Optimization Analysis of Payment Transaction Speed on a Badminton Court Rental Website Using Paired T-Test and Midtrans Payment Gateway Integration

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Abstract. This study examines the optimization of payment transaction speed on a badminton field rental website, utilizing the Paired T Test and integrating the Midtrans payment gateway. In the context of the 4.0 revolution, where rapid advancements in technology significantly impact business operations, the efficiency of digital transactions is crucial for enhancing user experience and satisfaction. The research addresses the common challenge of prolonged transaction times during court bookings, which can deter potential clients. By implementing the Midtrans payment gateway, the study aims to streamline the transaction process, allowing for faster and more efficient rental experiences. Data analysis using the Paired T Test reveals significant improvements in transaction speed post-integration, demonstrating the effectiveness of technological advancements in optimizing service delivery in the sports rental industry.

Keywords: Payment transaction speed, Badminton court rental, Midtrans payment gateway, Optimization analysis, Paired T Test.

1 Introduction

Advances in science and technology (IPTEK) have had a significant impact on business people in Indonesia [1] [2]. Many of them are using digital technology to run their businesses. Businesses are driven by technological advancements to move forward and keep up with emerging technology trends. Many companies are turning to digital transaction models to simplify payments and provide convenience to customers. Digital payments offer more benefits than drawbacks. How cashless payments affect the stability of Indonesia's financial system [3]. The findings of the study, which are based on examining transactions involving debit cards and electronic money, show that these payment methods have a favorable effect [4] on the movement of money.

This is also true for companies that rent out badminton courts, as clients anticipate simple and secure online payment methods. One sport that can be played both indoors and outdoors is badminton. To accommodate badminton enthusiasts, several companies offer badminton courts [5], and many of them have embraced online court rental [6]

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[7]. However, the main problem in the growth of online services is the speed of transactions.

Money transaction procedures are an important component of internet services [8]. An important component in improving user experience is the speed and convenience of payment processing [9] [10]. Therefore, it is very important to pay attention to the optimization of payment transactions.

The purpose of this research is to use an integrated payment gateway to optimize payment transactions on a badminton court rental website. Previous research has highlighted the various benefits of payment gateway integration in improving transaction efficiency and security [11]. However, these studies pay less attention to aspects of transaction speed that directly affect user experience [12]. It is expected that by integrating payment gateways, the speed of the payment process duration will be reduced, increasing user convenience and efficiency.

By reaching a wider audience and increasing user trust in online services, the improved efficiency of payment transactions is also expected to provide benefits to website owners. In addition, in the context of online services, this research can help clarify the importance of payment transaction optimization.

This research is expected to produce solutions that can be applied to improve the speed of payment transactions on badminton court rental websites. The findings from this research should have a significant impact on how online services are developed in the future to meet the demands of online businesses and facilitate easier, effective, and efficient sales transactions [13].

2 Research Methods

This research uses an experimental design with a quantitative approach to analyze the optimization of payment transaction speed on the badminton court rental website through Midtrans payment gateway integration. This study involves several key variables that contribute to the analysis of payment transaction speed on a badminton field rental website. The independent variable is the integration of the Midtrans payment gateway, which serves as the technological enhancement aimed at improving transaction efficiency. The dependent variable is the payment transaction speed, quantified in seconds to provide a clear measurement of efficiency. Additionally, the measurement parameters for this analysis include server response time and overall payment time, both of which are critical in assessing the effectiveness of the integration and its impact on user experience during the booking process.

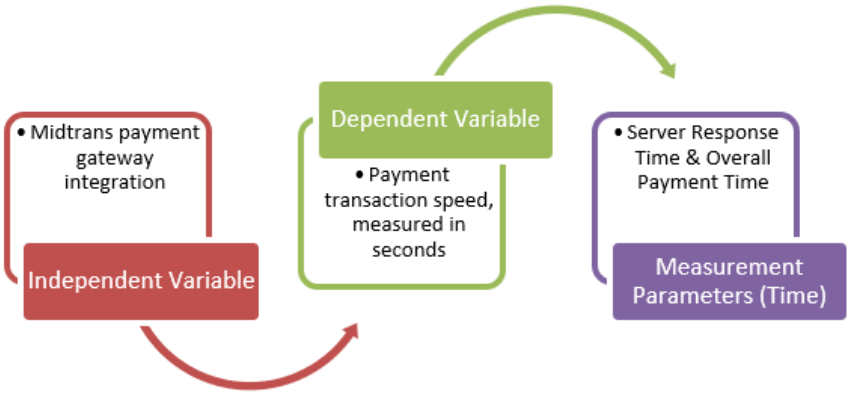

Fig. 1. Key variables in research analysis.

2.1 Object of Research

This study was conducted at the GOR Badminton Elite Center. This testing environment was chosen to create a context suitable for research that involves physical activity and behavioral observation in a sports setting. The GOR facilities feature standard badminton courts with adequate lighting and ventilation, as well as supporting amenities such as seating for spectators and rest areas. The selection of this location aims to establish real conditions that are relevant to the activities of the respondents. The center is located in Golden City, Bengkong Laut, Batam City, Riau Islands.

2.2 Data Collection Technique

The respondents in this study were members of the general public who used or visited the GOR Badminton Elite Center. The participants represented a diverse range of backgrounds in terms of age, gender, and profession. They were randomly selected from among the visitors present at the time of the study to ensure a sample that accurately represented the community interested in badminton and activities at the GOR. Users who had previously rented courts at the Elite Center were directly approached to gather data for this research through field observations. The purpose of this observational study was to collect data on the transaction speed during the payment process.

2.3 Analysis Method

The t-test was used in the optimization testing methodology of this research. A statistical test called the t-test is used to determine whether a hypothesis, which compares two average samples taken randomly from the same population, is true or false [14]. The purpose of this test is to determine how well payment gateway integration can reduce transaction time and increase payment speed.

2.4 System Design

From the explanation of the material that has been presented in the previous discussion, an overview of the system that will be designed in accordance with what has been explained is formed as follows:

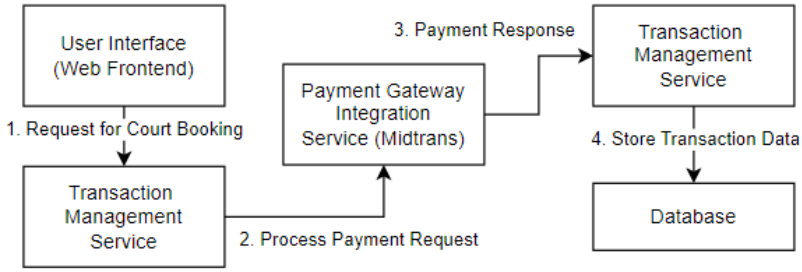

Fig. 2. System overview.

The System Flow Diagram illustrates the interactions between various components in the payment processing system on the badminton court rental website. This diagram consists of several key elements and the flow of information between them. The process begins with the User Interface (Web Frontend) [15], where users interact with the system to browse available badminton courts, make bookings, and select their desired payment method. Users can input new rental data by visiting the badminton court rental website, where they can also view rental and payment statuses.

After users submit their booking request, the data is sent to the Transaction Management Service, which is responsible for processing the payment request as well as managing transaction data, including logging the time taken for each transaction. The admin functions as a field data manager and confirms new rentals based on requests from users, ensuring that the information is accurate and up to date.

Next, the Payment Gateway Integration Service (Midtrans) takes over the payment process by communicating with the Midtrans API. This service handles the payment processing logic, including authentication and transaction validation. The field rental transaction data sent by the website to the Midtrans server is managed by the Midtrans server, ensuring secure and efficient payment processing. Once the payment is processed, Midtrans sends a Payment Response back to the Transaction Management Service, providing information on whether the payment was successful or failed, along with relevant details.

After receiving this response, the Transaction Management Service stores the transaction data in the database, which is managed by the database server [16]. This includes transaction time, payment status, and user details for further analysis. The database server also manages field data and field rental data, maintaining an organized system for efficient data retrieval.

Finally, the system sends a Payment Confirmation to the user via the web interface. Users receive a notification confirming their booking and payment details, completing the transaction process. Thus, the System Flow Diagram effectively describes the sequence of operations involved in processing payments for badminton court rentals,

highlighting how user interactions are handled, the integration with the payment gateway, and the storage of transaction data. This structured approach helps ensure a smooth and efficient user experience while maintaining the integrity of transaction processing.

3 Results and Discussion

3.1 Design Result

On the booking page, users can view various information, including a description of the available court schedules and a "Book Now" button for making reservations. This intuitive layout allows users to easily identify the time slots for each badminton court, ensuring they can select their preferred schedule with minimal hassle.

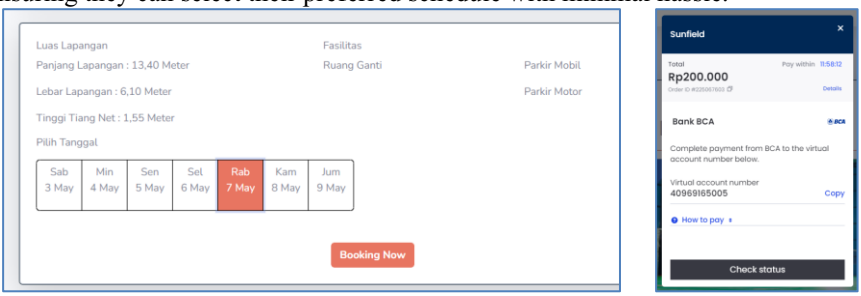

Fig. 3. Booking now and select payment method.

Additionally, the inclusion of clear visual indicators for available and booked slots enhances the user experience by preventing any potential confusion during the booking process. Overall, the design aims to streamline the reservation process, making it convenient and user-friendly.

In this view, users can see the options for payment methods, as well as a display of the total amount to be paid. This section is designed to provide clarity and transparency regarding the payment process, allowing users to choose their preferred method, whether it be through credit cards, digital wallets, or bank transfers. The total amount displayed is calculated in real-time, ensuring users are aware of any additional fees or discounts applied, which enhances their confidence in the transaction. By simplifying the payment options and clearly presenting the total, the design aims to create a seamless and efficient checkout experience.

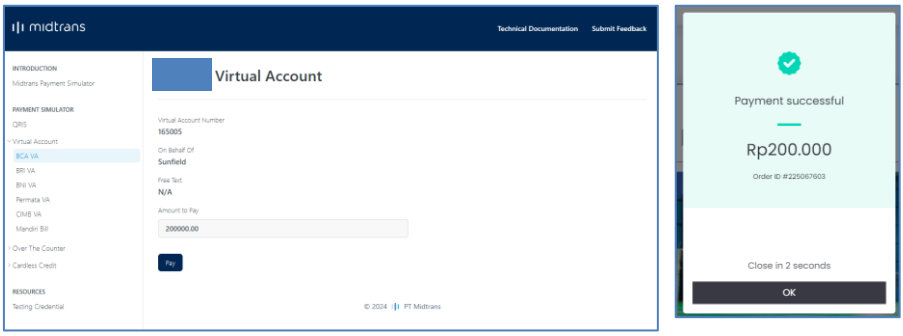

Fig. 4. Midtrans simulation and completed transaction page.

This display is a Midtrans interface used for payment simulation and the selected payment method. As the final page of the transaction process, it provides crucial information, including the payment status, which indicates whether the transaction was successful or failed. Additionally, this view shows other pertinent details, such as the total amount paid and the order ID, which serve as a reference for both users and administrators. By consolidating all relevant payment information on one page, this design enhances user confidence and provides a clear summary of their transaction, ensuring they have all necessary details at their fingertips before concluding the process.

3.2 Research Data

Population and Sample. The sample for this study consists of 25 transactions conducted on the badminton court rental website at the Gor Elite Center. A simple random selection technique [17] was employed to obtain the sample, ensuring that each member of the population had an equal opportunity to be chosen as a subject. The sample selection utilized the Slovin formula in accordance with the technique proposed by Isaac and Michael [18].

$$n = \frac{N}{1+N\,(e)^2} \quad (1)$$

N = Sample Size
N = Total Population
e = Precision (0.1 of 10% with 95% confidence level)

Based on the formula above, the number of transaction samples that will be used for testing can be obtained as follows:

$$n = \frac{25}{1 + 25\,(0.1)^2}$$

$$n = 20$$

Based on the transaction samples obtained from the formula above, a total of 40 transaction records were analyzed, consisting of 20 pairs of data representing transactions before and after the optimization of payment transaction speeds, as illustrated in the following table.

Table 1. Sample data.

Subject	Before Optimization (seconds)	After Optimization (seconds)
1	25	18
2	26	20
3	20	17
4	22	19
5	24	17
6	24	18
7	26	18
8	25	18
9	20	17
10	20	16
11	24	17
12	30	20
13	30	20
14	20	18
15	22	16
16	20	15
17	24	19
18	25	17
19	20	15
20	20	18

3.3 Statistical Analysis

Data Validation Test. The collected data must undergo validity testing to determine whether it is suitable for further analysis. In theory, the validity test can be measured using the product moment correlation or Pearson correlation [19]. To verify the accuracy of the data, a validation test should be conducted based on the findings from the data collection process, which involved 20 tenants from the Elite Center. The following table shows that the r-count for each data variable exceeds the r-table value of 0.3598, indicating that the data is considered valid. Data can be classified as valid if $r_{count} \geq r_{table}$.

Table 2. Validation test results.

r count	r table	Conclusion
0,429	0.3598	Valid
0,441	0.3598	Valid

Data Reliability Test. To find out whether the data obtained is reliable or not, it is necessary to conduct a reliability test using SPSS version 27. Instrument reliability testing was carried out using the Cronbach's Alpha formula technique [20] [21] In this investigation, the Cronbach's Alpha reliability measurement technique was used. If the reliability value for a research variable is 0.7, it is considered reliable according to this algorithm. The table below displays the findings of the research reliability test:

Hypothesis Test (t-test or T-test).

Table 3. Reliability test results.

Reliability Statistic	
Cronbach's Alpha	N of items
0,704	2

Based on the results of reliability testing, it is concluded that the Cronbach's Alpha result is 0.704, which is reliable.

Hypothesis Test (t-test).

a) T-test

In order to achieve the researcher's main objective, which is a significant change before and after optimization, a paired t-test was used in this test, comparing the average time [15] before and after optimization. The t-test formula and test findings for this investigation are as follows:

- Determining H0 & H1 values
  H0 : μ before = Transaction speed does not increase after payment gateway integration.
  H1 : μ after = Transaction speed increases after payment gateway integration
  H1 : μ1 - μ2>0

b) Menghitung nilai statistik

- Differensial

Difference data ;

d= { 7,6,3,3,7,6,8,7,3,4,7,10,10,2,6,5,5,8,5,2 }

Average difference ($\bar{d}$)

$$\sum_{i-1}^{20} di \quad = \frac{114}{20} = 5.7 = 6 \tag{2}$$

- Calculate the Squared Difference of the Means (di-$\bar{d}$)^2) for each data :
  Difference for each data: { 1, 9, 9, 1, 4, 1, 9, 4, 1, 16, 16, 16, 1, 1, 4, 1, 16 }
- Calculate the mean difference of squares to get the sample variance estimate.

$$\frac{110}{n-1} = \frac{110}{19} = 5.8 \tag{3}$$

- Standard deviation

  Standard deviation is the square root of the sample variance : $s = \sqrt{varian}$

$$s = \sqrt{5.8} = 2.4 \quad (4)$$

- Calculate statistics (paired t test)

$$t = \frac{\bar{d}}{s/\sqrt{n}} = \frac{6}{2.4/\sqrt{20}} = \frac{6}{2.4/4{,}48} = \frac{6}{0.5} = 12 \quad (5)$$

- Degrees of freedom (df): it is the degree of freedom for paired t test is n-1, where n is the number of data pairs (number of transactions).

$$df = n - 1 \quad (6)$$

$$df = 20 - 1 = 19$$

Table 4. Mean and Std Deviation test results.

N Valid	20
N Missing	0
Mean	39,85
Std.Deviation	4.221

- Interpretation of results
  When the critical value from the t distribution table for the corresponding degrees of freedom and the predetermined significance threshold of 0.10 is compared with the calculated t value. A value of t = 12 is found after the calculated t value, indicating that there is a considerable difference in the transaction time before and after optimization as the determined t value is more than the critical value. The figure below displays the distribution table.

Titik Persentase Distribusi t (df = 1 – 40)

Pr / df	0.25 0.50	0.10 0.20	0.05 0.10	0.025 0.050	0.01 0.02	0.005 0.010	0.001 0.002
1	1.00000	3.07768	6.31375	12.70620	31.82052	63.65674	318.30884
2	0.81650	1.88562	2.91999	4.30265	6.96456	9.92484	22.32712
3	0.76489	1.63774	2.35336	3.18245	4.54070	5.84091	10.21453
4	0.74070	1.53321	2.13185	2.77645	3.74695	4.60409	7.17318
5	0.72669	1.47588	2.01505	2.57058	3.36493	4.03214	5.89343
6	0.71756	1.43976	1.94318	2.44691	3.14267	3.70743	5.20763
7	0.71114	1.41492	1.89458	2.36462	2.99795	3.49948	4.78529
8	0.70639	1.39682	1.85955	2.30600	2.89646	3.35539	4.50079
9	0.70272	1.38303	1.83311	2.26216	2.82144	3.24984	4.29681
10	0.69981	1.37218	1.81246	2.22814	2.76377	3.16927	4.14370
11	0.69745	1.36343	1.79588	2.20099	2.71808	3.10581	4.02470
12	0.69548	1.35622	1.78229	2.17881	2.68100	3.05454	3.92963
13	0.69383	1.35017	1.77093	2.16037	2.65031	3.01228	3.85198
14	0.69242	1.34503	1.76131	2.14479	2.62449	2.97684	3.78739
15	0.69120	1.34061	1.75305	2.13145	2.60248	2.94671	3.73283
16	0.69013	1.33676	1.74588	2.11991	2.58349	2.92078	3.68615
17	0.68920	1.33338	1.73961	2.10982	2.56693	2.89823	3.64577
18	0.68836	1.33039	1.73406	2.10092	2.55238	2.87844	3.61048
19	0.68762	1.32773	1.72913	2.09302	2.53948	2.86093	3.57940
20	0.68695	1.32534	1.72472	2.08596	2.52798	2.84534	3.55181
21	0.68635	1.32319	1.72074	2.07961	2.51765	2.83136	3.52715

Fig. 5. T Distribution table.

Graphic Presentation. The average payment transaction time before and after optimization is compared in the graph. Figure 6 shows that after optimization, the average transaction time is shorter. It also provides an interesting visual representation of how optimization affects the speed of payment transactions. It is clear how significantly the two conditions differ from each other.

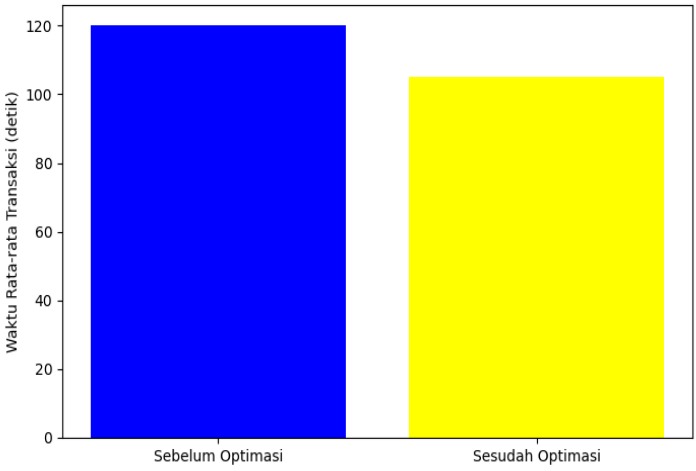

Fig. 6. Graphic presentation.

The bar chart illustrates the average transaction time (in seconds) for a badminton court rental system, comparing the periods before and after optimization. The blue bar represents the average transaction time prior to optimization, which is significantly higher at around 120 seconds, indicating that payment processing was relatively slow before improvements were made. In contrast, the yellow bar displays the average transaction time after optimization, which has decreased to approximately 100 seconds. This reduction in transaction time highlights the effectiveness of the optimization efforts, suggesting that they have successfully enhanced the speed of payment processing. Overall, the chart demonstrates a positive impact on transaction efficiency, likely leading to an improved user experience and greater customer satisfaction with the rental service.

Discussion. These results show that the average transaction time was effectively reduced by a significant amount thanks to the optimization of the payment transaction procedure.

Based on how these findings are interpreted, the website for renting badminton courts underwent modifications that significantly improved the speed of payment transactions. The average transaction time dropped by 6 seconds, allowing customers to make payments faster and more effectively and enjoy an overall better user experience.

This finding has significant economic consequences as faster transactions can increase customer satisfaction and decrease the likelihood of customers canceling transactions midway. In addition, by reducing the time taken for each transaction, resources can be allocated more wisely thereby improving operational efficiency.

It should be underlined that despite the beneficial effects of optimization, this study has certain limitations due to the small sample size and exclusive emphasis on a single website. To further validate these findings, a follow-up study with a larger sample size and a wider range of test situations is recommended.

4 Conclusions

Through the use of an integrated payment gateway, this project sought to optimize the payment process on a website for renting badminton courts. The analysis results show that the optimization succeeded in significantly lowering the average transaction time. Users can process payments faster and more effectively by integrating the payment gateway. Although the results show the success of optimization, there are some recommendations for additional studies. To increase the generalizability of the findings, further studies including more badminton court rental websites should be conducted. Second, because the system being tested is not yet online, still using a local database, this research has limitations in testing the server response time variable which is the time it takes for the server to process payment requests. As well as other variables that can affect transaction speed, such as service availability and transaction security, can be taken into account in this study. Ultimately, a deeper understanding of the relationship between the variables studied can be obtained through the development of increasingly complex analysis techniques such as regression analysis.

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