

# Golden Goal Futsal Court Rental Mobile Application Using the First Come First Serve (FCFS) Algorithm and Payment Gateway Integration

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**Abstract** – The futsal pitch rental process at Golden Goal is still done manually through direct communication or text messages, which often results in various problems such as unstructured booking queues, schedule conflicts due to the lack of a clear queuing system, and late payments. These problems result in low operational efficiency and an increased potential for scheduling errors. This research aims to develop a mobile-based futsal pitch rental application equipped with the implementation of the First Come First Serve (FCFS) algorithm to ensure the booking process is carried out based on the user's arrival time in a fair and orderly manner. The system development method used is the Waterfall model, which includes requirements analysis, design, implementation, testing, and maintenance. The application was developed using the Flutter framework because it has the ability to produce Android and iOS applications with only a single codebase, faster development time, and stable and responsive interface performance. These advantages make Flutter suitable for building a real-time booking system that requires fast interaction and a consistent user experience. Furthermore, the application is integrated with Midtrans services as a payment gateway to facilitate automatic digital payment transactions. Testing results using the black-box method indicate that all key features, including schedule selection, FCFS-based queuing mechanism, payment processing, and rental data management, have run well as needed. The implementation of this system has proven to be able to reduce schedule conflicts, improve the accuracy of the booking process, and increase the efficiency of rental management at Golden Goal. Thus, this application can be an effective and modern solution to address the problem of futsal field rentals that have been handled manually.

**Keywords** – Rental Application, Futsal Field, Mobile Application, First Come First Serve, Payment Gateway

## I. INTRODUCTION

The development of information and communication technology has driven rapid digital transformation in various sectors, including public services and online businesses. Digitalization enables automation, increased efficiency, and broader access to services for the public [1]. In the modern context, almost all aspects of human life now depend on digital technology, including education, economics, government, and entertainment. Innovations in information technology make it easier to carry out daily activities that previously required more time and energy. Therefore, the use of technology has become a primary need to support operational activities and improve service quality. This has encouraged many organizations and businesses to utilize mobile applications and online systems to provide faster, cheaper, and more accurate services [2].

Currently, many futsal field rentals are still done manually, via telephone, text message, or by visiting the rental location in person. This method is prone to scheduling conflicts, late confirmations, and recording errors [3]. The manual process also creates limitations in terms of information transparency, because users cannot directly check the field's availability. This often results in inefficiencies in service, both from the user and management side. Furthermore, the manual method is also unable to reach a wide range of customers because it relies on conventional communication. Therefore, a digital solution is needed that can overcome these obstacles by

providing a fast, transparent, and integrated booking system.

Based on initial observations conducted at Golden Goal Futsal, located at Jl. Pogung Raya No. 172, Pogung Kidul, Sinduadi, Yogyakarta, it was discovered that the rental process is still carried out manually via WhatsApp or telephone. This manual method creates a number of real problems, including scheduling conflicts between users, delays in booking confirmations, transaction recording errors, the lack of structured booking history data, and customers being unable to view field availability in real time. These conditions hamper operational processes and reduce the quality of service to customers.

One of the main solutions is the development of mobile-based applications, due to their ease of access anytime and anywhere. With mobile applications, users can check field availability in real time, make reservations, and receive automatic confirmation via notifications [4]. Such applications not only provide convenience for users, but also help field managers in organizing schedules, recording transactions, and minimizing human error. In addition, mobile-based systems have high flexibility in adjusting features according to business needs. Mobile-based sports reservation applications have been proven to speed up processes and improve user experience [5].

The payment aspect is a crucial part of the rental system. Conventional payment methods such as cash or manual bank transfers often face problems such as verification delays, number errors, and low security [6]. Therefore, integrating digital payments through a payment gateway is an ideal solution, enabling payment methods



such as e-wallets, credit cards, or bank transfers with better transaction security [7]. Based on these factors, this study proposes the design of a mobile-based futsal field rental application integrated with a payment gateway as an effort to improve the efficiency, accuracy, and convenience of rental services.

Besides the payment aspect, one of the main challenges in a rental system is fair and orderly scheduling, especially when multiple users make reservations at almost the same time. For this reason, a reservation mechanism is needed that has clear rules in determining who is entitled to get the slot first. The First Come First Serve (FCFS) algorithm is one of the simplest and most effective scheduling algorithms that processes requests based on the order of arrival [8]. Several other studies have shown that FCFS is able to reduce reservation conflicts in reservation systems and digital queuing systems because it is deterministic, easy to implement, and guarantees fairness based on the time of request [9]. This algorithm has been applied to various modern systems such as futsal field reservation applications, sports facility reservations, and public service systems, and has been proven to be able to prevent schedule conflicts and overlapping reservations [10].

The purpose of this research is to develop a mobile-based futsal field rental application that can simplify the digital booking process. This application is designed to overcome various problems that often arise in the manual booking process, such as long queues, clashing booking schedules, and limited transparency of field availability information. In addition, this research aims to implement the First Come First Serve (FCFS) algorithm as an automatic scheduling method to ensure that each booking is processed fairly based on arrival time. This research also aims to integrate a payment gateway system so that the payment process can be carried out more easily, quickly, and securely. Overall, this research is expected to produce an effective and efficient digital solution to support the management of futsal field rentals.

## II. RESEARCH METHODOLOGY

The research method used in this study explains the stages undertaken by researchers in the application design and development process. This research process was conducted in a structured and systematic manner, starting with data collection, needs analysis, system design, implementation, and system testing. To illustrate the overall research flow, a research methodology flowchart was used, as shown in Figure 1.

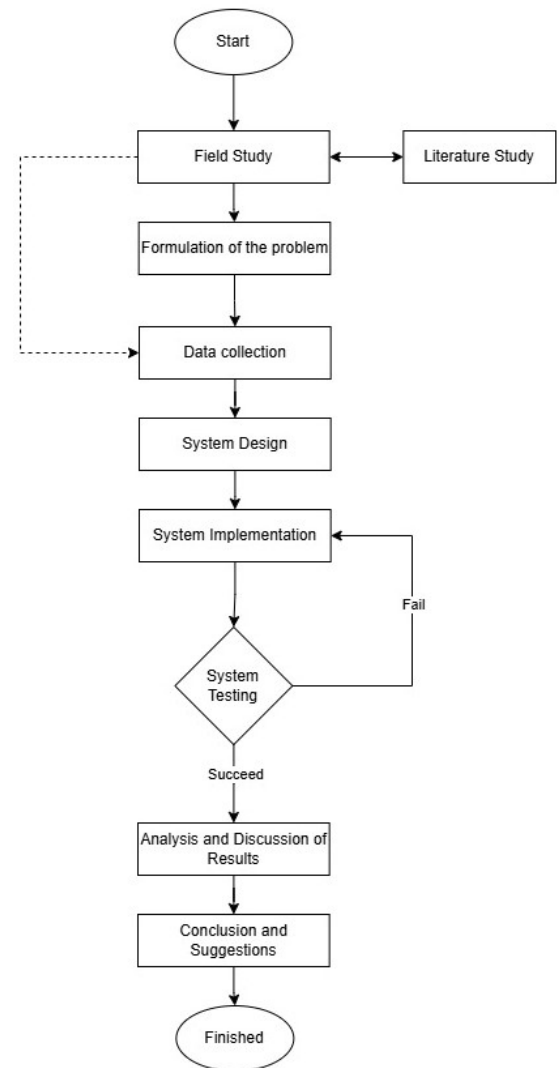


Figure. 1 Research Stages

### A. Data Collection Method

At this stage, data collection was conducted through direct field observations and interviews with futsal field managers to formulate user needs. Functional (reservations, schedule management, payments) and non-functional (security, convenience, performance) requirements were identified and documented as system specifications.

#### 1. Observation

The observation method is carried out by direct observation of the research object, which allows researchers to obtain empirical data in the field. The purpose of observation is to describe behavior, interactions, and processes as they occur naturally in the research context, thus producing a more contextual and valid understanding of the phenomena being studied [11]. In this study, observations were conducted at Golden Goal Futsal, located at Jl. Pogung Raya No. 172, Pogung Kidul, Sinduadi, Mlati District, Sleman Regency, Special Region of Yogyakarta 55284. Through this method, researchers observed the field rental process, the schedule recording system, and interactions between managers and customers. The geographical location of Golden Goal Futsal can be seen in Figure 2.

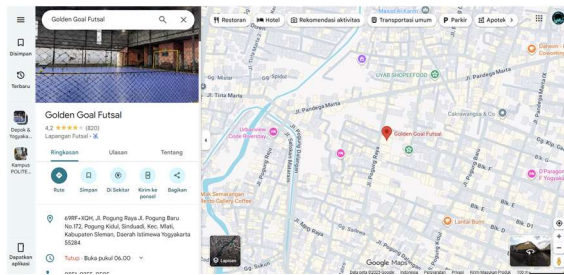


Figure. 2 Research Location

## 2. Interview

To obtain in-depth information from the parties involved in the futsal field rental process, the researcher used the interview method. The purpose of interviews in qualitative research is to gain an understanding of the experiences, perceptions, and meanings given by individuals to the situations or events they experience through direct interaction with the researcher [12]. Interviews were conducted directly with the owners and managers of Golden Goal Futsal, with the aim of obtaining data regarding the field rental management system, obstacles faced in management, and the need for a more efficient digital system.

## B. System Development Method

This research uses the Waterfall method, a sequential and systematic software development model. The selection of the Waterfall method in this research is based on the characteristics of stable, unchanging system requirements that can be fully defined from the start. The Waterfall model provides a sequential and clearly documented workflow, so that each stage, such as analysis, design, testing, and maintenance, can be tightly controlled. This approach is relevant because the futsal field rental system with payment gateway integration and the FCFS algorithm has a relatively fixed business process, so it does not require dynamic iteration of requirements.

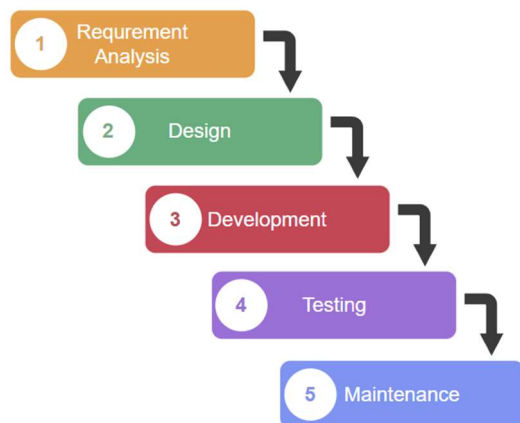


Figure. 3 Waterfall Method

## 1. Requirements Analysis

The requirements analysis phase is the initial step in the Waterfall method, which aims to identify and define the system's overall requirements. This phase involves data collection through observation, interviews, and document review to understand the problems within the existing system. The results of this analysis include functional requirements, such as

user registration, field booking, schedule management, and payment systems, as well as non-functional requirements such as security, performance, and ease of use. This requirements analysis serves as the primary basis for system design, ensuring that the developed solution aligns with user needs and research objectives.

## 2. Design

The system design uses the Unified Modeling Language (UML) modeling approach because it can clearly describe the structure and operation of the system. At this stage, two main types of diagrams are used: Use Case Diagrams and Activity Diagrams. Use Case Diagrams are used to explain the relationships between actors and the main functions within the system, while Activity Diagrams are used to illustrate the flow of activities or business processes occurring within the application. With this modeling, the system design becomes more focused and easier to understand before the implementation process is carried out.

## 3. Development

At this stage, the entire system design is converted into program code using the appropriate programming language and framework. In this research, the implementation was carried out by building a mobile-based application connected to the server and database via an API. The main features implemented include user registration, field schedule booking, confirmation notifications, and payments via a payment gateway. This integration is carried out so that the system can process transactions in real time and automatically record payment status in the database.

## 4. Testing

Testing is performed after the system is implemented, using the Black Box Testing method, which focuses on testing from the user side (input-output) without looking at the internal code structure [13]. For example, the application is tested with valid and invalid input scenarios to ensure the system provides an appropriate response. The Black Box Testing method is also used for financial applications with boundary value analysis techniques [14].

## 5. Maintenance

At this stage, the system is monitored and repaired after implementation. Maintenance is performed to fix bugs, improve application performance, and adapt the system to user needs, which may change over time. This stage also ensures that the application remains functional and secure in the long term, especially when integrating with digital payment systems that require regular updates.

## C. First Come First Serve

The First Come, First Served (FCFS) algorithm is one of the most basic scheduling methods, operating in the order of arrival of requests. The processes or data that arrive first are processed first, regardless of priority or weight. This concept follows the First In, First Out (FIFO) principle. This approach is particularly relevant for queuing and reservation systems that require transparency in user

request processing, such as sports facility reservations. Due to its simple and deterministic nature, FCFS is easy to implement in both web and mobile applications.

In the context of a field booking system, FCFS has been proven to reduce the risk of scheduling conflicts and simplify reservation management. The FCFS algorithm helps e-booking systems process bookings in a structured manner, thereby reducing the potential for scheduling conflicts between users [15]. Furthermore, FCFS is effective for use on mobile-based sports field reservation platforms because it can clearly organize user booking flows and minimize human error [16]. Therefore, the implementation of FCFS in a futsal field rental application significantly supports queue fairness while maintaining scheduling consistency.

### III. RESULTS AND DISCUSSION

#### A. Use Case Diagram

This Use Case Diagram design illustrates the relationship between Customers and Admins with the system, with the main functions that can be accessed by each according to their role and access rights. The Use Case Diagram design can be seen in Figure 3.

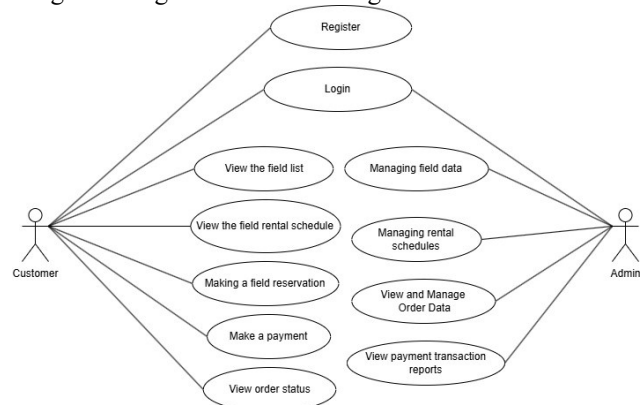


Figure. 4 Use Case Diagram

#### B. Activity Diagram

In this activity diagram, there are several activities that are defined, namely activities when logging in and registering, validating input data, checking field availability, calculating rental costs, integrating with payment gateways, and confirming payments.

In this activity diagram, you can see the initial process when the user opens the application and logs in or registers on the application until the main page of the application is displayed.

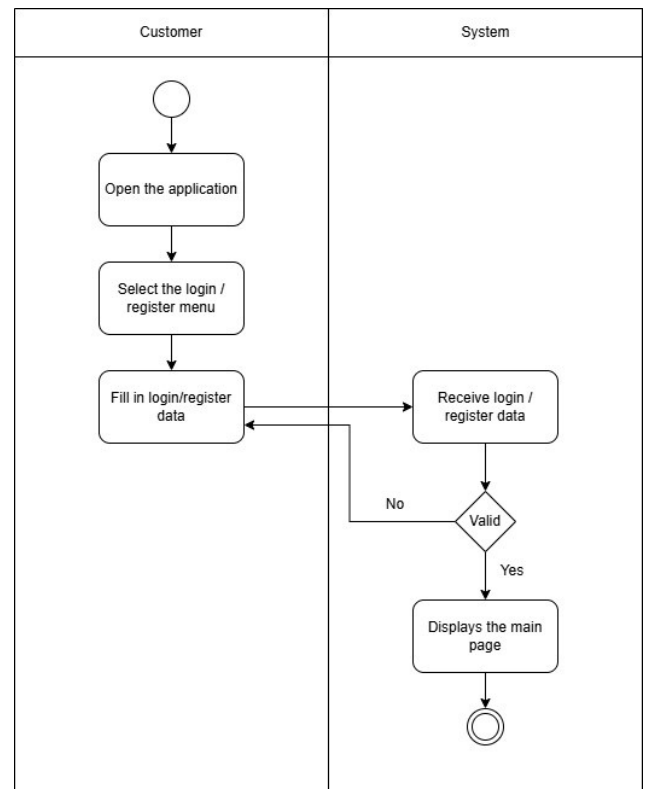


Figure. 5 Activity Diagram of User Login and Registration

In this activity diagram, every user input (such as date, duration, and personal data) is checked by the system. Validation includes correct formatting, mandatory data, and value limits. The goal is to prevent data errors before proceeding to the next stage.

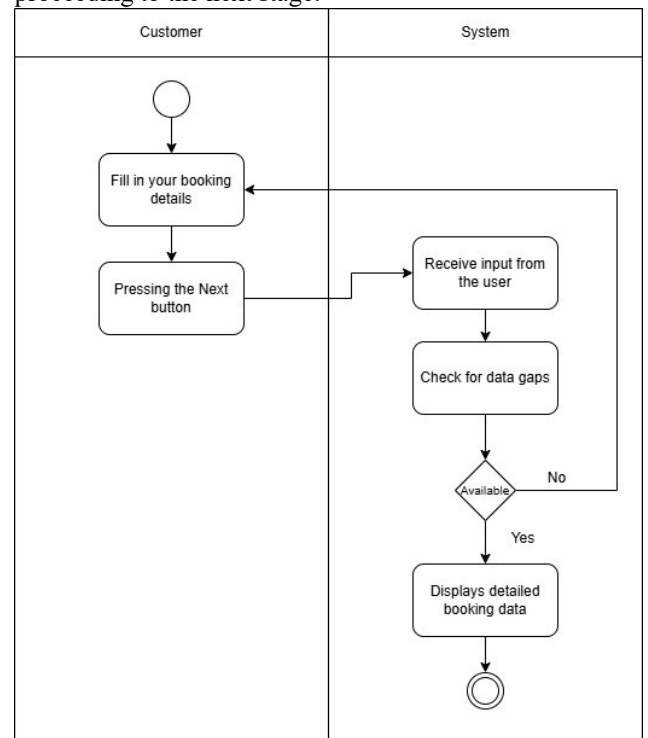


Figure. 6 Activity Diagram Validation of Input Data

In this activity diagram, after selecting a date and time, the user sends a request to the system to check if the field

is available. The system checks the database and informs the user in real time whether the field is available or not.

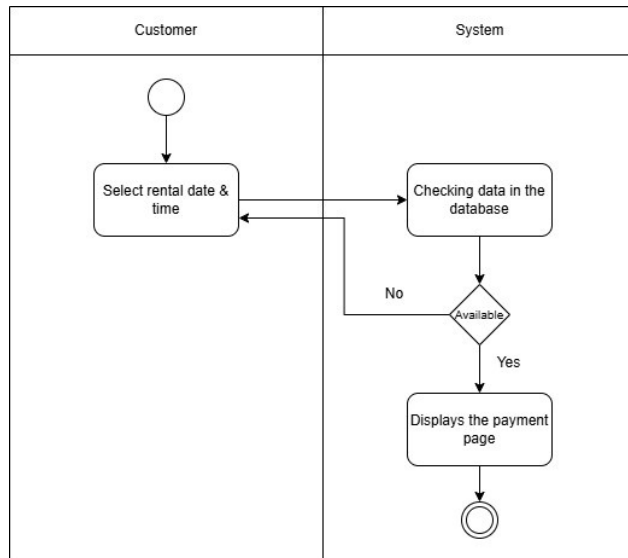


Figure. 7 Activity Diagram for Field Availability Check

In this activity diagram, the system automatically calculates the total rental cost based on duration, days, and field type. Any active promotions or discounts are also taken into account. The calculation results are displayed to the user for transparency.

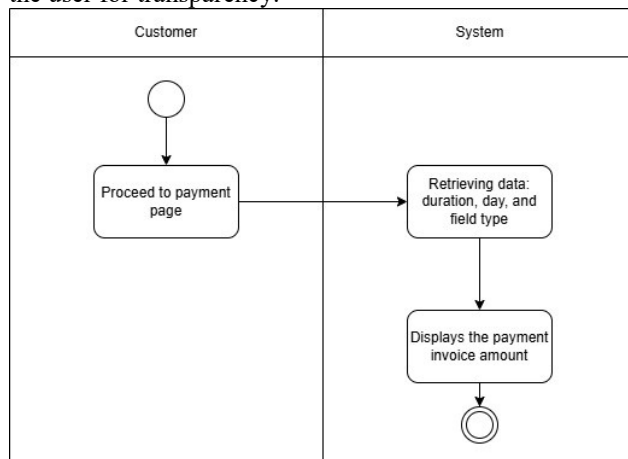


Figure. 8 Activity Diagram Calculating Rental Costs

In this activity diagram, after a successful order is placed, the user is redirected to the Midtrans payment page. The system sends a transaction token to Midtrans and waits for the user to complete the payment on the platform.

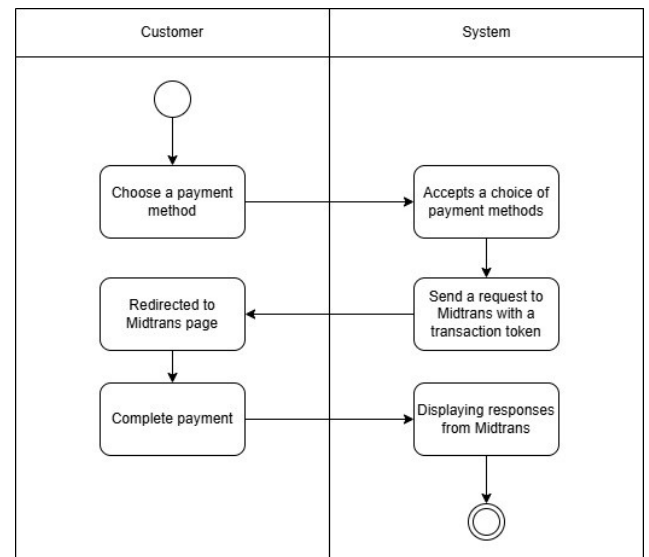


Figure. 9 Activity Diagram of Integration with Payment Gateway

In this activity diagram, after a payment is made, Midtrans sends a notification (webhook) to the server. The system receives the payment status (successful, failed, or pending) and updates the information in the database. The user can then view the transaction status directly in the application.

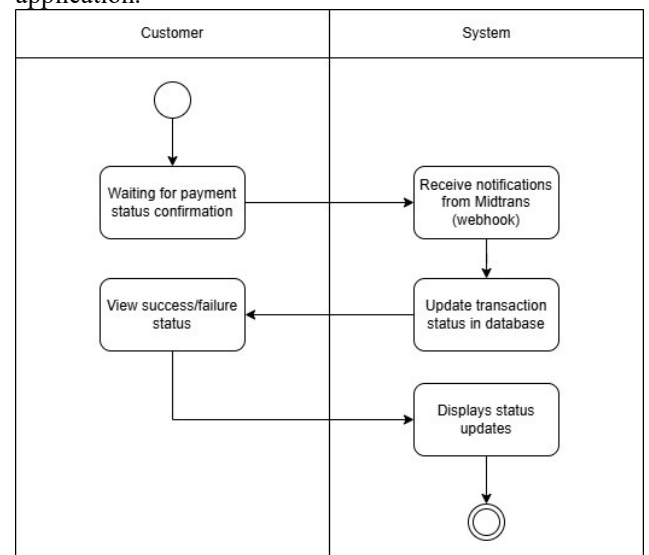


Figure. 10 Activity Diagram Calculating Rental Costs

### C. Application Display

This section presents the results of the system created based on the existing design. Screenshots from the application are used to demonstrate how the features work effectively, meeting user needs.

#### 1. Login Page

On the login page, users open the app by entering information such as their email address and password. Additionally, there's a Google login option for a faster and easier way to log in.

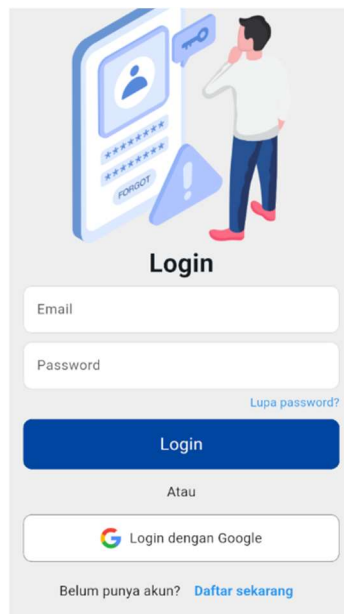


Figure. 11 Login Page View

## 2. Register Page

Next is the registration page, which is used by new users to register for the application. Users are asked to enter information such as name, email address, and password. Validation is performed to ensure the entered data is correct and not duplicated. After successful registration, users will be redirected to the login page.

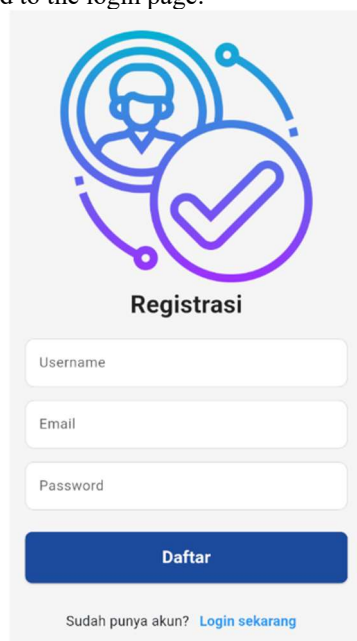


Figure. 12 Register Page View

## 3. Home Page

The main page appears after a user successfully logs in. It provides concise information and navigation to key features, such as field booking. It also features a user-friendly and easy-to-use interface.

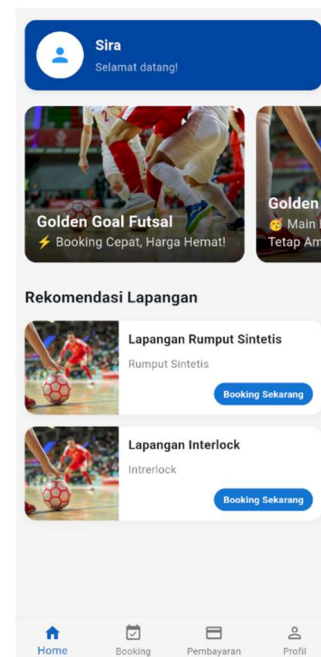


Figure. 13 Main Page View

## 4. Booking Page

On this page, users can select a field, choose a date and time to play, and view availability. The system will automatically display the rental price based on the selected time. If available, users can proceed with the booking process. Validation is performed to avoid scheduling conflicts.

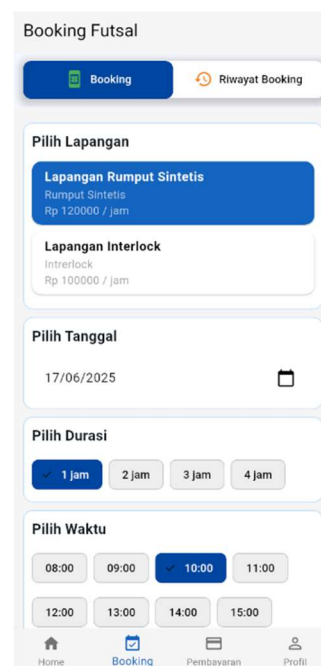


Figure. 14 Booking Page View

## 5. Booking History Page

On this page, customers can view a list of booking history or schedules entered through the previous Booking page. Furthermore, this page displays the payment status for each booking, allowing customers to monitor whether the payment has been successful, is still in progress, or has not yet been made.

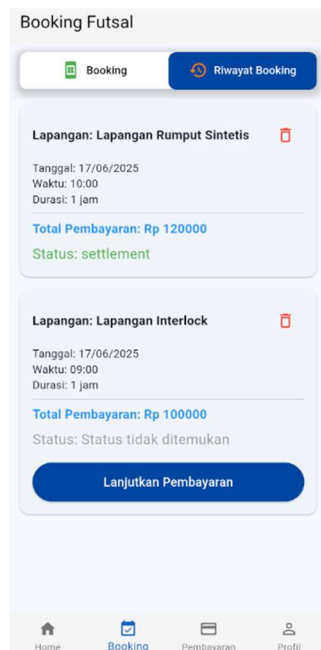


Figure. 15 Booking History Page View

## 6. Payment Page

After placing an order, users are directed to the payment page. Here, they can select a payment method, and the system will automatically connect to Midtrans as the payment gateway. Once payment is successful, the system will display a confirmation and update the order status directly via a response from Midtrans.

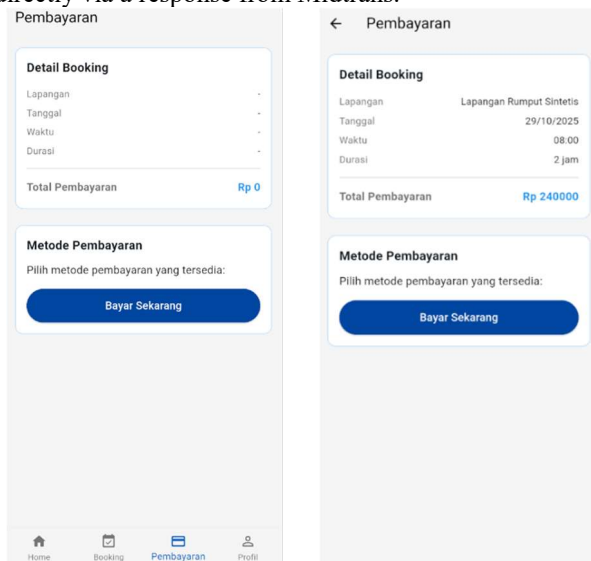


Figure. 16 Payment Page View

## 7. Profile Page

This page displays user account information, including name and email address. Users can also update their personal data or log out of their account. This page helps users manage their personal information within the app.

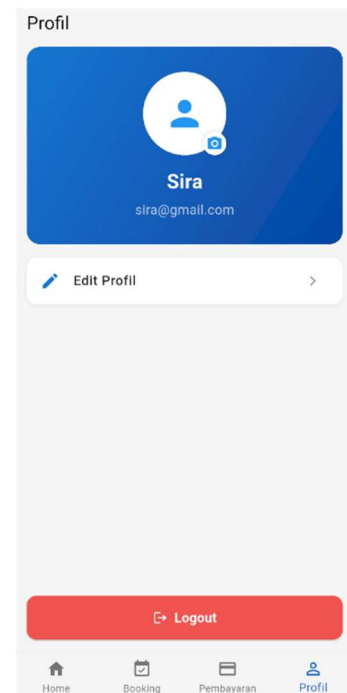


Figure. 17 Profile Page View

## 8. Admin Dashboard Page

The following is a view of the admin dashboard. On this dashboard, admins can view various statistics, such as the number of fields, the number of bookings, and the number of users. Furthermore, navigation to key management features, such as field settings, bookings, and reports, is clearly visible on this screen for easy access.

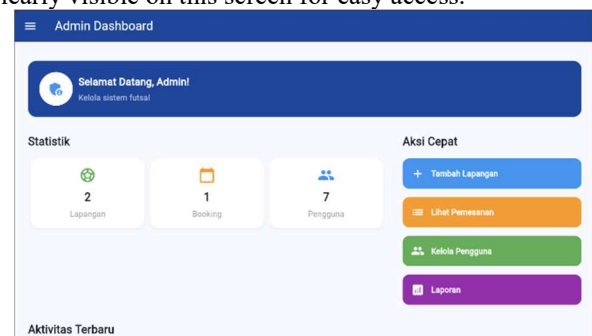


Figure. 18 Admin Dashboard Page View

## 9. Halaman Kelola Lapangan Admin

On this page, admins can manage available field data. This management includes determining field types, setting rental prices, and scheduling field availability. This feature ensures that field operational data can be flexibly updated as needed.

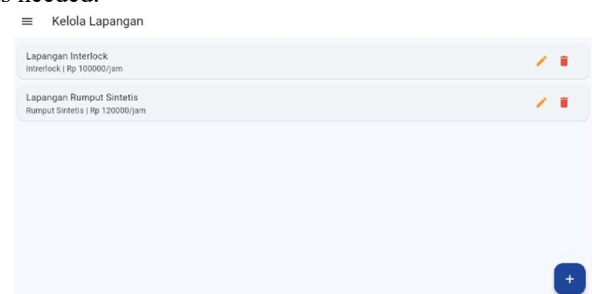


Figure. 19 Admin Field Management Page View

#### 10. Manage Admin Field Page

On this page, admin can monitor reports and statistics of income and orders.

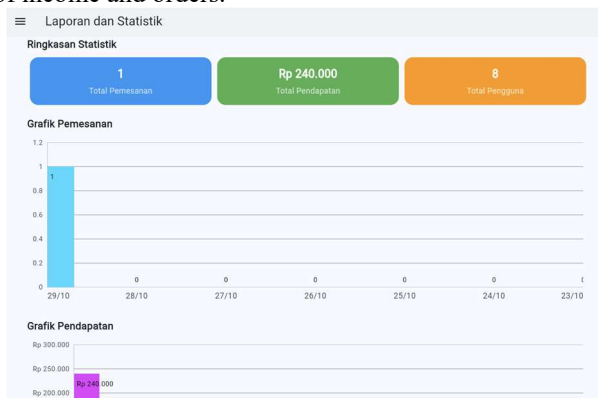


Figure. 20 Admin Reports and Statistics Page View

#### D. Black Box Testing

The futsal field rental application was tested using the Black Box Testing method to ensure that all system functions operate according to established specifications. This testing process evaluates the system's ability to respond to user input and produce output that meets expectations. The test results are shown in Table 1.

Table 1. Black Box Testing Results of Applications on Customers

Feature	Condition	Results
Login Page	Customers log in using a registered account or using a Google account login	Success
Registration page	Customers can register by filling in complete data to enter the application	Success
Halaman Utama	Displays the main page on the application for customers	Success
Home Page	Customers can make bookings by filling in the field data	Success
Booking History Page	Customers can view the history of field bookings and also see the payment status.	Success
Payment Page	Customers will make payments according to the data in the previous booking	Success
Profile Page	Customers can view profile information related to personal data and others	Success

Table 2. Black Box Testing Results of the Application on the Admin

Feature	Condition	Results
Login Page	Admin logs in using a registered account or logs in using a Google account	Success
Dashboard Page	Displaying the dashboard page on the application for Admin	Success
Manage Field Page	Admin can manage field data by adding, changing, and deleting available field information	Success
Reports and Statistics Page	Admin can view reports and statistics of the number of orders and revenue	Success

#### IV. CONCLUSION

Based on development and testing results, the mobile-based futsal field rental application built using Flutter, the FCFS algorithm, and the Midtrans payment gateway integration has successfully met the primary needs of both

users and field managers. The FCFS algorithm implementation has proven to be able to avoid scheduling conflicts because the system automatically gives priority to users who make the earliest bookings. The payment gateway integration has also been proven to increase transaction efficiency, speed up the payment confirmation process, and minimize verification errors compared to manual methods. Black-box testing results show that all core features, from registration, login, checking schedule availability, booking, and payment, run according to the designed scenario without any functional errors.

Although the application has been functioning well, this research still has room for further development. In future research, the system can be enhanced by adding automatic notification and reminder features to ensure users don't miss their scheduled playtimes, as well as cancellation and refund features fully integrated with the payment gateway to increase user flexibility and convenience. Furthermore, the development of more adaptive scheduling algorithms such as EDF (Earliest Deadline First) or dynamic prioritization can also be explored to improve schedule management efficiency under more complex demand conditions.

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