



Design and Development of an Integrated Futsal Court Scheduling Reservation Information System in Subang Regency Using the Greedy Algorithm

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Article Info

Article history

Received : Apr 10, 2025

Revised : Apr 28, 2025

Accepted : Apr 30, 2025

Keywords:

Information System;

Greedy Algorithm;

Reservation;

User Acceptance Testing;

Waterfall.

Abstract

The futsal court reservation system in Subang Regency is still conducted manually, leading to several issues. From the renters' perspective, it is difficult to schedule futsal courts, and they must visit the futsal venue in person to make a reservation. From the court managers' perspective, the manual recording process results in paper waste due to the use of notebooks, and there are frequent incidents of lost payment receipts and scheduling data. The system development method used is the System Development Life Cycle (SDLC), applying the waterfall model which includes the stages of planning, analysis, design, and system implementation to ensure a structured, tested, and measurable system that meets user needs effectively. To optimize scheduling recommendations, this system utilizes the greedy algorithm, which can provide alternative suggestions when the desired court is unavailable at the requested time. These recommendations are based on the nearest available times and aim to provide the best solution for renters. This study produces an information system designed to facilitate the reservation and scheduling process of futsal courts in Subang Regency. The system is designed for renters to make futsal court reservations and for managers to manage and record reservation data. In addition, the study implements the greedy algorithm to optimize scheduling recommendations when the desired court is fully booked. The system has been tested using Black Box Testing and functions correctly with 100% valid results, and the User Acceptance Testing (UAT) measurement yielded an 86% satisfaction rate, indicating that the futsal court scheduling reservation information system works well and is feasible for use.

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1. Introduction

Currently, information technology has developed rapidly with the presence of the internet, enabling connectivity between various media. The need for information technology is very high to assist various types of human work, including futsal court reservations. According to Khotimah (2022), futsal has become one of the most popular sports in Subang Regency and across Indonesia, including West Java Province. Based on 2021 data, the total number of futsal courts was 2,906, an increase of 8.74%

(opendata.jabarprov.go.id).

ABCD Futsal, EFGH Futsal, IJKL Futsal, and MNOP Futsal are futsal facilities located in Subang Regency, particularly in the Subang District, which are currently the most preferred venues for futsal court renters. However, the reservation process at these places is still manual due to the absence of a reservation information system—both in terms of service, court scheduling, payment, and recording. Based on several problems observed in these futsal venues from both management and renter perspectives, the writer has identified common issues in the reservation process. Firstly, renters face difficulties in scheduling because they must visit the court directly, which is time-consuming, especially for those coming from outside Subang District. If the desired time slot has already been booked by someone else, they have to look for other venues without receiving any recommendations for other available time slots.

When trying to reserve via WhatsApp, messages often get buried among many others, causing delays and lack of transparency regarding the schedule. For payment, after selecting a time and venue, renters must pay a down payment (DP) by coming directly to the venue. After payment, they receive a paper receipt as proof. Upon full payment, they receive another paper receipt, leading to paper waste and longer processing times. It is also common for renters to lose their payment receipts. Additionally, there is no existing collaboration between futsal venues in Subang Regency, known as integration, particularly in terms of scheduling information. This results in the absence of real-time information for renters looking to make court reservations across venues in Subang.

To address these issues, the writer proposes a solution in the form of an integrated and systematic information system that utilizes technological advancements to manage futsal court reservations in Subang Regency. "Integrated" means that the futsal venues in Subang Regency can collaborate in building a better reservation system, improving the overall reservation process—starting from court search, booking schedules, and payment, to providing scheduling recommendations using the greedy algorithm. This algorithm will offer the best alternative schedules when the desired time slot is fully booked.

The proposed system will offer convenient payment methods for renters wanting to play futsal in Subang City without the need for in-person or WhatsApp-based payments. Integration in this context means that a single system connects four or more futsal courts, collaborating with a unified goal and shared components for schedule recommendations. The integrated reservation system is expected to produce a new, improved reservation process for futsal courts throughout Subang Regency. It aims to provide information that is fast, accurate, and timely for renters, while also benefiting futsal court managers by promoting their businesses and expanding their marketing reach through a website (Hendra Kurniawan et al., 2018).

2. Research Methodology

Research Design

System Development Method

The research process requires a clearly structured framework with defined stages. The development stages for the Design and Development of an Integrated Futsal Court Reservation Information System in Subang Regency use the Waterfall methodology. This methodology includes the stages of: Requirements Analysis and Definition, System and Software Design, Implementation and Unit Testing, and Integration and System Testing (Eka Achyani et al., 2018).

The Waterfall method is a software development approach that follows a linear, sequential, and tiered flow. This approach consists of several phases that must be completed one by one in order. The application of the Waterfall method in the design of the integrated futsal court scheduling reservation information system in Subang Regency using the Greedy algorithm includes the following phases:

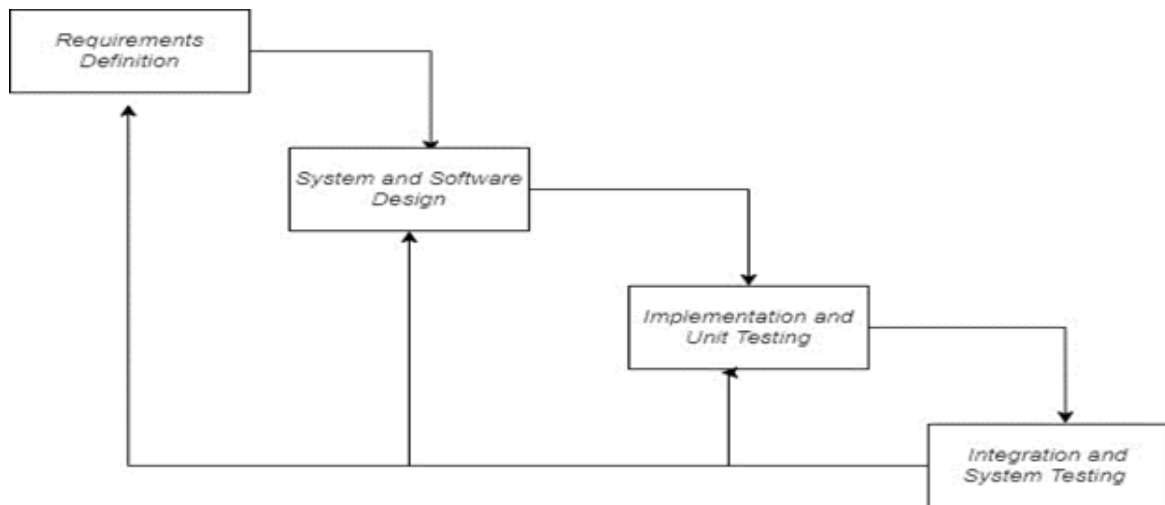


Figure 1. Waterfall Methodology

Requirements Definition

In the first steps, the author conducted an analysis of the requirements needed to develop an information system specifically for reservations. The technique used for gathering requirements included observation, interviews, and literature studies to find and collect data as system requirements. The observation and interview process was carried out with futsal field managers at each futsal venue as well as with the renters of the futsal fields. During the interview process, the author identified several issues such as scheduling and record-keeping problems.

System and Software Design

At this step, the author will design the structure and architecture of the integrated futsal court reservation and scheduling information system. This includes defining the reservation, scheduling, and payment process flow, as well as creating a manual calculation design related to the greedy algorithm to determine the best schedule recommendation. Additionally, the user interface (UI/UX design) will be structured to ensure that users can easily operate the system both in terms of modeling and visual design. The modeling process uses the Unified Modeling Language (UML) approach and produces several diagrams, including the Use Case Diagram, Activity Diagram, Class Diagram, and Sequence Diagram. The tool used for creating these models is StarUML.

Implementation and Unit Testing

In the Implementation and Unit Testing step, the system design is translated into programming using source code. The programming language used is Laravel, and the system utilizes a MySQL database.

The implementation also includes applying a scheduling recommendation system using the Greedy Algorithm to optimize futsal court recommendations, allowing users to receive the best possible schedule among multiple available futsal courts in the system. For testing, the Black Box testing method is used by preparing test cases and conducting User Acceptance Testing (UAT) as the basis for the evaluation process.

Integration and System Testing

In the Integration and System Testing step, the system is integrated with both the futsal court managers and the users (renters), enabling all parties to be interconnected and function as a unified system. This facilitates collaboration among futsal court providers across Subang Regency. For system testing, if any bugs are found, the author will document them. Once the bugs are fixed, the author will conduct retesting to ensure the system functions correctly.

3. Results and Discussion

Requirement Definition

Observation

At the observation step, direct visits were conducted to several futsal locations in the central area of Subang Regency, including ABCD Futsal, EFGH Futsal, IJKL Futsal, and MNOP Futsal. The observation was carried out by observing the activities taking place at the futsal venues and witnessing the enthusiasm of people of various ages, especially males, for the sport of futsal.

Interviews

The interviews were conducted directly with the futsal field managers at ABCD Futsal, EFGH Futsal, IJKL Futsal, and MNOP Futsal. Based on the interview results from the four futsal venues located in the central area of Subang Regency, all four locations have generally similar business processes. The reservation activity begins with visitors coming to the futsal location to check the available schedule, then proceeding with the booking process to select the desired time and paying a down payment in advance. Sometimes, if the desired time is unavailable, some visitors choose to reschedule or look for other available futsal fields. In addition, the scheduling is recorded manually in a notebook, which is considered less effective as the paper-based process is prone to loss or damage due to human error.

System and Software Design

Use Case Diagram

The following is the use case diagram of the Design and Development of the Futsal Field Reservation and Scheduling Information System, as shown in Figure 2 Use Case Diagram.

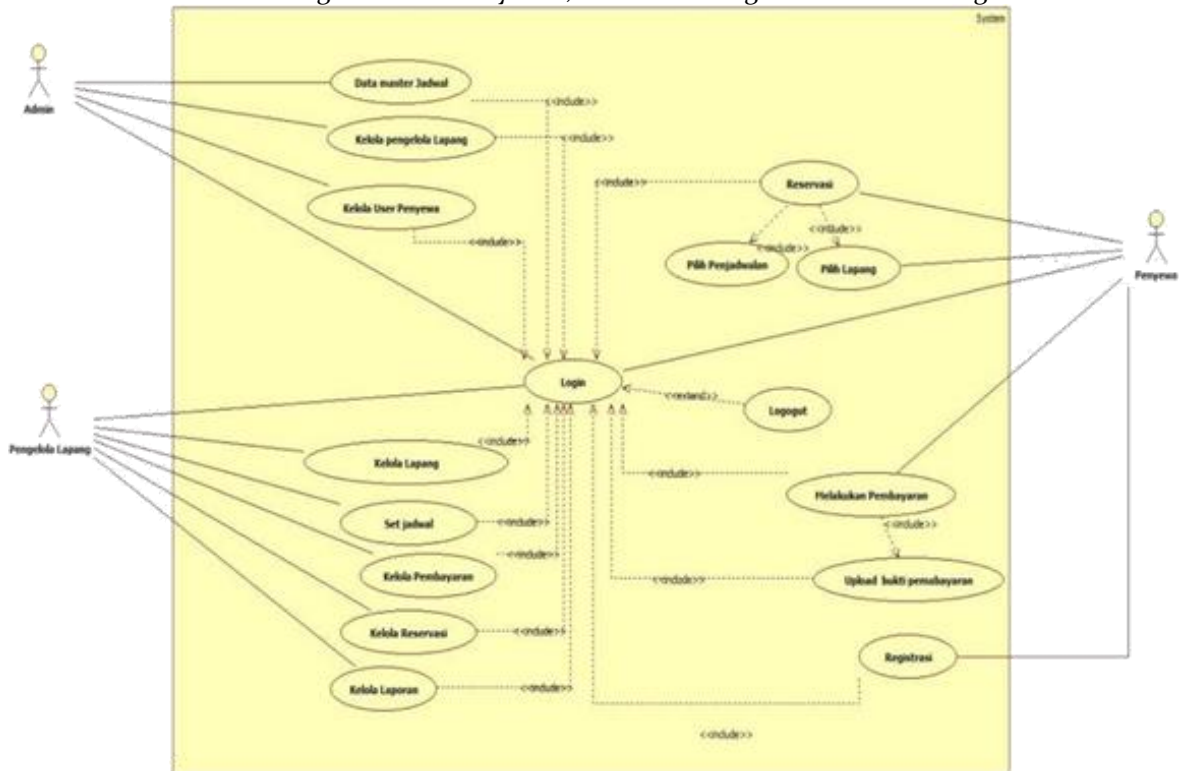


Figure 2. Use Case Diagram

Activity Diagram

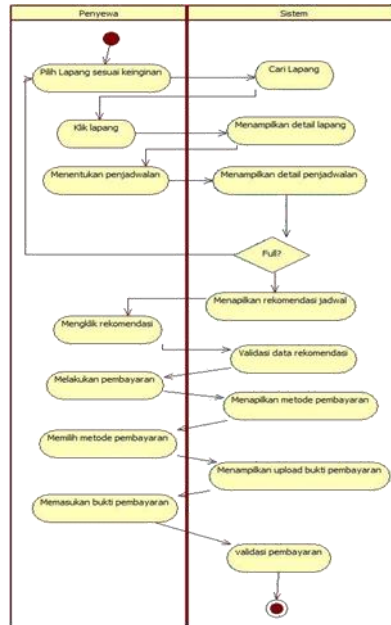


Figure 3. Reservation Activity Diagram

Sequence Diagram

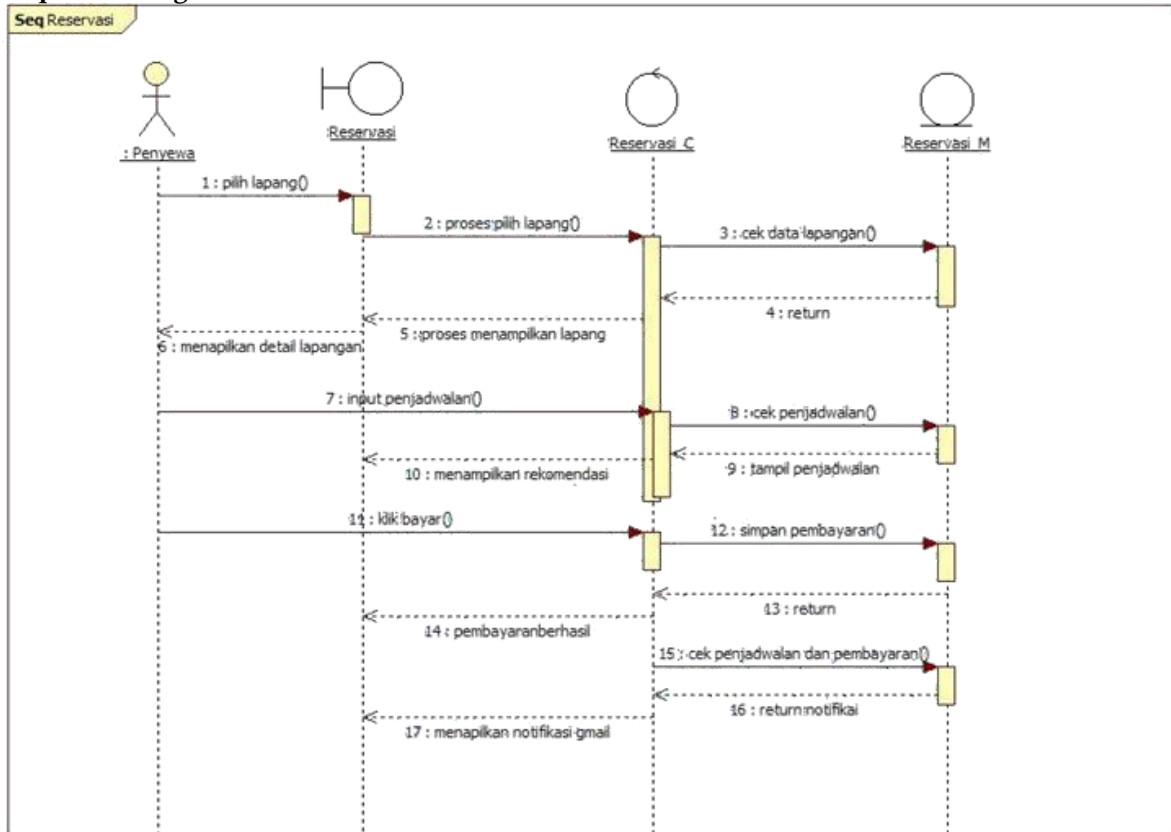


Figure 4. Reservation Activity Diagram

Class Diagram

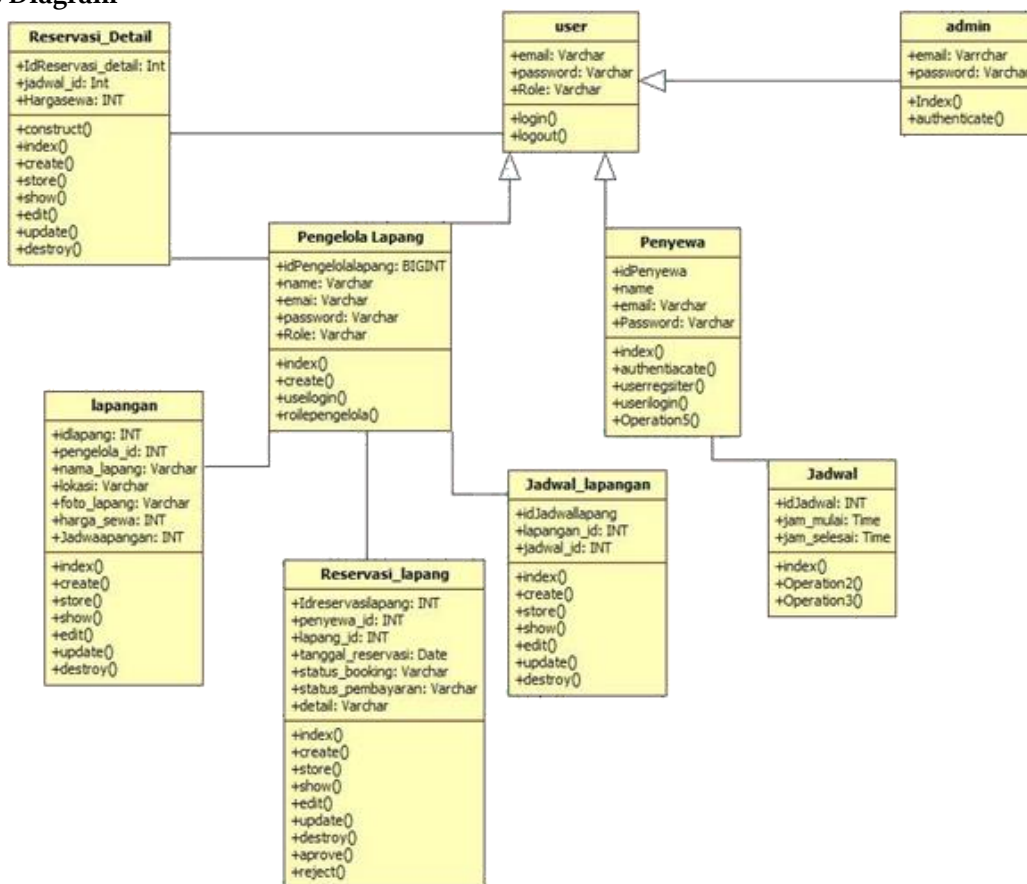


Figure 5. Class Diagram

Generating the Best Schedule Recommendation Using the Greedy Algorithm Method

The greedy algorithm is one of the methods used to solve optimization problems. In the context of futsal field reservations, the optimization problem involves providing the best schedule recommendation to renters when their preferred futsal field is already fully booked.

The following are the steps for determining the scheduling recommendation elements for futsal fields using the greedy algorithm, based on the renter's distance to the field and the available time slots:

- 1) Determine the set of candidates, which includes the names of the futsal fields along with their distances calculated using latitude and longitude, obtained when inputting the field locations, as well as the availability status of each schedule (available or full). Determine the set of candidates, which includes the names of the futsal fields along with their distances calculated using latitude and longitude, obtained when inputting the field locations, as well as the availability status of each schedule (available or full).

Table 1 Set of Greedy Algorithm Candidates

Fields	Schedule	Latitude	Longitude	Price	Status
ABCD	20:00 - 21:00	-6.6459698	107.3797426	65000	Available
EFGH	18:00 - 20:00	-6.6405783	107.3915092	60000	Full
IJKL	16:00 - 17:00, 20:00 - 22:00	6.5279362	107.4298522	70000	Available
MNOP	19:00 - 21:00	-6.5570605	107.4368364	60000	Full

- 2) Determining the set of solutions based on the renter's distance at the time of registration

Table 2 Set of Solutions of the Greedy Algorithm

Id_renters	Latitude	Longitude	Fields	Price
1	-6.642.103	107.375.819	ABCD	65000
1	-6.642.103	107.375.819	EFGH	70000
1	-6.642.103	1.073.758.109	IJKL	60000

- 3) The function of the solution is to assess whether the distance between the renter and the field has been maximized.

Table 3 Solution Function for Determining the Distance Between the Renter and the Manager

Id_renters	Latitude	Longitude	Fields	Distance Between the Renter and the Manager
1	-6.642.103	-6.642.103	ABCD	2320,79
1	-6.642.103	-6.642.103	EFGH	8734,88
1	-6.642.103	-6.642.103	IJKL	14860,11353

- 4) The selection function is to choose the nearest field and an available schedule.

Table 4 Selection Function for Choosing the Nearest Field to the Renter

Fields Name	Distance (meter)	Status
Seleksi [EFGH]		
ABCD	2320,79	<i>Availbale</i>
IJKL	8734,88	<i>Availbale</i>

- 5) The feasibility function determines whether the nearest distance and the time slot at the field are truly available.

Table 5 Feasibility Function for Determining the Nearest Distance and Available Time Slot

Fields Name	Distance (meter)	Schedule	Status
Carera	2320,79	16.00-18.00	<i>Available</i>

Implementation and Unit Testing

1) User Interface Landing Page

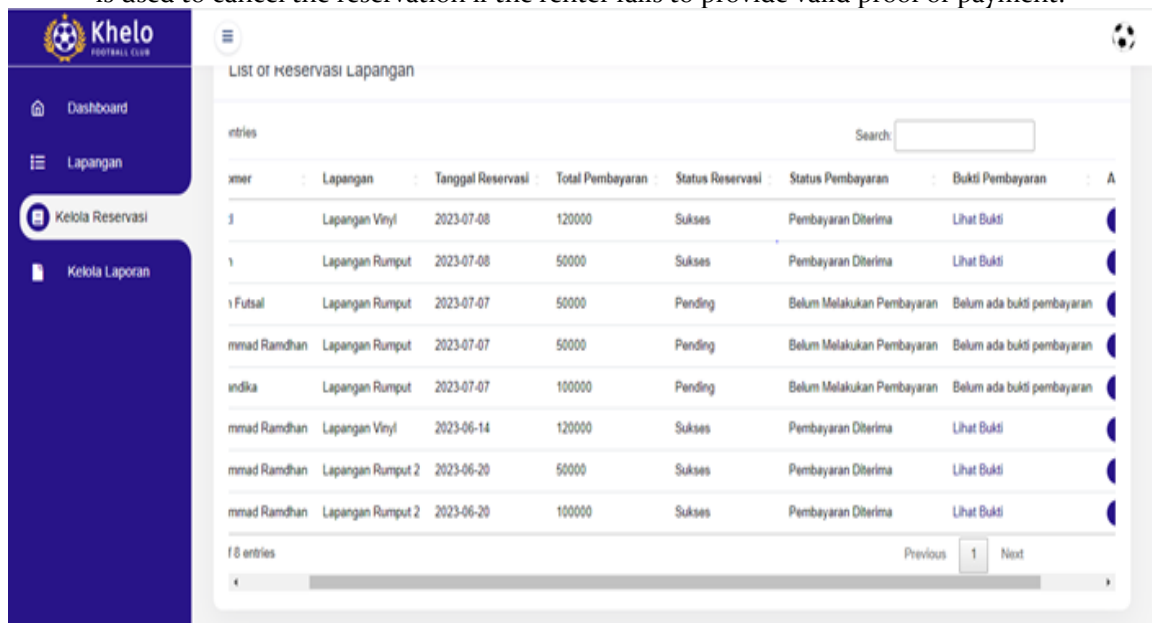
The user landing page is the main page of the scheduling reservation information system



Figure 6. User Interface Landing Page

2) User Interface Reservation Management Page

The renter reservation management page is used by the manager to view and validate payments through approval or rejection. Approve is used to confirm the payment, while Reject is used to cancel the reservation if the renter fails to provide valid proof of payment.



No	Lapangan	Tanggal Reservasi	Total Pembayaran	Status Reservasi	Status Pembayaran	Bukti Pembayaran	
3	Lapangan Vinyl	2023-07-08	120000	Sukses	Pembayaran Diterima	Lihat Bukti	
1	Lapangan Rumput	2023-07-08	50000	Sukses	Pembayaran Diterima	Lihat Bukti	
1	Futsal	Lapangan Rumput	2023-07-07	50000	Pending	Belum Melakukan Pembayaran	Belum ada bukti pembayaran
mamad Ramdhan	Lapangan Rumput	2023-07-07	50000	Pending	Belum Melakukan Pembayaran	Belum ada bukti pembayaran	
indka	Lapangan Rumput	2023-07-07	100000	Pending	Belum Melakukan Pembayaran	Belum ada bukti pembayaran	
mamad Ramdhan	Lapangan Vinyl	2023-06-14	120000	Sukses	Pembayaran Diterima	Lihat Bukti	
mamad Ramdhan	Lapangan Rumput 2	2023-06-20	50000	Sukses	Pembayaran Diterima	Lihat Bukti	
mamad Ramdhan	Lapangan Rumput 2	2023-06-20	100000	Sukses	Pembayaran Diterima	Lihat Bukti	

Figure 7. User Interface Reservation Management Page

Integration and System Testing

Black box Testing

At this step, the evaluation takes the form of testing, in which the author conducts black box testing on the integrated futsal field scheduling reservation information system in Subang Regency. This black box testing is carried out to evaluate the system in terms of its functionality. Based on the results, there are 46 test cases, with 46 valid tests and 0 invalid tests.

4. Conclusion

This study demonstrates that the design and implementation of an Integrated Information System for Futsal Field Reservations and Scheduling in Subang Regency based on the Greedy algorithm can provide an effective solution to the problems associated with manual management that have been occurring. This system not only provides real-time scheduling information and digital payment features but also automatically generates alternative scheduling recommendations when a particular field is fully booked. The use of the Greedy algorithm has proven to be efficient in quickly determining optimal choices, in line with user needs in the context of sports field reservations. The implementation results show a significant improvement in data management efficiency, scheduling accuracy, and user satisfaction. As a follow-up to this research, future system development can be directed toward integrating machine learning-based predictive features to analyze booking trends and optimize field time allocation. Additionally, developing a mobile app with real-time notifications and location-based features will enhance the accessibility and responsiveness of services to community needs. It is also recommended to expand the scope of this system to include other sports facilities in the Subang region, thereby supporting more comprehensive management of recreational infrastructure and encouraging community participation in organized sports activities.

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