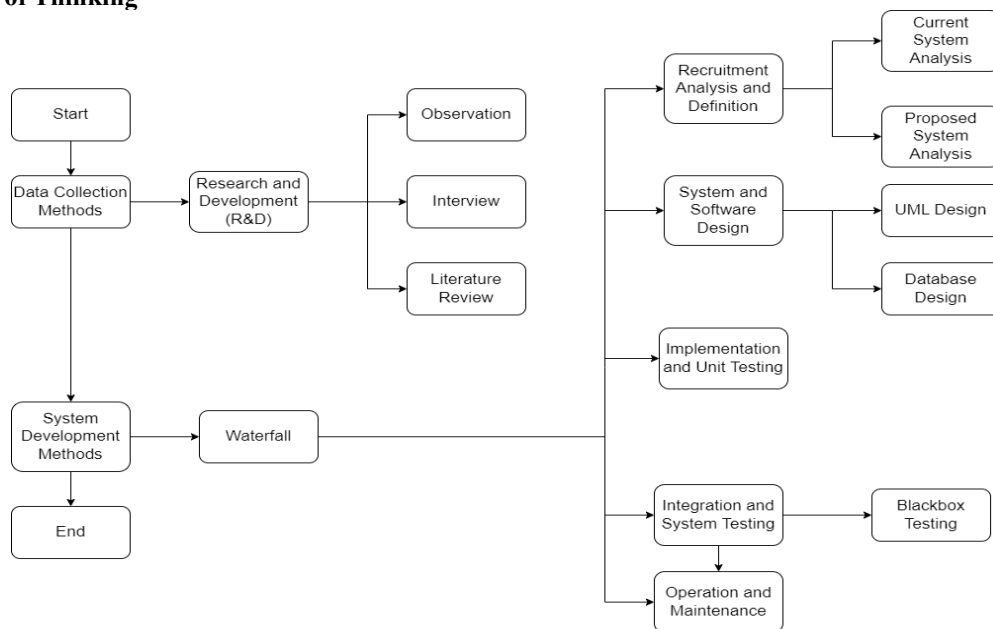
Framework of Thinking

Fig. 1 Framework of Thinking

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In carrying out this research the author used the R&D research method. The development research procedure basically consists of two main objectives, namely developing the product, and testing the product's effectiveness in achieving the goal (Triase & Samsudin, 2020). The first objective is called the developer function while the second objective is called validation. Thus, the concept of development research is more accurately defined as development efforts that are simultaneously accompanied by validation efforts.

This R&D has steps including research to find potential problems, gathering information, small-scale research, planning, design development, early-stage trials, revision of trial results, re-trial, revision of results, feasibility test, final product revision, and implementation product. (T. Kurniawan et al., 2021).

In conducting research and gathering information, the researchers carried out observations, interviews, and literature reviews. Observations were conducted at the North Sumatra Province Youth and Sports Office by directly observing the field. The interview was conducted through a question-and-answer session between the researcher, as the interviewer, and the admin responsible for the athlete's homestead. The literature review was conducted by seeking references from various sources such as books, theses, journals, and other relevant materials.

System Development Methods

The system development method used in this research is the Waterfall method. The Waterfall method is a development model that provides a software life flow approach in a sequential manner, starting with analysis, coding design, testing, and supporting stages. (Ena, 2023). The Waterfall development model is often also called the linear sequential model or also called the classic life cycle. (Syahranitazli & Samsudin, 2023). This waterfall model is the oldest model and has been widely used to develop software engineering. The Waterfall method is systematic and sequential software development. The stages of this model include analysis, design, programming, and testing. (Mathindas et al., 2021).
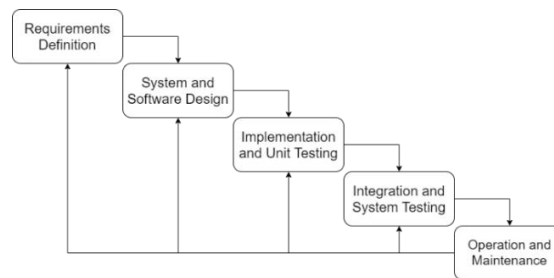

Fig. 2 Waterfall Method

The research method applied in this research is the development of the waterfall method. The waterfall method is a systematic and sequential information system development model. The waterfall method has the following stages. (C. C. Kurniawan et al., 2022):

1) Requirements analysis and definition
   System services, constraints, and objectives are determined by the results of consultations with users which are then defined in detail and function as system specifications.
2) System and software design
   The system design stage allocates system requirements for both hardware and software by forming the overall system architecture. Software design involves identifying and describing the software's basic system abstractions and their relationships.
3) Implementation and unit testing
   At this stage, software design is realized as a series of programs or program units. Testing involves verifying that each unit meets its specifications.
4) Integration and system testing
   The individual units of the program are combined and tested as a complete system to ensure whether it meets the software requirements or not. After testing, the software can be sent to the customer.
5) Operator and maintenance
   Usually (although not always), this stage is the longest stage. The system is installed and used in real life. Maintenance involves rounding up errors not found in previous stages, improving system services as new requirements arise.

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In this research, the author did not use the maintenance stage in the waterfall method because this stage is usually carried out by IT companies (software houses) that are part of the service.

4. RESULT

Requirements Analysis

In this research, a problem analysis was conducted on the system currently running at DISPORASU Medan, with a focus on the e-booking application for sports infrastructure, which was still being carried out manually by visiting in person and filling out a rental application letter. In terms of data collection, there were difficulties in carrying out the booking process, such as renters who lived outside the city of Medan, spending a lot of time traveling to gather information on facilities and infrastructure levy fees.

Therefore, the author aimed to develop an application that would coordinate all sports infrastructure at DISPORASU. The use of this e-booking application was expected to become a solution for both the admin and users in the rental process.

1) System Analysis

The researcher analyzed the existing system at the research site, where tenants booked sports infrastructure by visiting DISPORASU and meeting the receptionist. The receptionist directed them to the administration office, where data was collected for the rental. Afterward, the tenant was informed of the total payment and given 24 hours to complete it. Payment proof was then sent via WhatsApp to the administrative officer. The administration summarized the rental data and handed the keys to the field officer, who passed them to the tenant. After use, the field officer inspected for damage. If found, the tenant was fined; otherwise, the keys were returned.
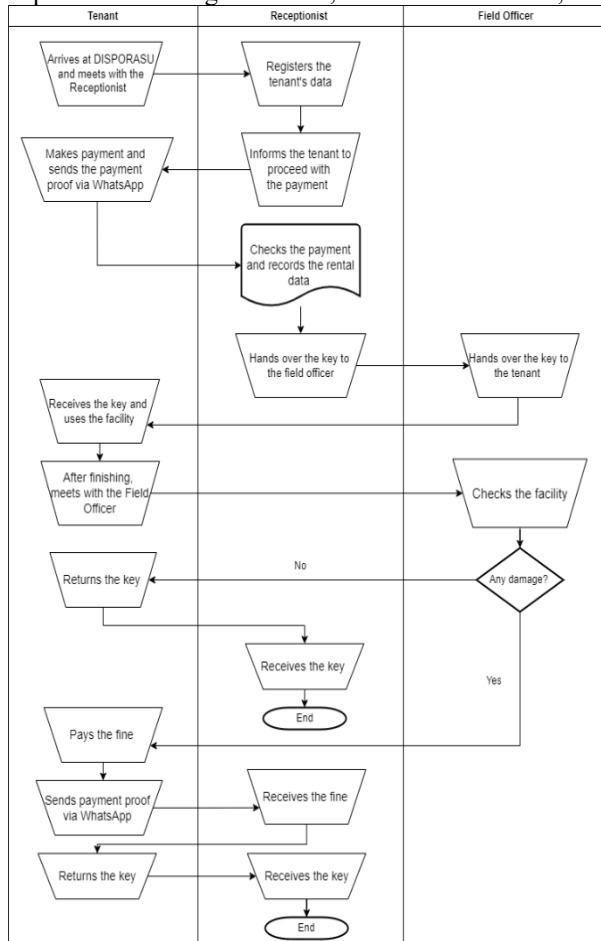

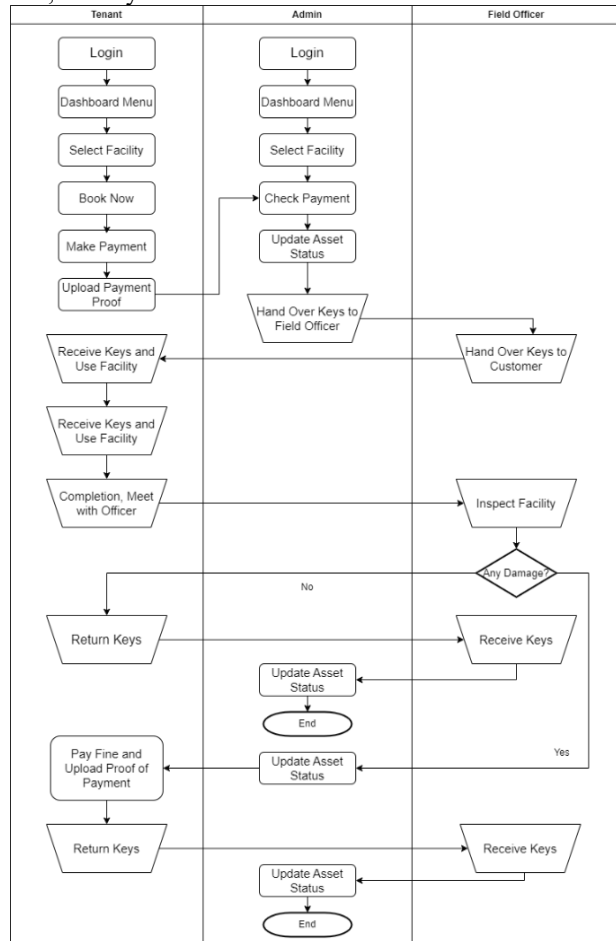Fig. 3 The Analysis of the Current System Diagram

Fig. 4 The Proposed System Analysis Diagram

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After analyzing the existing system, a proposed system was designed to achieve the objectives and resolve the identified issues. In the proposed system, users book facilities through an online application. Users wishing to book facilities must first log in and register. After logging in and registering, users are directed to the dashboard page, where they can view available facilities. Once a booking is made, users are given 24 hours to upload proof of transaction. The admin will verify the uploaded payment proof and update the facility status to unavailable. The admin will then hand over the key to the field officer, who will go to the facility location to deliver the key to the renter. After the renter has finished using the facility, the field officer will inspect the location for any damage. If no damage is found, the renter may immediately return the key to the field officer, and the admin will update the facility status to available again. However, if there is any damage to the building or inventory belonging to the facility, the renter will be fined, and the admin will update the user's status to indicate the fine. The renter is required to pay the fine, according to the specified amount, and upload proof of the fine payment through the upload button in the application.

2) Software Requirements Analysis

The software requirements for the Sports Infrastructure E-Booking system include the development of an Android-based application that enables users to make online bookings for sports facilities. This application must include features such as login, user registration, a display of available facilities, a booking process integrated with a payment system, and the ability to upload transaction proof. To support this system, Firebase was chosen as the database to store user information, booking status, payment proof, and fines. Additionally, the application was built using the Dart programming language with the Flutter Framework to ensure smooth operation on the Android platform.

3) Hardware Requirements Analysis

The hardware requirements involve the devices used by various parties in the system. Application users need Android devices compatible with the application, such as smartphones or tablets with an internet connection. Additionally, a server is required to host the application and database, with cloud servers used for data storage via Firebase.

4) Brainware Requirements Analysis

The Brainware requirements involve three main groups: users (tenants), admins, and field officers. Application users are members of the public who wish to book sports facilities and must have basic knowledge of using smartphones and the Internet. Admins refer to the staff or officers at DISPORASU responsible for managing and verifying bookings, as well as updating the facility status in the system. Field officers handle operational tasks, such as handing over keys to renters and inspecting the condition of facilities after use. All parties must possess sufficient knowledge to carry out their roles within the system to ensure smooth booking and facility management processes.

System and Software Design

According to Sucpito, UML (Unified Modeling Language) is a successful way to overhaul object-oriented analysis and design that first appeared in the 90s. UML is the main graphic for notes on how to design quickly and procedurally. In designing and designing a system, UML recommends stages in the process, because UML is a very important part to be used as certainty, it is the most important key part in communicating for a design. (Hudzaifah & Rismayadi, 2021).

1) Use Case Diagram

Use Case Diagrams are depicted with a group of Use Cases and actors accompanied by the relationships between them. Use case diagrams are used to explain the relationship between actors connected by a Use Case.
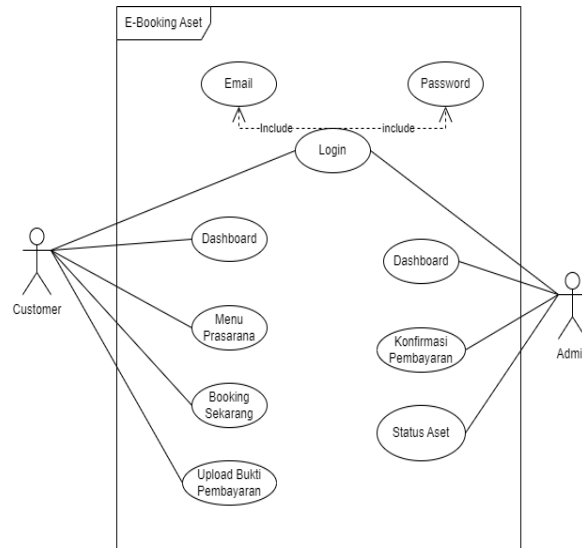
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Fig. 5 Use case Diagram

The Use Case Diagram image explains how users will book sports infrastructure and admins who will take action on user data.

2) Activity Diagram

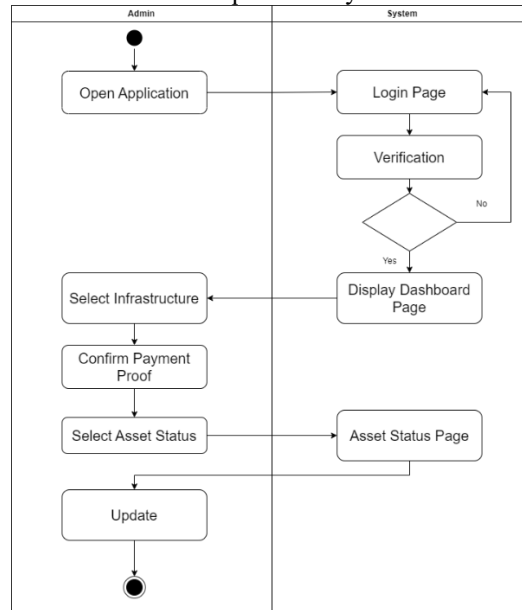Activity Diagram is a diagram used to show the sequence of system activities.

Fig. 6 Activity Diagram

The reservation activity diagram image explains how users carry out the process of booking infrastructure through the application. When opening the application the user is expected to log in first, then the user will be taken to the dashboard page where the user can immediately select the infrastructure they want to book, after that the user can upload proof of the rental transaction so that the admin can update the infrastructure status.

3) Sequence Diagram

Sequence diagrams explain the sequence of processes that occur in the system and the relationships between objects from the sequence of these processes. By describing objects sequentially, the activities that occur in the sequence diagram are as follows.
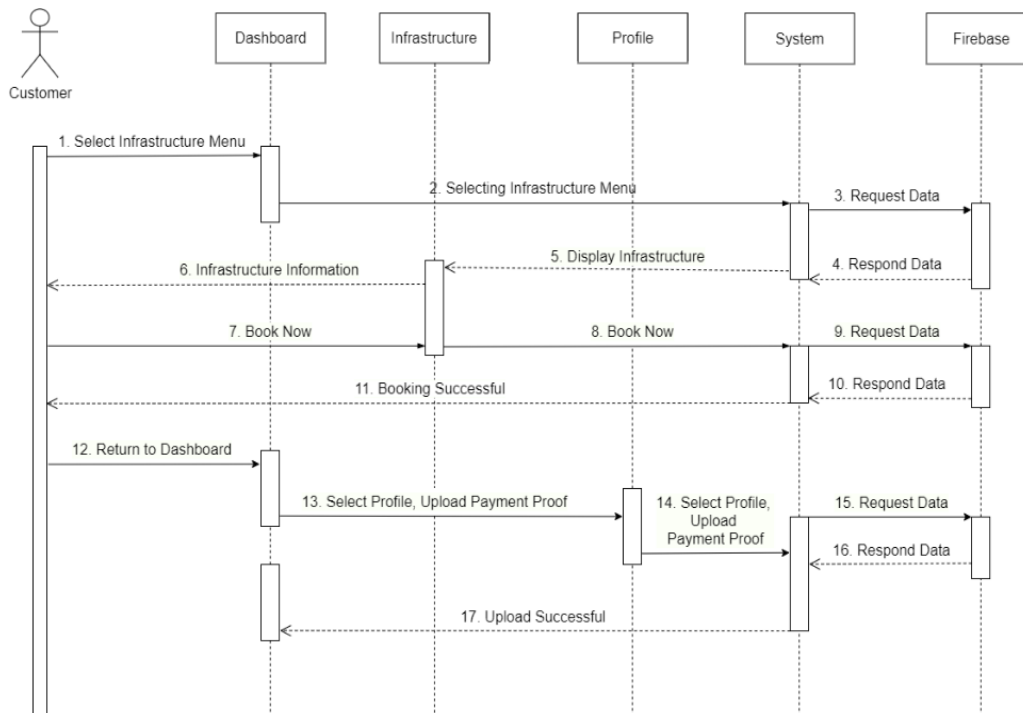
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Fig. 7 Sequence Diagram

In the image, the sequence diagram explains the process of booking infrastructure. Starting with the user selecting one of the available sports infrastructures, then the user clicks on the desired infrastructure and the system will request data from Firebase then Firebase will respond to the data so that the system will display a page containing the data information.

4) Class Diagram

Class Diagram is a framework that defines classes designed for system development. The class diagram in the Sports Infrastructure E-Booking application on DISPORASU is shown in the following image.
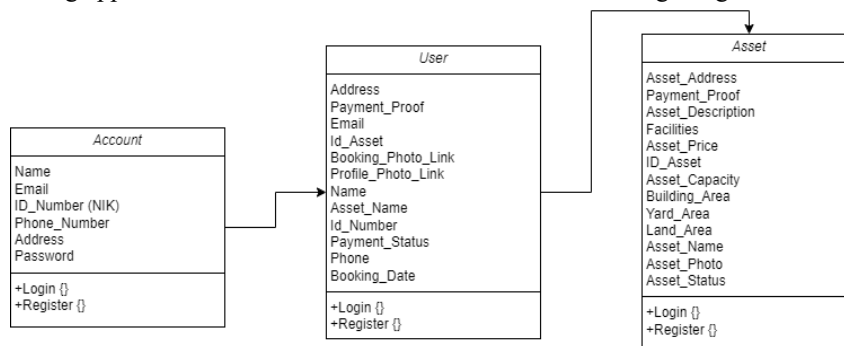

Fig. 8 Class Diagram

This sports infrastructure e-booking application class diagram image explains the database used to build the application.

Implementation

At this stage, it explains how the application runs. This application is designed using the Flutter Framework, and Dart as the programming language and uses the Firebase database. Below is a display of the system design results:
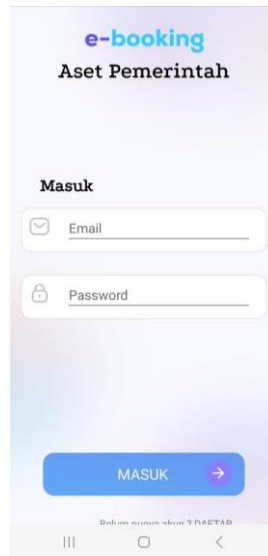
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Fig. 9 Login Page

The user login page explains how the DISPORASU sports infrastructure booking application page will appear when opened. This page is the login page for users who already have an account or have already created one.
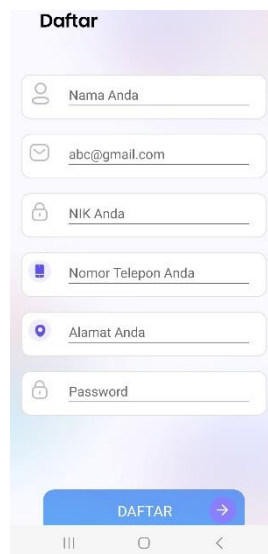

Fig. 10 Registration Page

The registration page is an account creation page for prospective users who want to book sports infrastructure. Prospective users fill in data according to the existing format to create an account.
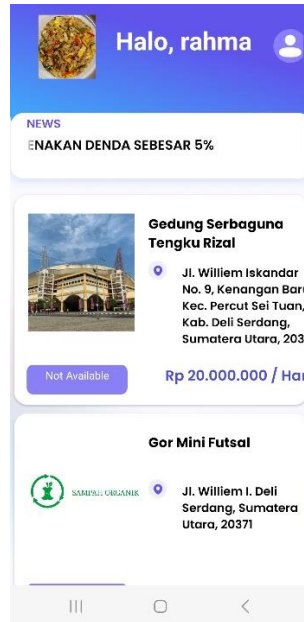
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Fig. 11 Booking page

The booking page is a page that appears after the user has successfully logged in as a guest, a display will appear that will offer sports infrastructure contained in DISPORASU that can be rented by the user. In this display, there is information at a glance, such as the name of the infrastructure, address of the infrastructure, levy fees, and information on infrastructure availability.

Fig. 12 Order Details

If the user has determined which infrastructure will be booked, the next display will display details of the infrastructure which contains a photo gallery of the infrastructure selected by the user, fees, infrastructure specifications, and facilities offered.
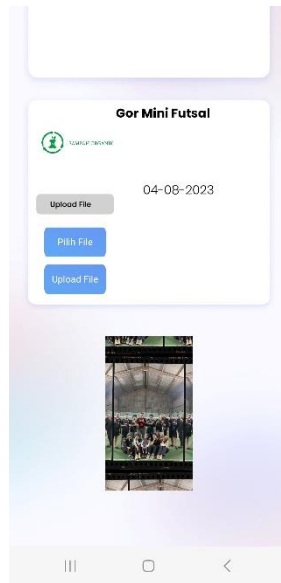
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Fig. 13 User's Home Page

After the user reads the detailed infrastructure information and then carries out the booking process, the next display the user will receive is a notification indicating a successful booking which will then be directed to the user's brand. In this display, the user will be given the option to upload a photo which contains proof of payment, file selection, and options for uploading photo files.

Integration and System Testing

The application that had been created was first tested to determine whether the application ran well and whether all the functions in the application operated according to their intended purpose. This testing was conducted using black-box testing.

Table 1
Black Box Testing

Test	Action Performed	Test Results	Conclusion
Login Form	Enter email and password	Successfully entered the infrastructure menu	Valid
Infrastructure Menu Page	Select the Infrastructure Menu	Successfully displayed available infrastructure	Valid
Selected Infrastructure Form	Select the available button	Successfully entered the infrastructure details page	Valid
Selected Infrastructure Form	Upload proof of payment on the upload button	Successfully uploaded proof of payment	Valid
Selected Infrastructure Form	Admin login	Successfully displayed the registered user data page	Valid
User Data Form	Select the User Data Menu	Successfully displayed the registered user data page	Valid

The table above represents a testing table, which is a system testing process carried out on users to ensure whether the system was suitable for use or if there were still elements that needed improvement.

Operator and maintenance

After the implementation of the proposed system, the maintenance phase began to ensure the system operated optimally in practice. Maintenance involved monitoring the system's performance to ensure that each feature functioned as intended, fixing any bugs or errors found during use, and developing new features based on user needs.

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The admin was also responsible for updating data within the system to maintain accuracy, including the status of facilities and payment proofs. Security aspects of the system were continuously improved to protect user data and transactions from threats. Additionally, training was provided to users, admins, and field officers to ensure a thorough understanding of the system, and periodic evaluations were conducted to assess system performance and make improvements based on user feedback. Effective maintenance ensured that the system remained efficient and relevant to user needs over time.

DISCUSSIONS

This study successfully developed an application that coordinated all sports facilities at DISPORASU, utilizing the Dart programming language with the Flutter Framework and Firebase as the database. The application was designed to facilitate administrators in managing the rented sports facilities, while also providing rental and return reports to assist the administration in addressing potential damages or fines for tenants. Additionally, the application generated transparent data accessible to all relevant parties. For users, the E-Booking application simplified the process of finding suitable sports facilities and provided information about available amenities and associated rental fees.

Based on the results of this study, further developments can be made for future research and application enhancements. The Android-based E-Booking application for sports facilities could be expanded into a multiplatform system, allowing users to access it from various devices. Moreover, the payment system could be optimized by integrating a more comprehensive payment gateway API, making the payment process more efficient and secure.

5. CONCLUSION

The result of this research is an Android-based e-Booking application for sports infrastructure on DISPORASU. This application was built using the Flutter Framework, Dart as the programming language and Firebase as the database. The application that is built can be used as a media for renting infrastructure for people who want to carry out a sports activity or be used for other public activities. This application displays in detail what information is offered by one infrastructure versus another, thus helping users find out the condition of the infrastructure without having to visit directly the location where the infrastructure is located.

The researcher realizes that the application being built has a weakness, for this reason the researcher hopes that this application will be useful for the people who will use it. Further researchers are advised to develop, and improve the functions and features of this application so that it can provide other uses and benefits to the wider community.

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